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LETTER OF TRANSMISSION

To The Honourable Herbert Alexander Bruce,
Lieutenant-Governor of the Province of Ontario.

May it please Your Honour:—

The undersigned has the honour to transmit to you herewith, for presentation to the Legislative Assembly of the Province of Ontario, the Forty-fourth Annual Report, 1934, of the Department over which I have the honour to preside.

Respectfully submitted,
Paul Leduc,
Minister of Mines.

Department of Mines,
Toronto, 1935.

INTRODUCTORY LETTER

To The Honourable Paul Leduc,
Minister of Mines.

Sir,—The undersigned has the honour to submit the Forty-fourth Annual Report of the Department of Mines, issued in eight parts, as follows:—

Part I

Statistical Review of the Mineral Industry of Ontario for 1934, by A. C. Young.
List of Mines, Quarries, and Works, 1934.
Mines of Ontario in 1934, by D. G. Sinclair, E. C. Keeley, D. F. Cooper, E. B. Weir, A. R. Webster.
Mining Accidents in 1934, by D. G. Sinclair, R. H. Cleland, D. F. Cooper, E. C. Keeley. A. R. Webster.
Classes for Prospectors, 1934–35, by E. M. Burwash.

Part II

Geology and Ore Deposits of the Matachewan-Kenogami Area, with maps Nos. 44a and 44b, by W. S. Dyer.

Part III

Little Long Lac Gold Area, with map No. 44d, by E. L. Bruce.

Part IV

Geology of the Rowan-Straw Lakes Area, with map No. 44e, by Jas. E. Thomson.
Gold Deposits on the Lake of the Woods, by Jas. E. Thomson.
Some Gold Occurrences West of Port Arthur, by Jas. E. Thomson.

Part V

Natural Gas in 1934, by R. B. Harkness.
Petroleum in 1934, by R. B. Harkness.

Part VI

Gold Deposits in the Vicinity of Red Lake Mines, by M. E. Hurst.
Geology of the Cat River–Kawinogans Lake Area, with map No. 44f, by W. D. Harding.

Part VII

Geology of the Opeepeesway Lake Area, with map No. 44g, by H. C. Laird.
Horwood Lake Area, by H. C. Laird.
Recent Developments in the Swayze and West Shiningtree Areas, by H. C. Laird.
Part of Strathy Township, by W. S. Savage.
Mongowin Township and Vicinity, by H. C. Rickaby.

Part VIII

Geology of the Lochalsh-Missinaibi Area, with map No. 44c, by E. M. Burwash.

Only Part I is bound with the Sessional Papers of the Legislature. All parts, together with accompanying geological maps as indicated above by number and letter, are available on application to the Department.

Respectfully submitted,
T. F. Sutherland,
Deputy Minister of Mines.

Department of Mines,
Toronto, 1935.

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLIV, PART I, 1935

Statistical Review of the Mineral Industry of Ontario for 1934 1-53
List of Mines, Quarries, and Works, 1934 - - - - - 54-66
Mines of Ontario in 1934 - - - - - - - - - - 67-167
Mining Accidents in 1934 - - - - - - - - - - 168-174
Classes for Prospectors, 1934-35 - - - - - - - - - 175

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CONTENTS

Vol. XLIV, Part I

	PAGE
Letter of Transmission	i
Introductory Letter	ii

STATISTICAL REVIEW OF THE MINERAL INDUSTRY OF ONTARIO FOR 1934

General Summary	1
Mineral Production	1
Metal Production	5
Diamond-Drilling	5
Prospecting	6
Metallics	6
Gold	6
General Summary	6
Gold-Milling Plants	7
Labour Statistics	9
Production and Dividends	9
Mint Receipts from Ontario Mines	17
Exchange Equalization	17
World Output	18
Silver-Cobalt	19
Nickel-Copper and Platinum Metals	24
Production of Platinum Metals	26
Dividends	26
Iron Ore, Pig Iron, Steel, and Coke	27
Iron and Steel	27
Ferro-Alloys	28
Coke	28
Chromite	29
Radium and Uranium	30
Non-Metallics	30
Arsenic	30
Barite	31
Diatomite	31
Feldspar and Nepheline Syenite	31
Fluorspar	32
Graphite	32
Gypsum	32
Iron Pyrites and Sulphuric Acid	32
Mica	33
Mineral Waters	33
Natural Gas and Petroleum	33
Peat	34
Quartz, Quartzite, and Silica Brick	34
Salt	34
Talc	35
Structural Materials	36
Building Permits	36
Construction Contracts	36
Cement	37
Cement Products	37
Lime	38
Sand and Gravel	39
Sand-Lime Products	40
Stone	40
Clay Products	40
Refractory Clays	40
Heavy Clay Products	41
Miscellaneous Statistics	41
Mining Company Incorporations	41
Mining Revenue and Expenditures	48
Temiskaming Testing Laboratories	51
Provincial Assay Office	52
Draughting Office, North Bay	53

LIST OF MINES, QUARRIES, AND WORKS, 1934

Metallics	54
Metallurgical Works	58
Non-Metallics	59
Structural Materials	62
Clay Products	66

MINES OF ONTARIO IN 1934

Chromium	67
Chromium Mining and Smelting Corporation, Ltd.	67
Gold	67
Algold Mines, Ltd.	67
Algoma Summit Gold Mines, Ltd.	68
Alschbach Gold Mining Co., Ltd.	68
Amalgamated Gold Fields Corporation, Ltd.	68
Anglo-Huronian, Ltd.	69
Ardeen Gold Mines, Ltd.	70
Ashley Gold Mining Corporation, Ltd.	71
Bankfield Gold Mines, Ltd.	72
Barry-Hollinger Mines, Ltd.	72
Bathurst Gold Mines, Ltd.	72
Bidgood Kirkland Gold Mines, Ltd.	73
Bob Tough Gold Mines, Ltd.	73
Bousquet Gold Mines, Ltd.	74
Buffalo Ankerite Gold Mines, Ltd.	74
Canadian Kirkland Mines, Ltd.	76
Canusa Gold Mines, Ltd.	77
Casey Summit Gold Mines, Ltd.	77
Centennial Gold Mines, Ltd.	78
Central Canada Mines, Ltd.	78
Central Patricia Gold Mines, Ltd.	79
Central Porcupine Mines, Ltd.	81
Churchill Mining and Milling Co., Ltd.	82
Cole Gold Mines, Ltd.	83
Concordia Gold Mining Co., Ltd.	83
Coniaurum Mines, Ltd.	83
Consolidated Mining and Smelting Co. of Canada, Ltd.	85
Afton Mine	85
McKenzie Claims	85
Mackey Point Property	85

PAGE

Gold—*Continued*
Cooper and Barry ... 86
Coulson Consolidated Gold Mines, Ltd. 86
Craig Gold Mines, Ltd. ... 86
Darwin Gold Mines, Ltd. ... 87
Delnite Mines, Ltd. ... 87
De Santis Gold Mining Co., Ltd. ... 88
Dome Mines, Ltd. ... 89
Duport Mining Co., Ltd. ... 92
Ed. Hargreaves Kirkland Gold Mines, Ltd. ... 92
Excello Mines, Ltd. ... 92
Federated Mining Corporation, Ltd. ... 93
Foley O'Brien Corporation, Ltd. ... 93
Foley Syndicate ... 94
Four Nations Consolidated Gold Mines, Ltd. ... 94
Fox Lake Gold Syndicate ... 95
Gold Eagle Gold Mines, Ltd. ... 95
Gold Lands Syndicate of Algoma ... 95
Gold Range Mines, Ltd. ... 96
Golden Gate Mining Co., Ltd. ... 96
Golden Star Consolidated Mines, Ltd. 96
Golden Summit Mines, Ltd. ... 97
Goodfish Mining Co., Ltd. ... 97
Greenlaw Gold Mines, Ltd. ... 98
Halcrow-Swayze Mines, Ltd. ... 98
Hard Rock Gold Mines, Ltd. ... 98
Harkness-Hays Gold Mines, Ltd. ... 99
Hillside Gold Mines, Ltd. ... 99
Hollinger Consolidated Gold Mines, Ltd. ... 100
Hollinger Mine ... 102
Young-Davidson Mine ... 102
Hislop Property ... 102
Cochenour-Willans ... 103
Gold Island ... 103
Horseshoe Mines, Ltd. ... 103
Howey Gold Mines, Ltd. ... 103
Hudson Patricia Gold Mines, Ltd. ... 105
J-M Consolidated Mines, Ltd. ... 106
Kenora Prospectors and Miners, Ltd. 106
Mikado ... 107
Cedar Island ... 107
Kenty Gold Mines, Ltd. ... 107
Kirkland Consolidated Mines, Ltd. ... 108
Kirkland Gold Belt Mines, Ltd. ... 108
Kirkland Lake Gold Mining Co., Ltd. 108
Lake Caswell Mines, Ltd. ... 109
Lake Shore Mines, Ltd. ... 110
Lakeland Gold, Ltd. ... 113
Lakeside-Kirkland Gold Mines, Ltd. ... 113
Lebel Oro Mines, Ltd. ... 114
Lee Gold Mines, Ltd. ... 114
Little Long Lac Gold Mines, Ltd. ... 114
Lucky Cross Leasing Syndicate ... 115
Lucky Kirkland Gold Mines, Ltd. ... 116
Macassa Mines, Ltd. ... 116
McIntyre-Porcupine Mines, Ltd. ... 117
McKenzie Red Lake Gold Mines, Ltd. 121
McLaren-Porcupine Gold Mines, Ltd. 122
MacLeod-Cockshutt Gold Mines, Ltd. 122
J. Bruce McMartin ... 123
McMillan Gold Mines, Ltd. ... 123
Manitoba and Eastern Mines, Ltd. ... 124
Marbuan Gold Mines, Ltd. ... 124
Martin Bird Syndicate ... 127
Matachewan Consolidated Mines, Ltd. 127
Miller Independence Mines (1924), Ltd. ... 127

PAGE

Gold—*Continued*
Minto Gold Mines, Ltd. ... 127
Moffatt-Hall Mines, Ltd. ... 128
Munro Croesus Mines, Ltd. ... 128
Naybob Gold Mines, Ltd. ... 129
Neville Canadian Gold Mines, Ltd. ... 129
North Shores Gold Mines, Ltd. ... 129
Northern Empire Mines Co., Ltd. ... 130
O'Connell Gold Mines, Ltd. ... 131
Orecana Trusts, Ltd. ... 131
Kozak Property ... 131
Michael-Boyle Property ... 131
Pamour Porcupine Mines, Ltd. ... 131
Parkhill Gold Mines, Ltd. ... 132
Paymaster Consolidated Mines, Ltd. 133
Pickle Crow Gold Mines, Ltd. ... 134
Porcupine Peninsular Gold Mines, Ltd. 135
Ramore Gold Mining Co., Ltd. ... 136
Red Crest Gold Mines, Ltd. ... 136
Red Lake Gold Shore Mines, Ltd. ... 137
Richelieu Gold Mines, Ltd. ... 137
Roche Long Lac Gold Mines, Ltd. ... 137
St. Anthony Gold Mines, Ltd. ... 138
Sakoose Gold Mines, Ltd. ... 139
Saundary Syndicate ... 139
Selected Canadian Golds, Ltd. ... 139
Sinclair Mines Syndicate ... 140
S. B. Smith ... 140
South Vermillion Gold Mines, Ltd. ... 140
Stanley Gold Mines, Ltd. ... 141
Stellar Gold Mines, Ltd. ... 141
Straw Lake Beach Gold Mines Syndicate, Ltd. ... 141
Swayze-Huycke Gold Mines, Ltd. ... 142
Sylvanite Gold Mines, Ltd. ... 142
Talisman Gold Mines, Ltd. ... 145
Tashota Goldfields, Ltd. ... 145
Teck-Hughes Gold Mines, Ltd. ... 145
Teddy Bear Valley Mines, Ltd. ... 147
Toburn Gold Mines, Ltd. ... 147
Tom Johnson–Nipigon Mines, Ltd. ... 148
Vermilion Lake Gold Mines, Ltd. ... 149
Wawa Goldfields, Ltd. ... 149
Wells Longlac Mines, Ltd. ... 149
Wendigo Gold Mines, Ltd. ... 150
West Red Lake Gold Mines, Ltd. ... 150
Witch Bay Gold Mines, Ltd. ... 151
Wright-Hargreaves Mines, Ltd. ... 151
Young-Davidson Mines, Ltd. ... 154
Young-Shannon Gold Mines, Ltd. ... 154
Graphite ... 154
Black Donald Graphite Co., Ltd. ... 154
Gypsum ... 155
Canadian Gypsum Co., Ltd. ... 155
Gypsum, Lime and Alabastine, Canada, Ltd. ... 155
Molybdenite ... 156
Phoenix Molybdenite Corporation, Ltd. ... 156
Nickel and Copper ... 156
Cuniptau Mines, Ltd. ... 156
Falconbridge Nickel Mines, Ltd. ... 156
International Nickel Co. of Canada, Ltd. ... 158
Radium ... 161
Canada Radium Mines, Ltd. ... 161
Silver and Cobalt ... 162
Cain and Taylor ... 162
Cobalt Properties, Limited ... 162
George Martin ... 162

PAGE

Silver and Cobalt—*Continued*
Mining Corporation of Canada, Ltd.. 162
Nipissing Mining Co., Ltd..... 162
M. J. O'Brien, Ltd..... 163
Cross Lake Mine..... 163
Miller Lake O'Brien Mine..... 164
Peterson Cobalt Mines, Ltd..... 164
C. W. Price..... 164
Sandoe and Moyle..... 164
Smith Cobalt Mines, Ltd..... 164
A. Wood..... 165
Talc..... 165
Canada Talc Co., Ltd..... 165
Geo. H. Gillespie Co., Ltd..... 165
Metallurgical Works..... 165
Algoma Steel Corporation, Ltd..... 165
Canadian Furnace Co., Ltd..... 165
Canadian Industries, Ltd..... 166
Deloro Smelting and Refining Co., Ltd. 166
International Nickel Co. of Canada, Ltd..... 166
Ontario Refining Co., Ltd..... 166
Steel Co. of Canada, Ltd..... 166

MINING ACCIDENTS IN 1934

PAGE

Accidents during 1934..... 168
Fatal Accidents..... 168
Non-Fatal Accidents..... 170
Infection..... 171
Accidents from Explosives..... 171
Electric Accidents..... 172
Mine Fires..... 172
Goodfish Mining Co., Ltd..... 172
Hollinger Consolidated Gold Mines, Ltd..... 173
Spontaneous Combustion in Carbide Refuse..... 173
Prosecutions..... 174
Summary of Rope Tests, 1934..... 174

CLASSES FOR PROSPECTORS, 1934-35

General Summary..... 175
Analysis of Class Attendance..... 175

ILLUSTRATIONS

PAGE

Chart of average monthly and yearly prices of gold in Canadian funds from 1931 to 1934, inclusive..... 17
Graph showing fluctuations of the buying rate in Canada for New York funds from 1918 to 1934, inclusive..... 17

Statistical Review of the Mineral Industry of Ontario for 1934

By A. C. Young

GENERAL SUMMARY

Mineral Production

Mineral production for 1934, valued at $145,854,173, exceeded that of any previous year. For purposes of compilation the mineral industry is grouped into four main sections: metallics, non-metallics, structural materials, and clay products. Of these, metallics, including the famous gold-producers and the nickel-copper mines, is by far the most important. Owing to the increased price of gold ($35.00 per ounce) the production value by this group exceeded the total output from all sources in 1929, the peak year in Ontario's mineral record. An examination of the table, "Summary of Mineral Statistics, 1934" (page 2), shows improvement in every group. Metals gained in value $33,908,668, or 35.5 per cent.; non-metallics were up $458,925, or 6.4 per cent.; structural materials $1,430,586, or 22.6 per cent.; and clay products $236,427, or 23 per cent.

The Dominion Bureau of Statistics has reported the value of Ontario field crops as $143,734,000 for 1934, or the highest figure since 1930. For the first time in the history of the province mineral production has had a value in excess of field crops; this affords a striking illustration of the growing importance of the mineral industry in the economic life of Ontario.

Reference to the table "Comparative Value of Mineral Production, 1930-1934" (page 3), shows that the value of gold production has increased 19.3 per cent.; silver, 35.9; nickel, 59.6; copper, 46.4; and the platinum metals, which are a by-product of the nickel-copper industry and dependent entirely upon the prosperity of that industry, showed a gain of 312.6 per cent.

Activity in prospecting was widespread throughout the province during the year, and many claims were staked and recorded in the area east of Lake Nipigon. New properties came into production or were preparing to produce. Many old mines in the Lake of the Woods area were again taken up, giving work to many of the unemployed, besides attracting attention to this area, which figured so prominently during the nineties of the last century.

In the *Monthly Review of Business Statistics* for January, 1935, published by the Dominion Bureau of Statistics, Ottawa, the trend in the business affairs of Canada was reported as follows:—

> Economic conditions in Canada showed improvement in 1934, adding to the advance recorded in the greater part of the preceding year. Most of the principal factors measuring the trend of economic activity were consequently much more favourable than during the low point of the depression reached in 1932 and the first quarter of 1933. The improvement was well defined during the first part of the year just ended, many factors reflecting a process of consolidation during the later months. The physical volume of business at the dawn of the new year [1935] was about equivalent to that of the later part of 1931.
>
> The level of business operations in the last half of 1934 was, of course, far below that of 1928 or 1929. The result was that large numbers of the increasing active population remained unemployed, and many plants were either idle or operated at a point far below capacity levels.
>
> A feature of the year was the advance in high-grade bond prices to the maximum point since the pre-war period. Wholesale prices remained stable at a level somewhat higher than that of 1933. After considerable fluctuation, common stock prices were slightly higher at the end of the year than at the beginning. The average of the official index for the twelve months ended December was 24.9 per cent. greater than the average for 1933. Trading on the Montreal and Toronto stock exchanges was inactive as compared with the preceding year.

SUMMARY OF MINERAL STATISTICS, 1934

Product	Quantity[1]	Value	Employees	Wages
METALLIC				
Gold ..... oz.	2,105,341	$43,521,249	10,193	$15,920,169
Exchange equalization	.....	29,287,439	.....	.....
Silver ..... oz.	5,523,938	2,600,393	272	291,243
Copper in matte exported[2] ..... lbs.	13,383,479	602,257		
Copper, metallic and in concentrates, exported ..... lbs.	191,676,060	14,220,447		
Nickel in matte, in speiss, and in ore exported; metallic nickel; and nickel content of oxides and salts ..... lbs.	128,687,340	32,139,425	[3]5,793	[3]8,603,461
Platinum metals ..... oz.	200,109	6,187,992		
Selenium ..... lbs.	51,574	91,286		
Tellurium ..... lbs.	5,130	25,599		
Bismuth ..... lbs.	7,552	3,444		
Cobalt in metal, oxides, salts, ores, and residues ..... lbs.	594,671	592,497	[4]150	[4]149,580
Lead in concentrates exported ..... lbs.	21,558	525		
Chromite ..... tons	40	480	16	9,485
Total	.....	$129,273,033	16,424	$24,973,938
NON-METALLIC				
Actinolite ..... tons	30	$365	.....	.....
Arsenic, white ..... lbs.	1,647,513	56,412	([5])	([5])
Diatomite ..... tons	46	1,920	.....	.....
Feldspar, crude and ground ..... tons	7,302	61,665	49	$10,767
Fluorspar ..... tons	150	2,100	4	825
Graphite, crude and refined ..... tons	.....	64,998	21	11,564
Gypsum ..... tons	33,234	141,389	69	53,718
Sulphur[6] ..... tons	14,598	145,980	.....	.....
Mica ..... lbs.	1,236,302	9,059	19	1,395
Mineral waters ..... Imp. gals.	21,775	1,622	.....	.....
Natural gas ..... M cu. ft.	7,682,851	4,741,368	931	1,010,979
Peat ..... tons	1,878	7,343	.....	.....
Petroleum, crude ..... bbls.	141,385	299,874	204	110,008
Quartzite and quartz ..... tons	89,838	134,572	55	28,746
Silica brick ..... M	369	14,730	8	7,558
Salt ..... tons	276,751	1,734,196	252	296,116
Talc ..... tons	13,934	135,978	47	33,796
Total	.....	$7,553,571	1,659	$1,565,472
STRUCTURAL MATERIALS				
Cement, Portland ..... bbls.	1,702,128	$2,403,590	341	$328,648
Hydrated lime ..... tons	22,281	249,038	187	116,020
Quicklime ..... tons	168,760	1,287,250		
Sand and gravel ..... tons	7,254,926	1,714,569	334	178,502
Sand-lime products[7]	.....	146,009	50	39,113
Stone: limestone, trap, granite, sandstone . tons	2,460,301	1,965,507	810	368,109
Slate ..... tons	120	600	.....	.....
Total	.....	$7,766,563	1,722	$1,030,392
CLAY PRODUCTS				
Brick, face ..... No.	23,410,266	$479,850		
Brick, common ..... No.	16,114,490	227,276		
Brick, fancy and ornamental ..... No.	14,277	835		
Brick, sewer ..... No.	307,147	5,992		
Tile, drain ..... No.	6,017,379	137,699	717	$311,732
Tile, structural, roofing, and floor	.....	120,981		
Sewer pipe, copings, flue-linings, etc.	.....	226,005		
Pottery	.....	52,578		
Haydite	.....	9,790		
Total	.....	$1,261,006	717	$311,732
TOTAL VALUE in Canadian funds	.....	$145,854,173	20,522	$27,881,534

[1]All tons in this table are 2,000 pounds.

[2]Copper in matte valued at 4½ cents per pound, and nickel at 18 cents.

[3]Employees and wages for nickel-copper mines, smelters, and refineries include statistics of the Ontario Refining Company.

[4]Employees and wages for silver-cobalt smelters and refineries.

[5]Employees and wages included with figures for silver-cobalt smelters and refineries ([4]).

[6]Tonnage given is sulphur content of sulphuric acid; no iron pyrites was sold in 1934.

[7]No deduction made for lime used in manufacturing.

COMPARATIVE VALUE OF MINERAL PRODUCTION, 1930–1934

Product	1930	1931	1932	1933	1934
METALLICS					
Gold (Canadian value)	$35,923,260	$45,043,837	$53,418,449	$61,044,951	$72,808,688
Silver	3,998,112	1,880,860	1,910,937	1,912,934	2,600,393
Platinum metals	2,436,683	2,812,834	1,998,911	1,501,233	6,187,992
Cobalt[1]	1,144,007	651,179	587,957	597,752	592,497
Nickel[2]	24,455,134	15,005,080	7,179,862	20,130,480	32,139,425
Copper, metallic and in matte	15,186,467	8,907,069	5,025,684	10,118,847	14,822,704
Selenium	.....	32,108	.....	53,745	91,286
Tellurium	.....	.....	.....	.....	25,599
Lead, pig and in ore	116,034	41,987	1,756	692	525
Zinc in ore and concentrates	127,004	.....	.....	.....	.....
Bismuth	6,366	3,532	7,289	3,731	3,444
Molybdenite	.....	280	.....	.....	.....
Chromite	.....	.....	.....	.....	480
Total	$83,393,067	$74,378,766	$70,130,845	$95,364,365	$129,273,033
NON-METALLICS					
Actinolite	$437	$456	.....	.....	$365
Arsenic, white	109,932	135,170	$98,914	$56,534	56,412
Barite	.....	.....	.....	60	.....
Diatomite	140	840	309	1,298	1,920
Feldspar, crude and ground	104,670	103,008	42,920	45,350	61,665
Fluorspar	1,240	620	464	1,064	2,100
Graphite, crude and refined	86,543	32,149	18,483	16,145	64,998
Gypsum	776,069	374,469	186,176	112,319	141,389
Iron pyrites and sulphur[3]	73,855	65,080	33,320	81,960	145,980
Mica	34,275	23,465	2,752	9,371	9,059
Mineral waters	20,754	8,578	2,473	2,347	1,622
Natural gas	5,061,588	4,635,497	4,719,297	4,523,084	4,741,368
Peat fuel	1,602	1,096	10,107	900	7,343
Petroleum, crude	235,746	219,993	247,468	253,486	299,874
Quartzite and quartz	274,674	148,642	93,574	86,146	134,572
Silica brick	19,120	13,702	4,303	7,351	14,730
Salt	1,558,405	1,760,388	1,789,752	1,755,087	1,734,196
Talc and soapstone	133,213	122,044	111,585	142,134	135,978
Total	$8,492,263	$7,642,308	$7,361,897	$7,094,636	$7,553,571
STRUCTURAL MATERIALS					
Cement, Portland	$5,779,404	$5,006,826	$2,288,975	$1,587,812	$2,403,590
Lime, hydrated and quicklime	2,177,587	1,221,190	1,273,230	1,227,196	1,536,288
Sand and gravel	3,559,487	2,317,015	2,000,298	2,467,916	1,714,569
Sand-lime brick[4]	424,178	253,228	78,398	69,785	146,009
Stone: limestone,trap,granite, etc.	4,630,970	3,197,297	1,655,016	983,268	1,965,507
Slate	.....	.....	.....	.....	600
Total	$16,571,626	$11,995,556	$7,295,917	$6,335,977	$7,766,563
CLAY PRODUCTS					
Brick, face	$1,811,569	$1,278,954	$532,728	$351,292	$479,850
Brick, common	779,744	622,777	286,928	163,338	227,276
Brick, fancy and ornamental	23,858	16,829	1,790	387	835
Brick, sewer	12,490	33,321	18,638	3,683	5,992
Tile, drain	593,980	244,368	144,579	179,015	137,699
Tile, structural, roofing, and floor	848,556	378,193	169,824	74,064	120,981
Sewer pipe, copings, flue-linings, etc	834,361	696,964	451,786	185,138	226,005
Pottery	89,384	73,860	67,866	52,650	52,578
Haydite	227,275	167,533	16,366	15,012	9,790
Total	$5,221,214	$3,552,799	$1,690,505	$1,024,579	$1,261,006
GRAND TOTAL	$113,678,170	$97,569,429	$86,479,164	$109,819,557	$145,854,173

[1]Cobalt in oxide, metallic cobalt, and cobalt content of residues marketed.
[2]Nickel in matte, oxide, and metallic nickel.
[3]Includes value of sulphuric acid produced.
[4]No deduction made for lime consumed in manufacturing.

The table below shows the aggregate value of metals from the time production began in Ontario and of other minerals beginning with 1891. Since 1914 the statistics of annual production credit the province only with the value of the pig iron made from Ontario ore. This is but a small part of the total output, since the great bulk of the iron ore charged to the blast furnaces of the province is "lake" ore from the mines of Minnesota and Wisconsin. In the production tables, credit is taken only for the ore exported or shipped to points other than Ontario blast furnaces, since to include the value of the domestic ore converted into pig iron in Ontario would involve a duplication of this item.

TOTAL MINERAL PRODUCTION

Year	Exchange equalization or discount	Metallics	Non-metallics	Structural materials	Clay products	Total
Before 1891[1]		$9,520,269				$9,520,269
1891		388,715		$4,316,958		4,705,673
1892		864,382		4,509,757		5,374,139
1893		614,762		5,505,991		6,120,753
1894		842,750		5,244,008		6,086,758
1895		616,055		4,554,083		5,170,138
1896		963,288		4,271,715		5,235,003
1897		1,038,089		4,480,452		5,518,541
1898		1,689,002		5,546,875		7,235,877
1899		2,055,592		6,361,081		8,416,673
1900		2,565,286		6,733,338		9,298,624
1901		5,016,734		6,814,352		11,831,086
1902		6,257,499		7,134,135		13,391,634
1903		5,242,575		7,628,018		12,870,593
1904		4,906,677		6,665,970		11,572,647
1905		10,201,010		7,653,286		17,854,296
1906		13,353,080		9,035,303		22,388,383
1907		14,550,835	3,020,537	3,876,275	3,571,726	25,019,373
1908		16,754,986	2,629,749	3,396,406	2,856,476	25,637,617
1909		22,928,496	2,825,751	4,028,206	3,198,922	32,981,375
1910		28,161,678	3,141,658	4,380,000	3,630,559	39,313,895
1911		29,102,867	3,674,926	4,935,609	4,263,395	41,976,797
1912		34,799,734	4,009,643	4,701,170	4,831,056	48,341,603
1913		37,507,935	4,296,450	5,866,775	5,561,151	53,232,311
1914		33,345,291	4,339,703	4,505,368	4,105,597	46,295,959
1915		44,109,769	4,655,250	3,609,371	1,871,379	54,245,679
1916		55,002,918	4,982,140	3,734,065	1,584,699	65,303,822
1917		56,831,857	7,702,942	4,962,284	2,596,749	72,093,832
1918		66,178,059	7,815,062	4,297,401	2,018,450	80,308,972
1919		41,590,759	6,308,182	7,208,413	3,776,562	58,883,916
1920	$1,376,275	48,281,553	8,141,796	11,921,019	4,735,154	74,455,797
1921	1,359,636	28,777,581	6,636,217	13,967,386	5,183,125	55,923,945
1922	208,621	40,290,157	7,591,913	13,640,166	6,944,218	68,675,075
1923	279,446	44,075,660	8,511,786	13,139,757	6,269,140	72,276,789
1924	196,749	52,130,314	7,555,283	12,398,465	5,137,865	77,418,676
1925	—2,838	62,495,472	7,488,034	12,451,174	5,148,626	87,580,468
1926	—595	59,218,297	7,842,632	12,681,308	5,356,469	85,098,111
1927	—235	62,631,255	7,638,605	14,160,552	5,853,035	90,283,212
1928	2,811	71,267,003	7,822,641	14,815,814	6,177,664	100,085,933
1929	157,456	83,967,446	8,621,427	18,541,687	6,830,162	118,118,178
1930	36,702	83,356,365	8,492,263	16,571,626	5,221,214	113,678,170
1931	1,926,222	72,452,544	7,642,308	11,995,556	3,552,799	97,569,429
1932	6,133,828	63,997,017	7,361,897	7,295,917	1,690,505	86,479,164
1933	16,486,437	78,877,928	7,094,636	6,335,977	1,024,579	109,819,557
1934	29,287,439	99,985,594	7,553,571	7,766,563	1,261,006	145,854,173
Total	$57,447,954	$1,498,806,045		$633,288,916		$2,189,542,915

[1]Prior to 1891, when the Ontario Bureau (now Department) of Mines was established, it is estimated that metals to the value of $9,520,269 were produced. No estimate has been made of the output of non-metallics up to 1891.

Metal Production

In the total production of metals in Ontario, noted hereunder, gold moved up from third to first place in 1927:—

METAL PRODUCTION TO DECEMBER 31, 1934

Metal or product	To December 31, 1933	1934	To December 31, 1934
Gold	$486,081,471	$43,521,249	$529,602,720
Exchange equalization	28,160,515	29,287,439	57,447,954
Nickel, including nickel oxides and salts	359,383,615	32,139,425	391,523,040
Silver	257,686,623	2,600,393	260,287,016
Copper[1]	145,225,872	14,822,704	160,048,576
Pig iron from domestic ore	84,775,556	.....	84,775,556
Cobalt[2]	25,929,269	592,497	26,521,766
Platinum metals	24,806,192	6,187,992	30,994,184
Iron ore[3]	9,463,516	.....	9,463,516
Lead	4,485,314	525	4,485,839
Zinc, in ore and concentrates	535,696	.....	535,696
Molybdenite	210,015	.....	210,015
Bismuth	151,459	3,444	154,903
Selenium	85,853	91,286	177,139
Tellurium	.....	25,599	25,599
Chromite	.....	480	480
Total	$1,426,980,966	$129,273,033	$1,556,253,999

[1]Includes small quantities of copper sulphate.
[2]Includes metal, oxide, salts, and cobalt contents of residues exported.
[3]Value of ore shipped out of the province.

Dividends.—During 1934 dividends were paid by 12 gold, 2 nickel-copper, and 2 silver-cobalt mining companies. Total payments by metal mines of the province are rated hereunder by groups:—

DIVIDENDS PAID BY METAL MINES TO DECEMBER 31, 1934

Industry	To end of 1933	1934	To end of 1934
Nickel-copper	$149,723,449	$10,126,014	$159,849,463
Gold	153,107,391	26,841,464	179,948,855
Silver-cobalt	97,691,281	260,000	97,951,281
Total	$400,522,121	$37,227,478	$437,749,599

Diamond-Drilling

During the past two years diamond-drilling in Ontario has been active. Sixteen companies were operating, and the statistics which follow present a fairly complete picture. In 1933 there were 143 drills in use, and employment was given to 251 men who received $375,236 in wages. The corresponding figures for 1934 are 285 drills, 518 men, and $759,285 in wages. Diamond-drilling operations afford an excellent yard-stick in appraising the general trend in mining development and prospecting. As these Ontario firms do considerable drilling in the neighbouring provinces, Quebec and Manitoba, and also much farther afield, statistics covering the work done in these outside areas are also shown. It should, however, be pointed out that the data for outside provinces may be incomplete.

DIAMOND-DRILLING OPERATIONS, 1933 AND 1934

Province	1933		1934	
	Holes	Core footage	Holes	Core footage
Ontario	2,692	389,764	3,891	672,011
Quebec	472	138,692	1,023	215,153
Manitoba	277	39,462	418	81,226
Saskatchewan and N.W.T.	4	798	33	5,791
Total	3,445	568,716 (107.7 miles)	5,365	974,181 (184.5 miles)

On the other hand consumption of diamonds used in drilling refers to footage drilled in all provinces in which work was reported, and is indicative of the trade available for diamond merchants as well as the amount of wear or wastage of these abrasives in our hard pre-Cambrian rocks. The total consumption of borts, ballas, and carbons was 39,975.43 carats, as shown below:—

CONSUMPTION OF DIAMONDS BY REPORTING FIRMS, 1934

Period	Borts	Ballas	Carbons
	carats	carats	carats
On hand December 31, 1933	10,402.79	76.61	3,100.90
Purchased in 1934	40,835.30	32.19	2,680.13
	51,238.09	108.80	5,781.03
On hand December 31, 1934	13,380.92	76.57	3,695.00
Consumed (39,975.43) in 1934	37,857.17	32.23	2,086.03

Prospecting

An index of prospecting activity is afforded by the following table:—

MINING CLAIMS RECORDED, 1907–1934

Year	No.	Year	No.
1907	13,996	1921	2,459
1908	4,634	1922	5,686
1909	9,746	1923	6,092
1910	5,792	1924	5,222
1911	9,001	1925	4,751
1912	3,104	1926	13,496
1913	4,320	1927	15,554
1914	1,913	1928	15,046
1915	2,519	1929	8,207
1916	2,470	1930	3,886
1917	1,936	1931	5,779
1918	1,534	1932	4,945
1919	2,918	1933	8,077
1920	2,160	1934	16,888

METALLICS

Gold

General Summary

At the old price of gold the record of production from all sources in Ontario during 1934 was $1,037,265 below the figures for 1933. Taking the exchange equalization and world price into consideration, the production value in 1934

in Canadian funds was $11,763,737 in excess of that for 1933, the total figures of value being $72,808,688 as against $61,044,951.

Referring to the gold mines separately, the year 1934 has shown marked improvement, and while the ounces recovered in Ontario declined, the quantity of ore treated increased, moving up from 5,621,517 tons during 1933 to 6,413,010 tons in 1934, or an increase of 14 per cent. This expansion indicates the increased milling facilities and the ability of operators to treat much lower grade ore, thereby increasing the life of the mines and the communities now dependent on this industry. At Porcupine the average value per ton of ore treated, at the Canadian price of gold, was $8.88; at Kirkland Lake, $17.47; in Matachewan, $6.15; and in Northwestern Ontario, $4.83. In this connection it is of interest to note that in the Transvaal the record for 1934 as compared with 1933 shows an increase in tonnage milled of nearly 8 per cent., but a decrease in grade from 5.844 to 5.150 pennyweights per ton of ore, or almost 12 per cent. During 1934, 8 mines reported production from Porcupine, and 4 properties carried on small part-time operations. Ten were active at Kirkland Lake, 3 in Matachewan, and 18 in Northwestern Ontario.

Although the output from the northwestern portion of the province was small and mainly produced by one mine, the Howey, it is of interest to record the reopening of many old properties which were producers in the nineties and which are now being taken up again. In addition important new mines have recently come into production, e.g. Little Long Lac and others. The increased price of gold, modern milling methods, and improved transportation facilities have created a considerable change in the outlook of the gold-mining industry in this area. When it is remembered that favourable gold formations are known to exist and that new finds are becoming general over a wide area, the developments in gold-mining in this part of the province promise to be of considerable importance during the next few years.

In the late summer new finds were reported from the Sturgeon River area, which is east of Lake Nipigon. A gold "rush" followed, and hundreds of claims were staked and recorded, but it is too soon to estimate the importance of this new field. Very rich veins on the claims of the Sturgeon River Gold Mines have been found on surface and by diamond-drilling. Favourable developments at the Little Long Lac mine and at the Central Patricia and Pickle Crow mines near the Albany river, with continued interest at Red Lake, are an earnest of a revival of gold-mining in the northwestern part of Ontario. McKenzie Red Lake, the second producer at Red Lake, turned over its new 125-ton mill in February, 1935.

The number employed in producing gold mines, exclusive of salaried officials, increased from 8,706 in 1933 to 10,193 in 1934, while for the whole industry the number gainfully employed rose from 16,103 to 19,387, an increase of 21.6 per cent. This is exclusive of the great army of men absorbed in prospecting and developing newly staked claims. From the point of view of claims recorded, the year 1934 was the highest on record, a total of 16,888 claims having been filed. This is more than double the figure for 1933, when 8,077 claims were recorded. Previous high records were made in 1907, 1926, 1927, and 1928.

Gold-Milling Plants

The milling capacity in tons per day of idle and producing gold mines in Ontario at the end of 1934, and that of projected plants and proposed expansion of existing plants for 1935, are summarized as follows:—

GOLD-MILLING PLANTS AT ONTARIO MINES, 1934

Area and mine	Tonnage idle	Tonnage operating	Proposed tonnage
KIRKLAND LAKE BELT:			
Barry-Hollinger	.....	100	.....
Bidgood	.....	100	.....
Canadian Reserve (Larder lake)	500	.....	.....
Kirkland Gold Belt	.....	.....	100
Kirkland Lake Gold	.....	150	.....
Lake Shore	.....	2,325	.....
Lucky Cross (Golden Gate Mining Co.)	20	.....	.....
Macassa	.....	200	.....
Sylvanite	.....	325	.....
Teck-Hughes	.....	1,325	.....
Toburn	.....	100	.....
Wright-Hargreaves	.....	1,000	.....
PORCUPINE BELT:			
Anglo-Huronian (Vipond)	.....	300	.....
Blue Quartz (Amalgamated Goldfields)	.....	25	.....
Buffalo Ankerite	.....	350	.....
Canusa	.....	25	.....
Coniaurum	.....	400	.....
Dome	.....	1,500	.....
Gillies Lake Porcupine	.....	.....	75
Hayden	40	.....	.....
Hollinger	.....	5,000	.....
Lakeland	25	.....	.....
McIntyre-Porcupine	.....	2,250	.....
McLaren-Porcupine	.....	3	.....
Marbuan (March)	.....	200	.....
Munro Croesus	25	.....	.....
Northern Turnbull	.....	15	.....
Paymaster Consolidated	.....	200	.....
Porcupine Peninsular (Night Hawk lake)	200	.....	.....
MATACHEWAN AND WEST SHININGTREE:			
Ashley	.....	125	.....
Churchhill	.....	.....	10
Matachewan Consolidated	.....	100	.....
Young-Davidson	.....	500	.....
SUDBURY DISTRICT:			
Halcrow-Swayze	.....	25	.....
Lebel Oro (Long Lake)	.....	.....	200
McMillan	.....	125	.....
MICHIPICOTEN AND GOUDREAU:			
Algold (New Goudreau)	50	.....	.....
Algoma Summit	.....	25	.....
Minto	.....	80	.....
Parkhill	.....	100	.....
THUNDER BAY DISTRICT:			
Ardeen (Moss)	.....	200	.....
Little Long Lac	.....	200	.....
McMartin, J. Bruce (Dikdik)	.....	.....	10
North Shores (McKellar-Longworth)	.....	25	.....
Northern Empire (Beardmore)	.....	125	.....
St. Anthony	.....	125	.....
Tashota	.....	.....	50
PATRICIA PORTION OF KENORA:			
Casey Summit	.....	50	.....
Central Patricia	.....	50	+50
Howey	.....	1,100	.....
J-M Consolidated	.....	30	.....
McKenzie Red Lake	.....	.....	200
Pickle Crow	.....	.....	100
RAINY RIVER DISTRICT:			
Foley Syndicate	.....	5	.....
Golden Star	.....	5	.....
Saundary Syndicate	.....	5	.....
Total	860	18,893	795

Labour Statistics

The following figures summarize labour statistics for the gold-mining industry, as reported to the Ontario Department of Mines:—

AVERAGE YEARLY WAGE, GOLD-MINING INDUSTRY, 1933 AND 1934

Locality	1933			1934		
	No. of wage earners	Wages paid	Average wage per annum	No. of wage earners	Wages paid	Average wage per annum
Porcupine	4,728	$7,645,825	$1,617	5,295	$8,541,490	$1,613
Kirkland Lake	3,493	5,584,787	1,599	3,525	5,706,528	1,619
N.W. Ontario	485	717,492	1,480	1,373	1,672,151	1,217
Operating but non-producing	665	514,056	773	1,195	1,059,506	886
Total	9,371	$14,462,160	$1,543	11,388	$16,979,675	$1,491

Production and Dividends

The following tables show the total gold production from 1866 to 1934, the production by regions in 1934, the total production by regions since 1910, and the dividends paid by the various gold-mining companies.

GOLD PRODUCTION, 1866–1934

(On the standard basis of $20.671834 per ounce, or one dollar = 0.048375 ounces)

Year	Total production, value	Porcupine belt		Kirkland Lake belt		N.W. Ontario[1]	
		Value	Per cent.	Value	Per cent.	Value	Per cent.
1866–1891[2]	$190,258	.....	.....	.....	.....	.....	.....
1892–1909[3]	2,509,492	.....	.....	.....	.....	.....	.....
1910	68,498	$35,539	51.8	.....	.....	.....	.....
1911	42,637	15,437	36.2	.....	.....	.....	.....
1912	2,114,086	1,730,628	81.8	.....	.....	.....	.....
1913	4,558,518	4,294,113	94.1	$86,316	1.9	.....	.....
1914	5,544,979	5,206,006	93.8	114,154	2	.....	.....
1915	8,501,391	7,462,111	88.6	551,069	6.5	.....	.....
1916	10,339,259	9,391,408	90.8	702,761	6.8	.....	.....
1917	8,698,735	8,229,744	94.5	404,346	4.6	.....	.....
1918	8,502,480	7,767,907	91.4	632,007	7.4	.....	.....
1919	10,451,709	9,941,803	95.1	486,809	4.7	.....	.....
1920	11,686,043	10,597,572	90.7	1,033,478	8.8	.....	.....
1921	14,692,357	13,103,526	89.5	1,524,851	10.4	.....	.....
1922	20,579,569	18,374,658	89.3	2,159,581	10.5	.....	.....
1923	20,136,287	17,313,115	85.9	2,719,939	13.5	.....	.....
1924	25,669,303	22,135,534	86.2	3,446,632	13.4	.....	.....
1925	30,206,432	24,733,120	81.8	5,385,256	17.8	.....	.....
1926	30,950,753	23,680,670	76.5	7,174,083	23.2	.....	.....
1927	33,627,040	23,851,857	70.9	9,674,114	28.7	.....	.....
1928	32,629,111	20,246,319	62	12,233,524	37.5	.....	.....
1929	33,535,226	19,281,286	57.6	14,046,596	41.8	$22,988	0.07
1930	35,886,558	17,758,842	49.6	17,172,770	47.9	461,730	1.3
1931	43,117,615	19,891,521	46.2	21,734,729	50.4	1,007,756	2.3
1932	47,284,621	21,422,117	45.2	23,782,313	50.3	1,607,831	3.4
1933	44,558,514	21,624,617	48.5	20,817,277	46.7	1,352,017	3
1934	43,521,249	19,634,097	45	20,424,716	46.9	2,214,385	5
Total	$529,602,720	$347,723,547	65.6	$166,307,321	31.4	.....	.....

[1]Recent production only. Gold output from 1866 to 1909, inclusive, came from Hastings county and Northwestern Ontario. No segregation of statistics can now be made.

[2]Estimated.

[3]Maximum yearly output was $424,568 in 1899.

PRODUCTION OF GOLD MINES, 1934

Area	Ore milled	Gold bullion shipped				Total value, standard[1]	Exchange equalization	Value, Canadian funds
		Gold content[1]		Silver content				
PORCUPINE	tons	ounces		ounces				
Amalgamated Goldfields	500	19.02	$393	8	$4	$397	$266	$663
Anglo-Huronian (Vipond)	101,806	15,541.47	321,271	2,774	1,293	322,564	216,679	539,243
Buffalo Ankerite	131,720	20,603.16	425,905	1,999	939	426,844	286,054	712,898
Coniaurum	138,114	28,435.54	587,815	4,209	1,977	589,792	389,364	979,156
Dome	547,600	206,157.67	4,261,657	18,939	8,712	4,270,369	2,906,718	7,177,087
Hollinger	1,900,490	434,257.14	8,976,892	108,827	52,595	9,029,487	6,079,396	15,108,883
McIntyre-Porcupine	851,345	239,099.32	4,942,620	58,421	27,005	4,969,625	3,319,637	8,289,262
McLaren-Porcupine	50	9.86	204	2	1	205	134	339
Marbuan	26,030	3,304.35	68,307	298	147	68,454	44,968	113,422
Munro Croesus	.....	298.54	6,171	24	13	6,184	4,283	10,467
Northern Turnbull	30	5	103	.....	.....	103	69	172
Paymaster Consolidated	13,824	2,020.5	41,767	583	303	42,070	27,452	69,522
Miscellaneous	.....	48	992	.....	.....	992	664	1,656
Total	3,711,714	949,799.57	$19,634,097	196,084	$92,989	$19,727,086	$13,275,684	$33,002,770
KIRKLAND LAKE								
Argonaut (tailings)	12	54	$1,116	18	$9	$1,125	$747	$1,872
Barry-Hollinger	33,445	4,399.52	90,946	409	193	91,139	60,937	152,076
Bidgood	2,433	199.46	4,123	39	18	4,141	2,663	6,804
Kirkland Lake Gold	64,952	20,316.21	419,973	2,853	1,340	421,313	281,987	703,300
Lake Shore	836,023	472,762.19	9,752,189	96,940	45,513	9,797,702	6,508,117	16,305,819
Macassa	66,557	32,055.98	662,656	3,684	1,726	664,382	446,716	1,111,098
Moffatt-Hall	8,476	2,525.3	52,202	343	163	52,365	34,706	87,071
Sylvanite	111,767	50,336.63	1,040,552	8,298	3,770	1,044,322	696,062	1,740,384
Teck-Hughes	442,745	167,411.82	3,460,709	23,837	11,161	3,471,870	2,329,821	5,801,691
Toburn	36,230	20,400.69	421,720	4,874	2,311	424,031	284,088	708,119
Wright-Hargreaves	354,418	218,203.16	4,510,660	39,962	18,340	4,529,000	3,043,292	7,572,292
Miscellaneous	.....	380.69	7,870	34	16	7,886	5,264	13,150
Total	1,957,058	988,045.65	$20,424,716	181,291	$84,560	$20,509,276	$13,694,400	$34,203,676
MATACHEWAN								
Ashley	43,532	13,181.48	$272,485	2,023	$941	$273,426	$183,404	$456,830
Matachewan Consolidated	4,680	679.39	14,044	100	52	14,096	9,472	23,568
Young-Davidson	51,842	3,878.11	80,168	1,399	728	80,896	53,615	134,511
Total	100,054	17,738.98	$366,697	3,522	$1,721	$368,418	$246,491	$614,909

NORTHWESTERN ONTARIO								
Algoma Summit	421	143.80	$2,972	14	$7	$2,979	$1,947	$4,926
Ardeen (Moss)	38,143	5,815.27	120,212	31,796	15,175	135,387	80,707	216,094
Casey Summit[2]	4,094	887.89	18,354	87	41	18,395	12,278	30,673
Central Canada Mines	350	21.44	443	13	7	450	292	742
Central Patricia	11,536	6,373.15	131,745	577	292	132,037	87,525	219,562
Dikdik	230	1,082.00	22,367	644	309	22,676	14,962	37,638
Duport	25	64.99	1,343	.....	.....	1,343	899	2,242
Foley Syndicate	232	243.06	5,025	127	60	5,085	3,360	8,445
Golden Star	260	76.13	1,574	24	11	1,585	1,063	2,648
Howey	481,757	45,985.26	950,600	15,434	7,197	957,797	636,426	1,594,223
J-M Consolidated	3,443	1,019.09	21,067	621	359	21,426	13,963	35,389
Lebel Oro (Long Lake)	7	36.38	752	3	1	753	503	1,256
Little Long Lac	5,485	2,456.99	50,790	198	104	50,894	34,586	85,480
McMillan	12,313	1,959.39	40,504	63	31	40,535	26,809	67,344
Minto	22,189	4,912.20	101,544	144	66	101,610	67,691	169,301
Northern Empire	22,507	5,662.57	117,056	860	416	117,472	78,175	195,647
Parkhill	19,431	8,983.81	185,712	407	189	185,901	124,746	310,647
St. Anthony (ore, dump, tailings)	21,618	3,571.38	73,827	991	491	74,318	48,880	123,198
Saundary Syndicate	13	12.62	261	.....	.....	261	174	435
Sol-D'Or (Bathurst)	130	74.51	1,540	6	2	1,542	1,009	2,551
Total	644,184	89,381.93	$1,847,688	52,008	$24,758	$1,872,446	$1,235,995	$3,108,441
Total for gold mines[3]	6,413,010	2,044,966.13	$42,273,198	432,905	$204,028	$42,477,226	$28,452,570	$70,929,796
MISCELLANEOUS								
Nickel-copper refining; Cobalt ores	.....	60,374.48	$1,248,051	.....	.....	$1,248,051	$834,869	$2,082,920
Total gold output[4]	.....	2,105,340.61	$43,521,249	.....	.....	$43,521,249	$28,452,570	.....
CALENDAR YEAR 1933								
Porcupine	3,402,632	1,046,091.01	$21,624,617	171,437	$54,910	$21,679,527	$8,249,321	$29,883,318
Kirkland Lake	1,766,014	990,044.43	20,466,034	166,518	58,062	20,524,096	7,305,041	27,183,859
Matachewan	38,004	16,991.38	351,243	2,375	849	352,092	143,892	495,984
Northwestern Ontario	414,867	65,403.83	1,352,017	68,296	23,046	1,375,063	495,309	1,870,372
Miscellaneous	.....	36,987.66	764,603	.....	.....	764,603	292,874	1,057,477
Total gold output, 1933	5,621,517	2,155,518.31	$44,558,514	.....	.....	$44,558,514	$16,486,437	.....

[1]This value is based on the old price of gold ($20.671834 per fine ounce).
[2]According to mine officials the figures represent only the quantity of gold recovered and sold.
[3]Includes silver recovered with gold.
[4]From all sources, exclusive of silver.

VALUE OF PRODUCTION (GOLD AND SILVER) BY MINES OF THE PORCUPINE BELT, 1910–1934

Year	Hollinger	Dome	McIntyre	Vipond[1]	Coniaurum	Porcupine Crown and Northcrown	West Dome Lake	Buffalo Ankerite[2]	Marbuan (March)[3]	Night Hawk Peninsular	Schumacher[4]	Paymaster	Rea and Newray
1910	$31,194	$4,355											
1911	6,000	4,277		$5,160									
1912	909,181	737,499	$77,657	16,259									
1913	2,488,022	1,242,625	236,299			Crown $326,803							[5]$18,858
1914	2,719,355	1,059,238	549,166	73,628		Crown 685,135							[5]125,255
1915	4,206,015	1,530,287	750,812	246,053		Crown 602,436	$102,880				$48,236		
1916	5,073,401	2,153,820	1,218,073	176,686		Crown 578,322	16,814				225,301		
1917	4,261,938	1,480,174	1,710,204	209,738		Crown 377,904	44,434				198,605		[6]1,447
1918	5,752,371	82,127	1,578,444	82,868		Crown 124,474	103,745				92,842		[6]1,516
1919	6,722,266	1,290,301	1,978,014			Crown	23,910						
1920	6,219,665	2,020,568	2,223,083			Nc. Porcupine Crown 71,529	47,169						
1921	9,051,276	2,290,264	1,827,761			Nc. Porcupine Crown 97,301 Nc. Porcupine Crown 7,943							
1922	12,274,114	4,178,936	2,021,811									$2,800	
1923	10,446,412	4,374,144	2,550,129	23,876									
1924	13,433,063	4,307,624	3,604,874	596,803			60,642			$268,518			
1925	15,749,109	4,365,923	3,721,499	565,379			287,758			196,947			
1926	14,829,655	3,940,053	3,862,074	631,636			220,758	$140,588	$11,055	111,154		63,551	
1927	14,539,538	4,031,575	3,965,210	667,724			[7]35,252	359,005	19,839	166		135,025	
1928	10,706,235	3,915,051	4,201,808	694,426	$220,534			289,960	133,879			183,271	
1929	9,455,290	3,590,537	4,295,491	820,667	635,485		155,797	71,684	256,303				
1930	10,260,950	774,943	4,696,578	909,414	738,941		15,662	878	306,262				
1931	10,097,975	3,512,066	4,756,880	564,291	751,352				217,586				
1932	10,356,846	4,040,318	5,424,728	454,412	861,031			219,482	78,835				
1933	9,971,877	4,524,025	5,427,001	502,541	695,957			462,680					
1934	9,029,487	4,270,369	4,969,625	322,564	589,792			426,844	68,454			42,070	
Total	$198,591,235	$63,721,099	$65,647,221	$7,564,125	$4,493,092	$2,871,847	$1,114,821	$1,971,121	$1,092,213	$566,885	$564,984	$426,717	$147,076

[1]Changed to Anglo-Huronian, Limited, October 16, 1933.
[2]Formerly Ankerite; renamed Buffalo Ankerite in 1932.
[3]The March was renamed the Marbuan in 1934; the Buffalo Ankerite operated the Marbuan mill in 1933, treating 2,800 tons from the dump of the New York Porcupine Gold Mines, Ltd.
[4]Purchased by the Hollinger in 1922.
[5]Rea.
[6]Newray.
[7]Total value of bullion in 1927 was $87,919. Figures shown in above table allow for a reduction of $52,667, due to an erroneous return made in 1925.

VALUE OF PRODUCTION (GOLD AND SILVER) BY MINES OF THE PORCUPINE BELT, 1910–1934—*Continued*

Year	Porcupine United	David-son	Preston and Clifton	Scottish-Ontario	Porcupine Pet	Porphyry Hill	Gold Reef	Tommy Burns	De Santis	Hughes	Miscel-laneous	Total value (standard)
1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$35,549
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15,437
1912	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,740,596
1913	.....	.....	.....	.....	.....	$4,200	.....	.....	.....	.....	.....	4,316,807
1914	.....	.....	[6]$15,212	.....	$5,000	.....	.....	.....	.....	.....	.....	5,231,989
1915	.....	.....	.....	.....	5,551	2,036	$1,547	.....	.....	.....	.....	7,495,853
1916	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9,442,417
1917	.....	.....	.....	.....	.....	.....	588	$289	.....	.....	.....	8,285,321
1918	.....	$15,579	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,833,966
1919	.....	27,089	.....	.....	.....	.....	.....	.....	.....	.....	.....	10,041,580
1920	.....	11,246	.....	.....	.....	.....	.....	.....	.....	.....	.....	10,690,561
1921	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,177,244
1922	.....	.....	Clifton 1,664	.....	.....	.....	.....	.....	.....	.....	.....	18,479,325
1923	.....	.....	Clifton 8,331	.....	.....	.....	.....	.....	.....	.....	[7]$2,756	17,405,648
1924	.....	.....	Clifton 5,270	.....	.....	.....	.....	.....	.....	.....	.....	22,266,894
1925	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24,886,615
1926	.....	.....	.....	.....	.....	.....	.....	.....	$146	$30	.....	23,810,700
1927	.....	.....	.....	$5,893	.....	.....	.....	.....	.....	.....	[8]217,350	23,976,577
1928	.....	.....	.....	6,795	.....	.....	.....	.....	.....	.....	[9]140	20,352,099
1929	$44,285	.....	.....	.....	.....	.....	.....	.....	.....	.....	[10]47,701	19,373,240
1930	56,913	.....	.....	.....	.....	.....	.....	.....	.....	.....	[11]61,940	17,822,481
1931	5,439	.....	.....	.....	.....	.....	.....	.....	.....	.....	[12]36,114	19,941,703
1932	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[13]38,940	21,474,592
1933	.....	.....	.....	[14]887	.....	.....	.....	.....	[15]11,816	.....	[16]82,743	21,679,527
1934	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[17]7,881	19,727,086
Total	$106,637	$53,914	$30,477	$13,575	$10,551	$6,236	$2,135	$289	$11,962	$30	$495,565	$349,503,807

[6]Preston.
[7]Huddlestone and Cline.
[8]Includes "high-grade" recovered from W. P. Wilson.
[9]Blue Quartz.
[10]High-grade recovered.
[11]High-grade recovered.
[12]Munro Croesus, $3,955; and miscellaneous, $32,159.
[13]Hayden, $1,497; Munro Croesus, $5,722; J. Spence, $2,515; and miscellaneous, $29,206.
[14]Canusa.
[15]Treated in Hayden mill.
[16]Hayden, $2,516; New York Porcupine, $3,164; and $77,063 recovered mainly from scrapped machinery, of which J. M. McLaren is credited with $326 on ore shipped to Noranda.
[17]Amalgamated Goldfields, $397; McLaren-Porcupine, $205; Munro Croesus, $6,184; Northern Turnbull, $103; miscellaneous, $992.

VALUE OF PRODUCTION (GOLD AND SILVER) BY MINES OF THE KIRKLAND LAKE AND MATACHEWAN AREAS, 1913–1934

Year	Lake Shore	Teck-Hughes	Wright-Hargreaves	Sylvanite	Kirkland Lake	Tough-Oakes Burnside (Toburn)[1]	Barry-Hollinger	Argonaut[2]	Macassa	Miscellaneous	Matachewan Area			Total value (standard)
											Ashley	Young-Davidson	Matachewan Consol.	
1913	.....	.....	$1,127	.....	.....	$66,632	.....	.....	.....	[3]$21,178	.....	.....	.....	$88,937
1914	.....	.....	.....	.....	.....	117,644	.....	$5,204	.....	.....	.....	.....	.....	122,848
1915	.....	.....	.....	.....	.....	555,539	.....	.....	.....	.....	.....	.....	.....	555,539
1916	.....	.....	.....	.....	.....	711,625	.....	.....	.....	.....	.....	.....	.....	711,625
1917	.....	$66,722	.....	.....	.....	342,831	.....	.....	.....	.....	.....	.....	.....	409,553
1918	$416,414	80,570	.....	.....	.....	139,683	[4]$10,114	.....	.....	.....	.....	.....	.....	646,781
1919	263,354	169,590	.....	.....	$56,263	.....	.....	2,631	.....	.....	.....	.....	.....	491,838
1920	503,735	247,757	.....	.....	286,901	.....	.....	26,863	.....	.....	.....	.....	.....	1,065,256
1921	495,276	322,919	468,751	.....	242,417	.....	.....	513	.....	.....	.....	.....	.....	1,529,875
1922	471,341	596,495	762,753	.....	224,396	107,481	.....	.....	.....	[5]10,082	.....	.....	.....	2,172,548
1923	547,600	1,117,963	754,979	.....	223,102	12,174	.....	72,512	.....	.....	.....	.....	.....	2,728,331
1924	1,098,572	1,023,025	1,088,725	.....	46,512	47,547	.....	152,072	.....	.....	.....	.....	.....	3,456,453
1925	1,958,720	996,943	1,913,401	.....	.....	263,064	56,978	214,183	.....	.....	.....	.....	.....	5,403,289
1926	2,775,000	1,601,209	2,150,844	.....	126,999	309,709	86,263	143,387	.....	.....	.....	.....	.....	7,193,411
1927	3,375,053	2,781,962	2,151,916	$429,424	473,673	153,215	175,692	127,448	.....	[6]35,460	.....	.....	.....	9,703,843
1928	4,073,965	4,948,896	1,838,510	738,146	414,596	82,316	111,767	32,430	.....	[7]30,484	.....	.....	.....	12,271,110
1929	6,090,189	5,048,420	1,734,728	689,465	352,789	.....	151,758	9,959	.....	11,925	.....	.....	.....	14,089,233
1930	7,836,779	5,398,271	2,432,888	794,459	533,851	.....	217,835	1,891	.....	.....	.....	.....	.....	17,215,974
1931	11,065,618	6,093,199	2,909,837	901,168	586,250	.....	224,633	.....	.....	[8]2,457	.....	.....	.....	21,783,162
1932	12,647,128	5,855,570	3,548,161	828,195	524,329	203,642	160,697	.....	.....	[9]468	$61,290	.....	.....	23,829,480
1933	10,364,835	4,558,181	3,672,529	925,460	382,515	477,114	60,789	.....	$76,262	[10]7,005	351,498	.....	.....	20,876,188
1934	9,797,702	3,471,870	4,529,000	1,044,322	421,313	424,031	91,139	1,125	664,382	[11]64,392	273,426	$80,896	$14,096	20,877,694
Total	$73,781,281	$44,379,562	$29,958,149	$6,350,639	$4,895,906	$4,014,247	$1,347,665	$790,218	$740,644	$183,451	$686,214	$80,896	$14,096	$167,222,968

[1]Renamed the Toburn in 1931.
[2]Exclusive of copper values.
[3]Lucky Cross, $14,006; Swastika, $7,172.
[4]Patricia mine, afterwards called Barry-Hollinger.
[5]Ontario-Kirkland.
[6]Canadian Associated Goldfields, $34,595; samples shipped in 1923 and 1926 by the Gold Hill not heretofore reported.
[7]Canadian Associated Goldfields, $17,700; Gold Hill, $12,784.
[8]Trout Creek, $1,622; Telluride in Skead township, $835.
[9]Telluride in Skead township.
[10]Kirkland Gateway, $865; Atlas, $175; White Rock, $419; and from scrap machinery, $5,546.
[11]Bidgood, $4,141; Moffatt-Hall, $52,365; and miscellaneous, $7,886.

DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES TO DECEMBER 31, 1934

Name of company	Date of incorporation	Authorized capital, $ or shares	Capital stock issued, $ or shares	Par value per share	Dividends and bonuses paid to end of 1933	Dividends and bonuses paid during 1934	Rate per cent., or per share 1934	Total dividends and bonuses paid to Dec. 31, 1934	Date when last dividend or bonus was paid
Anglo-Huronian, Ltd.	Oct. 16, 1933	2,000,000	1,252,605	No par	.....	$501,042.00	40c.	$501,042.00	Dec. 1, 1934
Buffalo Ankerite Gold Mines, Ltd.	Oct. 5, 1932	$1,000,000	577,007	$1.00	$42,571.29	89,371.77	16c.	131,943.06	Nov. 15, 1934
Coniaurum Mines, Ltd.	July 4, 1929	6,000,000	2,717,447	No par	80,923.41	.....	.....	80,923.41	Aug. 15, 1932
Dome Mines, Ltd.[1]	Sept. 30, 1923	1,000,000	1,000,000	No par	18,221,178.15	3,336,669.00	$3.50	21,557,847.15	Oct. 20, 1934
Hollinger Cons. Gold Mines, Ltd.[2]	May 25, 1916	$25,000,000	$24,600,000	5.00	66,102,400.00	6,888,000.00	28%	72,990,400.00	Dec. 31, 1934
Howey Gold Mines, Ltd.	Mar. 12, 1926	5,000,000	5,000,000	1.00	.....	500,000.00	10c.	500,000.00	Dec. 1, 1934
Kirkland Gold Mining Co., Ltd.	Nov. 19, 1915	5,500,000	5,239,123	1.00	.....	157,173.69	3c.	157,173.69	Dec. 1, 1934
Lake Shore Gold Mines, Ltd.	Feb. 25, 1914	2,000,000	2,000,000	1.00	28,020,000.00	7,000,000.00	350%	35,020,000.00	Dec. 15, 1934
Macassa Mines, Ltd.	April 12, 1926	3,000,000	2,628,068	1.00	.....	131,403.40	5c.	131,403.40	Nov. 1, 1934
McIntyre-Porcupine Mines, Ltd.[3]	Mar. 16, 1911	$4,000,000	$3,990,000	5.00	12,489,162.43	1,596,000.00	$2.00	14,085,162.43	Dec. 1, 1934
Porcupine Crown Mines, Ltd.	May 25, 1913	2,000,000	2,000,000	1.00	840,000.00	.....	.....	840,000.00	July 15, 1917
Rea Consolidated Gold Mines, Ltd.	April 5, 1911	$1,000,000	$200,000	5.00	12,000.00	.....	.....	12,000.00	1915
Schumacher Gold Mines, Ltd.[4]	Jan. 6, 1914	2,000,000	1,850,000	1.00	.....	.....	.....	.....	.....
Sylvanite Gold Mines, Ltd.[5]	June 13, 1913	3,300,000	3,299,500	1.00	527,920.00	824,875.00	25%	1,352,795.00	Dec. 31, 1934
Teck-Hughes Gold Mines, Ltd., The	Mar. 2, 1923	5,000,000	4,807,144	1.00	18,673,861.60	2,643,929.20	55c.	21,317,790.80	Nov. 1, 1934
Toburn Gold Mines, Ltd.[6]	Jan. 24, 1931	2,000,000	1,850,000	1.00	.....	148,000.00	8c.	148,000.00	Nov. 22, 1934
Tough-Oakes Gold Mines, Ltd.	July 15, 1913	$3,000,000	$2,657,500	5.00	398,625.00	.....	.....	398,625.00	Dec. 27, 1916
Vipond Consolidated Mines, Ltd.	July 17, 1922	2,500,000	2,250,000	1.00	67,500.00	.....	.....	67,500.00	April 5, 1927
Wright-Hargreaves Mines, Ltd.[7]	June 16, 1916	5,500,000	5,500,000	No par	7,631,250.00	3,025,000.00	55c.	10,656,250.00	Oct. 2, 1934
Total	.....	.....	.....	.....	$153,107,391.88	$26,841,464.06	.....	$179,948,855.94	.....

[1]On April 22, 1922, the capital of Dome Mines Company, Limited, was reduced from $5,000,000 to $4,500,000, and $476,667 (repayment of capital not included in above table) distributed to shareholders in addition to dividends paid to September 30, 1923, when the new company, Dome Mines, Limited, issued 1,000,000 no par value shares at $7.00 per share. Of these 46,666 shares are transferred to a trustee and held in trust for the company.

[2]Hollinger Consolidated Gold Mines, Limited, is an amalgamation of the Acme Gold Mines, Limited; Millerton Gold Mines, Limited; and Hollinger Gold Mines, Limited. Dividends include $160,000 paid in 1915 by Acme, and $4,170,000 paid by Hollinger to May 25, 1916, the date of consolidation.

[3]The dividends are paid in United States funds.

[4]The Schumacher mine was sold to the Hollinger in 1922, and a total of $1,591,000, or 86 per cent. of the assets, distributed to shareholders, the final payment being made July 30, 1923.

[5]The rate of 25 per cent. includes 5 per cent. paid out of 1933 profits. The dividends are paid in United States funds.

[6]Formerly the Tough-Oakes Gold Mines, Limited.

[7]The authorized and issued capital was changed in May, 1927, from 2,750,000 shares of $1.00 par value to 5,500,000 shares of no par value.

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES, 1912-1934

Year	PORCUPINE						KIRKLAND LAKE							N. W. ONT.	Total
	Hollinger	Porcupine Crown	Dome Mines	McIntyre	Rea and Coniaurum	Buffalo Ankerite	Tough-Oakes	Lake Shore	Teck-Hughes	Wright-Hargreaves	Sylvanite	Kirkland Lake Gold	Macassa	Howey	
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
1912..	270,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	270,000.00
1913..	1,170,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,170,000.00
1914..	1,170,000	240,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,410,000.00
1915..	[1]1,560,000	240,000	400,000.00	.....	[2]12,000.00	.....	132,875	.....	.....	.....	.....	.....	.....	.....	2,344,875.00
1916..	3,286,000	240,000	800,000.00	.....	.....	.....	265,750	.....	.....	.....	.....	.....	.....	.....	4,591,750.00
1917..	738,000	120,000	300,000.00	541,542.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,699,542.45
1918..	1,230,000	.....	.....	543,042.45	.....	.....	.....	100,000	.....	.....	.....	.....	.....	.....	1,873,042.45
1919..	1,722,000	.....	.....	364,028.30	.....	.....	.....	100,000	.....	.....	.....	.....	.....	.....	2,186,028.30
1920..	2,214,000	.....	416,886.00	546,042.45	.....	.....	.....	80,000	.....	.....	.....	.....	.....	.....	3,256,928.45
1921..	3,198,000	.....	478,947.75	546,042.45	.....	.....	.....	120,000	.....	.....	.....	.....	.....	.....	4,342,990.20
1922..	3,198,000	.....	[3]715,000.00	546,042.45	.....	.....	.....	80,000	.....	412,500	.....	.....	.....	.....	4,951,542.95
1923..	3,198,000	.....	1,430,001.00	548,542.45	.....	.....	.....	160,000	.....	206,250	.....	.....	.....	.....	5,542,793.45
1924..	3,198,000	.....	1,906,668.00	774,125.00	.....	.....	.....	380,000	.....	206,250	.....	.....	.....	.....	6,465,043.00
1925..	4,378,800	.....	1,906,668.00	798,000.00	.....	.....	.....	600,000	.....	550,000	.....	.....	.....	.....	8,233,468.00
1926..	5,805,600	.....	1,906,668.00	798,000.00	.....	.....	.....	1,000,000	474,714.40	893,750	.....	.....	.....	.....	10,878,732.40
1927..	6,396,000	[4]67,500	1,191,667.50	798,000.00	.....	.....	.....	1,400,000	713,571.60	1,237,500	.....	.....	.....	.....	11,804,239.10
1928..	5,412,000	.....	953,334.00	798,000.00	.....	.....	.....	2,000,000	2,860,286.40	825,000	.....	.....	.....	.....	12,848,620.40
1929..	3,198,000	.....	953,334.00	798,000.00	.....	.....	.....	2,200,000	2,866,286.40	.....	.....	.....	.....	.....	10,015,620.40
1930..	3,444,000	.....	953,334.00	798,000.00	.....	.....	.....	3,000,000	2,872,286.40	.....	65,990	.....	.....	.....	11,133,610.40
1931..	3,444,000	.....	953,334.00	798,000.00	.....	.....	.....	4,800,000	3,118,143.60	825,000	131,980	.....	.....	.....	14,070,457.60
1932..	3,690,000	.....	1,239,334.20	997,499.86	[5]80,923.41	.....	.....	6,000,000	2,884,286.40	962,500	164,975	.....	.....	.....	16,019,518.87
1933..	4,182,000	.....	1,716,001.20	1,496,254.57	.....	42,571.29	.....	6,000,000	2,884,286.40	1,512,500	164,975	.....	.....	.....	17,998,588.46
1934..	6,888,000	[6]501,042	3,336,669.00	1,596,000.00	.....	89,371.77	[7]148,000	7,000,000	2,643,929.20	3,025,000	824,875	157,173.69	131,403.40	500,000	26,841,464.06
Total.	72,990,400	1,408,542	21,557,846.65	14,085,162.43	92,923.41	131,943.06	546,625	35,020,000	21,317,790.80	10,656,250	1,352,795	157,173.69	131,403.40	500,000	179,948,855.94

[1]Includes $160,000 paid by the Acme in 1915, before amalgamation with the Hollinger.
[2]Rea.
[3]Does not include repayment of capital of $476,667 in 1922.
[4]Vipond.
[5]Coniaurum.
[6]Anglo-Huronian.
[7]Toburn.

Mint Receipts from Ontario Mines

The table below shows the record over a five-year period of receipts of crude gold bullion from Ontario mines at the Royal Canadian Mint.

RECEIPTS OF CRUDE GOLD BULLION FROM ONTARIO MINES AT THE ROYAL CANADIAN MINT, OTTAWA, 1930–1934

Year	Quantity	Precious metals		Total value (standard)	Buying rate in Canada for New York funds[1]
		Gold	Silver		
	crude ounces	fine ounces	fine ounces		cents
1930	908,209	713,527	86,419	$4,760,111	100.147
1931	1,762,481	1,441,602	171,408	29,850,774	104.272
1932	2,865,271	2,248,106	300,927	46,554,898	113.580
1933	2,441,467	1,879,659	270,377	38,945,178	109.472
1934	2,668,456	2,031,719	292,445	42,134,234	.990

[1]The average rate of premium on New York funds is based on the day to day record of current quotations. The Federal Department of Finance pays for gold in Canadian funds and reimburses producers by an amount equivalent to the exchange premium on New York funds. Export of gold is prohibited except under license. After April 19, 1933, when the United States forsook the gold standard, Canadian output was marketed in London.

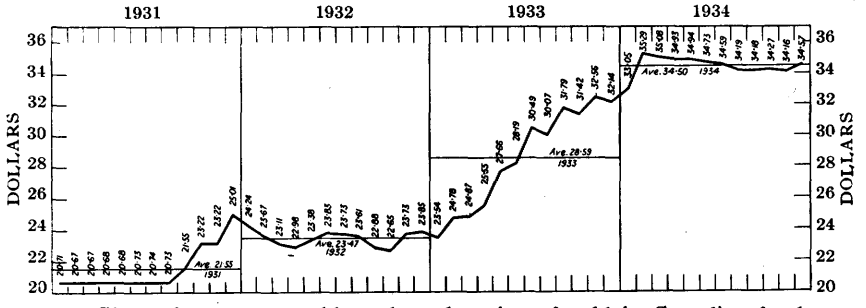
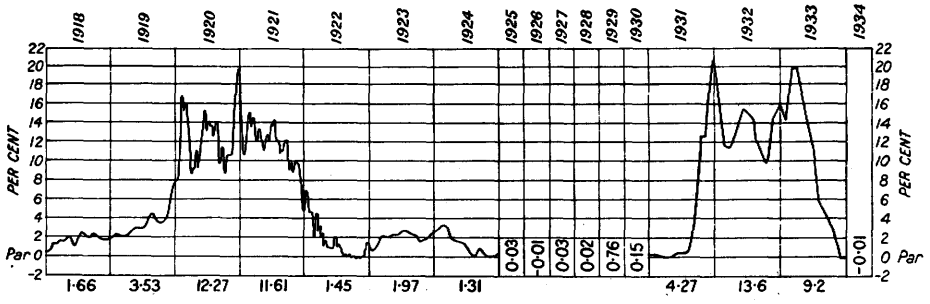


Chart of average monthly and yearly prices of gold in Canadian funds from 1931 to 1934, inclusive.

Exchange Equalization

The figure for exchange equalization published for 1933, namely $16,486,437, refers to the actual quantity of gold marketed during that period. Owing to the fact that in former years some mines reported only the exchange received during the calendar year and not exchange actually due on the year's gold shipments, some small corrections have been made on the following table for



Graph showing fluctuations of the buying rate in Canada for New York funds from 1918 to 1934, inclusive. The average yearly premium or discount rate is noted in percentage figures at the base of the chart.

the years 1931 and 1932, as follows: $81,728.42 received in 1933 should be credited to 1932; at the same time $113,088.91 should be deducted from 1932 and credited to 1931. In 1930, the exchange did not overlap with 1931. The corrections have been applied in the accompanying table.

EXCHANGE EQUALIZATION RECEIVED ON GOLD MARKETED BY ONTARIO PRODUCERS, 1920–1934

Year	Porcupine	Kirkland Lake	N.W. Ontario	Other areas	Total
1920	$1,265,664.29	$110,354.42	$256.78	.....	$1,376,275.49
1921	1,238,210.72	121,425.28	.....	.....	1,359,636.00
1922	189,022.11	19,590.77	.....	$7.87	208,620.75
1923	241,602.00	37,844.00	.....	.....	279,446.00
1924	172,721.71	24,027.67	.....	.....	196,749.38
1925[1]	—2,607.00	—231.00	.....	.....	—2,838.00
1926[1]	.....	—595.48	.....	.....	—595.48
1927[1]	.....	—235.10	.....	.....	—235.10
1928	.....	2,810.55	.....	.....	2,810.55
1929	87,173.00	70,283.00	.....	.....	157,456.00
1930	20,911.63	15,790.69	.....	.....	36,702.32
1931	830,799.04	1,006,607.22	61,857.38	26,958.00	1,926,221.64
1932	2,815,381.21	3,106,487.10	211,630.04	329.66	6,133,828.01
1933	8,249,321.00	7,448,933.00	495,309.00	292,874.00	16,486,437.00
1934	13,275,684.00	13,694,400.00	1,482,486.00	834,869.00	29,287,439.00
Total	$28,383,883.71	$25,657,492.12	$2,251,539.20	$1,155,038.53	$57,447,953.56

[1]Discounts paid during years when Canadian funds were at a premium. Figures for the three years have been deducted to arrive at the net totals.

World Output

The figures for the output by the leading gold-producing countries from 1930 to 1934, inclusive, in the following table have been abstracted chiefly from reports of the Director of the United States Mint and the American Bureau of Metal Statistics. Canada, which in 1930 attained second place among the gold-producing countries of the world, in 1934 dropped to third place, having been overtaken by Russia.

OUTPUT BY LEADING GOLD-PRODUCING COUNTRIES, 1930–1934
(One dollar = 0.048375 ounces)

Source	1930	1931	1932	1933	1934[1]
	fine ounces	fine ounces	fine ounces	fine ounces	fine ounces
World	20,836,318	22,329,525	24,141,486	25,369,879	27,339,233
Transvaal (S. Africa)	10,716,351	10,877,777	11,558,532	11,013,713	10,479,857
Russia (U.S.S.R.)	1,433,665	1,700,960	1,990,085	2,814,000	4,200,000
Canada	2,107,073	2,693,892	3,051,676	2,949,309	2,972,074
Ontario	**1,736,012**	**2,085,815**	**2,287,394**	**2,155,518**	**2,105,341**
United States[2]	2,100,395	2,213,741	2,279,305	2,276,711	2,734,415
California	450,289	521,158	566,031	594,867	701,000
S. Dakota	406,297	431,200	485,051	519,548	481,727
Oceania[3]	621,936	783,934	994,655	1,156,569	1,248,127
Australia	462,164	590,423	707,412	813,721	873,127
West Australia	416,369	510,570	605,561	637,207	651,000
S. Rhodesia	547,630	532,111	574,135	642,499	693,263
Mexico	671,871	628,468	584,487	637,727	662,000

[1]Preliminary figures from various sources subject to revision. The world estimate is that of the American Bureau of Metal Statistics. [2]Exclusive of the Philippine Islands.
[3]Includes Australia, Tasmania, New Zealand, and New Guinea.

Maximum Canadian production..... 3,051,676 ounces in 1932.
Maximum Russian production..... 4,200,000 ounces in 1934.
Maximum U.S. production..... 4,887,604 ounces in 1915.
Maximum Transvaal production..... 11,558,532 ounces in 1932.
Maximum World production..... 27,339,233 ounces in 1934.

Silver-Cobalt

A revival of activity has recently been observed in the old Cobalt camp, for many years so famous as a silver producer. Advancing prices for silver and a keener demand for cobalt ores indicate some measure of prosperity where the depression formerly was most keenly felt.

During the year twelve properties at Cobalt and one at Elk Lake made shipments totalling 2,899 tons. The properties, six of which were operated under lease, were as follows: Beaver, Cobalt Properties, Crown Reserve, Drummond lease, Dominion Reduction Company, Foster lease, Hudson Bay lease, Mining Corporation lease, McKinley-Darragh lease, Nipissing lease, O'Brien, and Temiskaming. The Miller Lake O'Brien shipped from Gowganda.

The price of silver on the New York market rose from 44.188 cents per ounce in January to 54.39 cents in December, and averaged 47.973 cents for the twelve months. The monthly average in Canadian funds was 47.46 cents. Early in August the United States nationalized silver at 50.01 cents an ounce, that is the United States government decided to take over all floating silver in that country and to pay 50.01 cents per ounce for it, while newly mined silver was to be paid for at 64.5 cents. Later the Treasury Department at Washington announced its intention of issuing silver certificates against the purchase of silver on the basis of $1.29 per ounce. An official announcement stated that the objective in view was a 25 to 75 silver-gold ratio, which would involve the purchase of about 1,350,000,000 ounces. This programme will doubtless require some years for completion.

This stabilizing of the price of silver in the United States definitely suspended the trading in silver in New York, which had developed the world's largest market for that metal, and directly led to the organization in Canada of the Canadian Commodity Exchange for trading in spot and future contracts in silver, with the trading floor in Montreal. To this exchange the members of the Toronto Stock Exchange and the Montreal Stock Exchange were given equal privileges of membership.

The following table shows the total silver production for the years 1933 and 1934:—

SILVER PRODUCTION, 1933 AND 1934

Source	1933		1934	
	Fine ounces	Value	Fine ounces	Value
Sales of bullion by the reduction companies, smelters, and mines[1]	3,602,529	$1,258,362	2,681,104	$1,244,081
Contained in silver-cobalt concentrates and residues exported	100,642	41,480	288,552	141,544
Estimated as recovered from concentrates treated outside of Ontario	236,863	87,922	299,084	146,094
In crude gold bullion	408,626	136,867	432,905	204,028
Recovered by nickel-copper refineries	1,026,370	388,303	1,822,293	864,646
Total	5,375,030	$1,912,934	5,523,938	$2,600,393

[1]There is included with the 1933 figures, 800,000 ounces of bullion produced in 1931 but held in storage for future sale.

The shipments of ores and concentrates from the Cobalt area in 1934, as reported by the T. & N.O. railway, were 940.27 tons to Deloro; 210.5 tons to Trail, B.C.; 821.63 tons to Noranda; and 926.11 tons exported to other coun-

tries; or a total of 2,898.51 tons, as compared with 1,445.09 tons in 1933. The increase is in proportion to the revival in mining operations in this famous old silver camp.

Shipments of silver mines by camps during 1933 and 1934 were as follows:—

SILVER SHIPMENTS BY CAMPS, 1933 AND 1934

Camp	1933			1934		
	Silver	Cobalt[1]		Silver	Cobalt[1]	
	fine ounces	lbs.		fine ounces	lbs.	
Cobalt	2,397,118	66,859	$20,265	1,990,073	201,025	$59,867
Gowganda	1,244,812	40,729	.....	1,039,565	32,273	.....
Total	3,641,930	161,911	$20,265	3,029,638	233,298	$59,867

[1]Figures represent the quantities paid for by the smelter and values received by the mines.

Since the discovery of silver at Cobalt in 1903, silver shipments from this and outlying silver camps, as reported by the operators, have been as follows:—

SILVER SHIPMENTS BY CAMPS, 1904–1934

Year	Cobalt	Casey township	South Lorrain	Gowganda	Montreal R., Maple Mountain, etc.	Total	Average price per ounce (New York)
	troy ounces	troy ounces	troy ounces	troy ounces	troy ounces	troy ounces	cents
1904	206,875	.....	.....	.....	.....	206,875	57.221
1905	2,451,356	.....	.....	.....	.....	2,451,356	60.352
1906	5,401,766	.....	.....	.....	.....	5,401,766	66.791
1907	10,023,311	.....	.....	.....	.....	10,023,311	65.237
1908	19,424,251	500	13,124	.....	.....	19,437,875	52.864
1909	25,658,683	26,185	194,955	.....	18,002	25,897,825	51.502
1910	29,849,981	92,544	221,133	471,688	9,835	30,645,181	53.486
1911	29,989,893	114,789	933,912	468,687	510	31,507,791	53.340
1912	28,605,940	253,824	834,119	549,976	.....	30,243,859	60.835
1913	28,105,505	825,108	248,992	502,370	.....	29,681,975	57.791
1914	24,155,699	499,643	108,199	399,300	.....	25,162,841	54.811
1915	24,280,366	223,939	.....	242,229	.....	24,746,534	49.684
1916	19,008,517	445,900	77,280	383,393	.....	19,915,090	65.661
1917	18,327,258	.....	10,000	1,064,635	.....	19,401,893	81.417
1918	16,807,407	143,901	72,188	638,198	.....	17,661,694	96.772
1919	10,314,689	171,278	4,586	723,764	.....	11,214,317	111.122
1920	10,402,249	.....	8,253	433,352	[1]2,467	10,846,321	100.900
1921	7,673,535	1,101	328,886	258,292	117	8,261,931	62.654
1922	9,239,147	1,028	1,284,307	170,651	[2]15,994	10,711,127	67.528
1923	7,259,858	.....	2,955,646	160,761	1,581	10,377,846	64.873
1924	6,704,787	.....	2,633,058	598,057	.....	9,935,902	66.781
1925	6,252,115	.....	3,099,964	1,355,156	.....	10,707,235	69.065
1926	6,262,249	.....	3,044,584	1,236,640	.....	10,543,473	62.107
1927	4,482,543	.....	2,319.356	1,741,614	.....	8,543,513	56.370
1928	3,934,020	.....	1,133,952	1,677,429	.....	6,745,401	58.176
1929	4,823,529	.....	876,006	2,081,894	.....	7,781,429	52.993
1930	5,329,335	.....	1,754,989	2,141,234	[3]52	9,225,610	38.154
1931	3,706,880	.....	594,360	1,697,242	.....	5,998,482	28.700
1932	3,262,380	.....	22,144	1,374,780	.....	4,659,304	27.892
1933	2,397,118	.....	.....	1,244,812	.....	3,641,930	34.727
1934	1,990,073	.....	.....	1,039,565	.....	3,029,638	47.973
Total	376,331,315	2,799,740	22,773,993	22,655,719	48,558	424,609,325	.....

[1]Includes 885 ounces from Silver Islet, Lake Superior.
[2]Silver Islet, Lake Superior.
[3]Nickel Hill Syndicate in the Sudbury area shipped silver-cobalt ore.

SHIPMENTS FROM SILVER MINES, SMELTERS AND REFINERIES, 1904-1934

Year	Bismuth		Copper[1]		Lead[1]		Nickel[2]		Cobalt[3]		Arsenic		Silver		Total
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Ounces	Value	Value
1904	.....	.....	.....	.....	.....	.....	14	$3,467	16	$19,960	72	$903	206,875	$111,887	$136,217
1905	.....	.....	.....	.....	.....	.....	75	10,000	118	100,000	549	2,693	2,451,356	1,360,503	1,473,196
1906	.....	.....	.....	.....	.....	.....	160	.....	321	80,704	1,440	15,858	5,401,766	3,667,551	3,764,113
1907	.....	.....	.....	.....	.....	.....	370	1,174	739	104,426	2,958	40,104	10,023,311	6,155,391	6,301,095
1908	.....	.....	.....	.....	.....	.....	612	.....	1,224	111,118	3,672	40,373	19,437,875	9,133,378	9,284,869
1909	.....	.....	.....	.....	.....	.....	766	.....	1,533	94,965	4,294	61,039	25,897,825	12,461,576	12,617,580
1910	.....	.....	.....	.....	.....	.....	504	.....	1,098	54,699	4,897	70,709	30,645,181	15,478,047	15,603,455
1911	.....	.....	.....	.....	.....	.....	392	.....	852	170,890	3,806	74,609	31,507,791	15,953,847	16,199,346
1912	.....	.....	.....	.....	.....	.....	429	14,220	934	314,381	4,166	80,546	30,243,859	17,408,935	17,818,082
1913	.....	.....	.....	.....	.....	.....	377	13,326	821	420,386	3,663	64,146	29,681,975	16,553,981	17,051,839
1914[4]	.....	.....	.....	.....	.....	.....	90	28,978	351	590,406	2,030	116,624	25,162,841	12,765,461	13,501,469
1915	.....	.....	.....	.....	.....	.....	35	28,353	206	383,261	2,490	148,379	24,746,534	12,135,816	12,695,809
1916	.....	.....	.....	.....	.....	.....	79	59,380	400	805,014	2,160	200,103	19,915,090	12,643,175	13,707,672
1917	.....	.....	53	$28,840	.....	.....	155	125,071	337	1,138,190	2,592	608,483	19,401,893	16,121,013	18,021,597
1918	.....	.....	72	35,712	3	$453	186	156,893	380	1,640,310	2,545	566,332	17,661,694	17,341,790	19,741,490
1919	.....	.....	110	40,976	12	1,296	276	188,418	298	1,019,479	2,834	485,360	11,214,317	12,738,994	14,474,523
1920	.....	.....	50	17,494	5	792	127	93,233	283	1,605,365	1,883	431,527	10,846,321	10,654,471	12,802,882
1921	.....	.....	103	34,504	3	270	10	7,665	126	616,235	1,491	233,763	8,261,931	5,564,594	6,457,031
1922	.....	.....	93	26,346	16	1,891	61	34,987	[5]776	1,333,676	2,059	299,940	10,711,127	7,658,802	9,355,642
1923[6]	9	$48,139	56	16,214	26	3,738	42	19,321	380	1,803,872	2,579	582,794	10,377,846	6,677,367	9,151,445
1924	6	16,079	55	14,290	45	7,295	130	26,862	476	1,662,526	1,915	323,186	10,361,945	7,009,984	9,060,222
1925	10	18,578	77	17,007	31	1,888	290	116,347	558	2,328,517	1,078	113,325	9,614,881	6,700,129	9,295,791
1926	3	6,440	35	5,394	11	1,463	83	30,051	332	1,136,014	2,025	135,549	8,981,557	5,541,009	6,855,920
1927	1	1,003	20	2,940	3	312	100	52,829	440	1,764,534	2,481	197,668	8,883,829	4,970,194	6,989,480
1928	7	5,067	38	15,764	27	2,169	111	57,039	477	1,671,900	2,049	178,149	6,688,454	3,882,570	5,812,658
1929	13	23,413	13	3,098	3	267	115	63,167	464	1,801,915	1,871	154,887	7,970,540	4,239,980	6,286,727
1930	6	6,366	23	5,070	22	1,748	53	27,455	347	1,143,631	1,375	109,928	9,109,885	3,460,247	4,754,445
1931	4	3,532	29	5,438	40	2,529	47	31,650	261	651,179	1,788	135,170	5,415,655	1,546,888	2,376,386
1932	8	7,289	18	2,152	43	1,756	33	17,772	245	587,957	1,212	98,914	5,106,888	1,592,893	2,308,733
1933	4	3,731	19	2,802	20	692	71	41,730	200	576,465	734	56,534	3,939,990	1,387,749	2,069,703
1934	4	3,444	12	.....	10	525	85	47,393	297	592,497	824	56,412	3,268,740	1,531,719	2,231,990
Total	72	$143,081	876	$274,041	320	$29,084	5,878	$1,296,781	15,290	$26,324,472	69,532	$5,684,007	423,139,772	$254,449,941	$288,201,407

[1]Copper and lead are recovered from certain silver ores and concentrates shipped to United States refineries.
[2]Nickel metal and metallic contents of all nickel compounds.
[3]Cobalt metal and metallic contents of all cobalt compounds, and cobalt contained in ores and speiss residues exported. In 1932, it includes 22,258 pounds worth $10,024 from northwestern Ontario.
[4]Prior to 1914 an estimate based on assays was made of the nickel, cobalt, and arsenic in the ores. Since that date recoveries have been reported.
[5]Includes 460 tons of speiss residues, worth $153,116. [6]Recoveries of bismuth from base bullion were not reported prior to 1923.

DIVIDENDS AND BONUSES PAID BY SILVER-MINING COMPANIES TO DECEMBER 31, 1934

Name of company	Date of incorporation	Authorized capital	Capital stock issued	Par value per share	Dividends and bonuses paid to end of 1933	Dividends and bonuses paid during 1934	Total dividends and bonuses paid to Dec. 31, 1934	Date when last dividend was paid
Aladdin Cobalt Company, Ltd.	Aug. 23, 1912	$500,000	$500,000	$5.00	$75,000.00	.....	$75,000.00	April 30, 1917
Beaver Consolidated Mines, Ltd.	Mar. 1, 1907	2,000,000	2,000,000	1.00	710,000.00	.....	710,000.00	May 31, 1920
Buffalo Mines, Ltd., The	April 27, 1906	500,000	[1]150,000	.50	2,787,000.00	.....	2,787,000.00	May 28, 1924
Casey Cobalt Silver Mining Co., Ltd.	Dec. 19, 1906	100,000	100,000	1.00	203,249.33	.....	203,249.33	April 22, 1914
Castle-Trethewey Mines, Ltd.	Jan. 20, 1922	2,000,000	[2]2,000,000	1.00	18,027.00	.....	18,027.00	April 15, 1925
Cobalt Central Mines Co., Ltd.	Dec. 13, 1905	5,000,000	5,000,000	1.00	192,845.00	.....	192,845.00	Aug. 25, 1909
Cobalt Comet Mines, Ltd.[3]	April 16, 1913	1,000,000	1,000,000	1.00	230,000.00	.....	230,000.00	April 1, 1915
Cobalt Silver Queen, Ltd.	April 1, 1906	1,500,000	1,500,000	1.00	315,000.00	.....	315,000.00	Dec. 31, 1908
Coniagas Mines, Limited, The	Nov. 24, 1906	4,000,000	4,000,000	5.00	11,540,000.00	$100,000.00	11,640,000.00	Jan. 10, 1934
Crown Reserve Mining Co., Ltd.	Jan. 16, 1907	2,000,000	1,999,957	1.00	6,190,849.00	.....	6,190,849.00	Dec. 28, 1916
Foster Cobalt Mining Co., Ltd.	Feb. 14, 1906	1,000,000	915,588	1.00	45,000.00	.....	45,000.00	Jan. 1, 1907
Hudson Bay Mines, Ltd.[4]	July 16, 1909	3,500,000	3,200,050	5.00	778,909.42	.....	778,909.42	Aug. 31, 1913
Keeley Silver Mines, Ltd.	June 22, 1922	2,000,000	2,000,000	1.00	2,240,000.00	.....	2,240,000.00	Mar. 15, 1928
Kerr Lake Mining Co., Ltd.	Aug. 9, 1905	40,000	40,000	100.00	[5]10,521,000.00	.....	10,521,000.00	Oct. 13, 1927
La Rose Mines, Ltd.	May 31, 1908	1,500,000	1,500,000	1.00	6,600,546.84	.....	6,600,546.84	Mar. 24, 1923
Lorrain Trout Lake Mines, Ltd.	Mar. 20, 1923	1,500,000	1,500,000	1.00	150,000.00	.....	150,000.00	July 15, 1925
McKinley-Darragh-Savage Mines of Cobalt, Ltd.	April 27, 1906	2,500,000	2,247,692	1.00	5,955,391.86	.....	5,955,391.86	Oct. 1, 1920
Mining Corporation of Canada, Ltd.	Nov. 23, 1916	8,300,250	8,300,250	5.00	7,573,937.47	.....	7,573,937.47	Dec. 19, 1929

City of Cobalt Mining Co., Ltd.[6]	Jan. 7, 1909	1,500,000	1,500,000	1.00	145,000.00	.....	145,000.00	April 15, 1920
Cobalt Lake Mining Co., Ltd.[6]	Dec. 22, 1906	3,000,000	3,000,000	1.00	465,000.00	.....	465,000.00	May 29, 1914
Cobalt Townsite Mining Co., Ltd.[6]	May 8, 1906	100,000	45,011	1.00	1,042,259.61	.....	1,042,259.61	Nov. 11, 1914
Nipissing Mining Co., Ltd	Dec. 16, 1904	250,000	250,000	100.00	[7]31,168,297.25	160,000.00	31,223,297.25	Aug. 15, 1934
Penn-Canadian Mines, Ltd	April 24, 1912	1,500,000	1,349,705	1.00	[8]175,461.65	.....	175,461.65	Sept. 10, 1917
Peterson Lake Silver-Cobalt Mining Co., Ltd.	April 11, 1906	3,000,000	2,469,802	1.00	462,350.35	.....	462,350.35	Jan. 2, 1917
Right of Way Mines, Ltd	Sept. 11, 1909	2,000,000	1,685,500	1.00	252,825.00	.....	252,825.00	Mar. 17, 1917
Right of Way Mining Co., Ltd	July 13, 1906	500,000	499,518	1.00	324,643.93	.....	324,643.93	Oct. 1, 1909
Seneca-Superior Silver Mines, Ltd	Sept. 29, 1911	500,000	478,884	1.00	1,579,817.20	.....	1,579,817.20	Dec. 15, 1916
Temiskaming Mining Co., Ltd	Nov. 5, 1906	2,500,000	2,500,000	1.00	2,159,156.25	.....	2,159,156.25	Jan. 31, 1920
Temiskaming and Hudson Bay Mining Co., Ltd.	July 10, 1903	25,000	7,761	1.00	1,940,250.00	.....	1,940,250.00	Nov. 10, 1914
Trethewey Silver Cobalt Mines, Ltd	May 30, 1906 June 1, 1911	2,000,000	1,000,000	1.00	1,211,998.50	.....	1,211,998.50	Jan. 2, 1919
Wettlaufer Lorrain Silver Mines, Ltd	Nov. 30, 1908	1,500,000	1,416,590	1.00	637,465.50	.....	637,465.50	Sept. 22, 1913
Total[9]	.....	.....	.....	.....	$97,691,281.16	$260,000.00	$97,951,281.16	.....

[1]In 1917 the capital stock of the company was reduced from $1,000,000 to $750,000; in 1918, from $750,000 to $500,000; and on December 21, 1919, from $500,000 to $150,000, but returning to shareholders amounts equal to the reduction in capital, leaving 300,000 shares issued of 50 cents each. The mine was sold to the Mining Corporation of Canada and operated by it in 1920 and subsequently.

[2]200,000 preferred shares, par $1.00, redeemed April, 1925, and capital reduced from $2,200,000 to $2,000,000.

[3]Cash assets amounting to $50,000 paid on April 27, 1917.

[4]Name of company changed from Temiskaming and Hudson Bay in 1909.

[5]In addition a return of capital amounting to $600,000 was made on July 3, 1919, to stockholders of the Kerr Lake Mines, Limited.

[6]Mining Corporation of Canada, Limited, now owns and operates the City of Cobalt, Cobalt Lake, and Cobalt Townsite mines.

[7]Includes $16,288,297.25 paid in dividends by the Nipissing Mines Company (the holding company) to the end of 1916.

[8]Paid out of capital $40,491.15 on September 10, 1917, and an equal amount on April 24, 1918.

[9]Does not include dividends by private companies such as M. J. O'Brien, Limited.

Nickel-Copper and Platinum Metals

The nickel-copper industry during the past twelve months has made a remarkable recovery and may now be said to have regained the prosperity noted in 1929. The name nickel-copper, so long used by the Department of Mines, has become a misnomer, since in point of quantity of metal recovered the copper far outstrips the nickel. In his note of November 15, 1934, to the shareholders, R. C. Stanley, President of the International Nickel Company of Canada, Limited, said in part:—

> In extracting nickel and making it an important servant of industry, approximately two pounds of copper are recovered for every pound of nickel. This means that copper is now being mined at the rate of more than 200,000,000 pounds per year as the direct result of providing the nickel now required in diversified industrial markets throughout the world.
>
> To refine its copper to the high degree of purity demanded by modern industry your company participated in the organization of the Ontario Refining Company, Limited, for the construction, as a custom refinery, of a modern electrolytic plant at Copper Cliff, Ont. Your company now owns 90 per cent. of the capital stock of the Ontario Refining Company, Limited, and that refinery is now engaged exclusively in the production of "ORC" brand electrolytic copper from our company's blister copper.

The table below has been changed somewhat from the one carried for so many years in these reports. It will be noted that the figures for matte produced no longer appear. This change has been made because of the reorganization in plant practice that has taken place during the past five years. Blister copper, which formerly was not produced at Sudbury, is now made direct from the high-grade copper ores of the Frood mine; and figures for matte, that is the nickel-copper Bessemer matte that was produced heretofore and still is, would not reflect the true conditions. From the table it is possible to secure figures showing total nickel or total copper produced, e.g. the sum of items 4 and 6 equals the total nickel from all sources, in matte and as refined, while the sum of items 3 and 7 gives the total copper.

An examination of the statistics presented indicates that ore smelted rose by 90 per cent. Matte exported showed an increase of 8 per cent., and matte treated at Port Colborne was up by 68 per cent. Comparing 1934 with 1930, the year in which the highest previous production was recorded, increases may be observed in the quantity of ore smelted and matte exported.

NICKEL-COPPER MINING AND SMELTING, 1930–1934

Item	1930	1931	1932	1933	1934
	tons	tons	tons	tons	tons
1. Ore shipped	2,115,139	1,690,192	790,614	1,533,887	2,903,310
2. Ore treated	2,357,154	1,884,959	793,552	1,523,814	2,896,959
3. Blister copper produced in Ontario	57,467	49,786	29,682	60,398	95,826
4. Nickel produced in Ontario	30,852	15,939	7,063	20,748	35,487
5. Matte exported[1]	34,550	30,294	21,778	43,315	46,755
6. Nickel content of matte exported[2]	20,978	16,847	8,068	25,811	28,771
7. Copper content of matte exported[2]	5,855	6,620	8,825	12,323	6,692

[1]All matte was exported prior to 1918, when refining in Canada began at Port Colborne, Ont. The British America Nickel Corporation commenced refining operations at Deschênes, Que., in 1920, and closed down finally in July, 1924.

[2]In 1932, after the reorganization of the metallurgical practice, the Orford process, i.e. the separation of the matte into copper tops and nickel bottoms, was carried out at Copper Cliff.

The recovery of this industrial group is also well illustrated in the record of wage-earners employed: In 1933 the total was 3,804 in mines, smelters, and refineries; in 1934 the pay-roll rose to 5,793, or an increase of 52.5 per cent.

Late in 1934 construction of 4 new converters at the Copper Cliff smelter was completed. These added to the former battery of 8 make 12 in all, which with the addition of other smelter units has resulted in a marked increase in capacity.

STATISTICAL SYNOPSIS OF THE NICKEL-COPPER INDUSTRY IN ONTARIO, 1932, 1933, AND 1934

Year	No. of producing companies	No. of plants in Ontario	Capital invested[1]	Dividends paid	Salaried employees		Wage-earners		Selling value of products[2]	
					No.	Salaries	No.	Wages	Kind	Value
1932	2	5 mines 3 smelters 2 refineries[3]	$90,815,075	[4]$1,933,909.26	41 77 106	$150,509 288,609 262,381	1,173 966 440	$1,621,364 1,365,220 736,093	Matte (exported) Metallic nickel Nickel oxide Converter copper Gold (standard) Silver Platinum metals	$7,779,846 3,787,581 468,727 200,080 1,998,911
Total			$90,815,075	$1,933,909.26	224	$701,499	2,579	$3,722,677		$14,235,145
1933	2	4 mines 3 smelters 2 refineries[3]	$91,785,900	$2,746,330	46 71 98	$157,795 287,817 251,895	1,459 1,413 751	$2,238,271 2,040,548 971,614	Matte (exported) Metallic nickel Nickel oxide Converter copper Gold (standard) Silver Platinum metals Selenium	$21,197,469 9,005,195 764,508 388,303 1,501,233 53,745
Total			$91,785,900	$2,746,330	215	$697,507	3,623	$5,250,433		$32,910,453
1934	2	4 mines[5] 3 smelters 2 refineries[3]	$102,801,859	$10,126,014	45 107 121	$149,890 444,873 329,101	2,505 2,210 1,078	$4,037,707 3,185,306 1,380,448	Matte (exported) Metallic nickel Nickel oxide Converter copper Gold (standard) Exchange Silver Platinum metals Selenium and tellurium	$32,092,032 14,218,611 1,247,957 834,526 864,646 6,187,992 116,885
Total			$102,801,859	$10,126,014	273	$923,864	5,793	$8,603,461		$55,562,649

[1]The capital invested is exclusive of value of mineral lands. In the report for 1929, Volume XXXIX, part 1, the capital shown includes the book value for mineral lands, or a total of $74,077,808 for the lands.

[2]Figures do not include the output of the Ontario Refining Company.

[3]Plants Port Colborne and Copper Cliff.

[4]On preferred shares only in 1932.

[5]Includes Cuniptau.

Production of Platinum Metals

The production of metals of the platinum group has increased to such an extent that the Sudbury nickel-copper mines have become one of the world's most important sources of these precious metals. With the exception of the year 1930, the entire production has been derived from the Sudbury area and has risen from 68,040 ounces in that year to a total of 200,109 for 1934. The metals gold and silver are also of importance.

PRECIOUS METALS RECOVERED, 1930–1934

	1930[1]	1931	1932	1933	1934
	ounces	ounces	ounces	ounces	ounces
Platinum metals:					
Platinum	34,000	44,725	27,284	24,746	116,177
Palladium	29,907	39,313			
Rhodium, ruthenium, osmium and iridium	4,133	7,605	37,613	31,009	83,932
Total ounces	68,040	91,643	64,897	55,755	200,109
Value	$2,436,683	$2,812,834	$1,998,911	$1,501,233	$6,187,992
Gold ounces	22,867	23,381	22,675	36,983	60,370
Silver ounces	1,067,154	822,971	663,795	1,026,370	1,882,293

[1]In 1930, 5 ounces of gold, 62 of silver, 4 of platinum, and 14 of palladium were included in ore exported from Strathy township.

Dividends

Total dividends paid to the end of 1933 and payments in 1934 are given in the following table. For convenience of comparison Mond figures have been converted to dollars on the basis £1 = $4.8665. The Falconbridge Nickel Mines paid its first dividend in 1933.

DIVIDENDS PAID BY NICKEL COMPANIES TO END OF 1934

Company	Period (inclusive)	To end of 1933	1934
Canadian Copper Company	1894–1901	$1,975,000.00	.....
International Nickel Company[1] preferred	1906–1928	12,299,273.00	.....
International Nickel Company[1] common	1909–1928	65,811,694.00	.....
International Nickel Company of Canada, Limited[2] preferred	1929–1932	9,448,811.53	$1,933,898.75
International Nickel Company of Canada, Limited[2] common	1929–1932	33,085,113.56	7,289,084.50
Falconbridge Nickel Mines, Limited	1928–1933	812,609.97	903,030.79
Total	.....	$123,432,502.06	$10,126,014.04
Mond Nickel Company[3] deferred	1906–1914	£264,043	.....
Mond Nickel Company[3] preferred	1904–1929	2,556,359	.....
Mond Nickel Company[3] ordinary	1905–1929	2,581,984	.....
Total	.....	£5,402,386 or $26,291,126	.....
GRAND TOTAL	.....	$149,723,628.06	$10,126,014.04

[1]Successors to the Canadian Copper Company. The International Nickel Company paid dividends on the common stock from 1909 to 1919, inclusive, and again from 1925 to 1928, inclusive. Common stock outstanding was $41,834,600, and preferred stock $8,912,600, or a total of $50,747,200 at the beginning of 1928. On December 19, 1928, the authorized capital stock of $62,000,000 of the New Jersey company was reduced by changing the par value of the shares from $25 to $1 each, and at the same time the name of the company was changed to Nickel Holdings Corporation. On December 31, 1928, the authorized capital was further reduced to $993,425 fully issued or subscribed-for stock, consisting of $843,700 preferred stock and $149,725 common stock, par value in each case.

[2]See bottom of page 27.

[3]See bottom of page 27.

Iron Ore, Pig Iron, Steel, and Coke

As shown in the following table, foreign ore charges amounted to 462,705 long tons, the average price of which was $4.65 (American funds, sales tax extra) at lower lake ports. From this ore, 271,725 long tons of pig iron was produced, including 177,361 long tons of basic, 49,655 of foundry, and 44,709 of malleable. Figures for the past five years follow:—

IRON AND STEEL STATISTICS, 1930–1934

Year	Foreign ore smelted	Limestone for flux	Coke	Pig iron produced		Steel made	
				Quantity	Value	Quantity	Value
	long tons	short tons	short tons	long tons		long tons	
1930....	935,005	234,309	542,094	534,542	$11,465,435	639,128	$22,369,480
1931....	568,886	149,454	320,133	318,645	6,363,101	444,107	15,099,638
1932....	198,063	56,880	119,064	113,665	2,558,799	244,693	8,319,562
1933....	182,060	46,944	113,102	110,562	2,066,049	258,841	8,800,594
1934....	462,705	118,350	253,532	271,725	6,249,675	476,699	16,207,766

At Montreal No. 1 pig iron (2.25 to 2.75 per cent. silicon) was quoted at $23.00, and malleable the same. No quotations were available for basic pig iron. Steel billets were quoted at $34.00 per long or gross ton at Hamilton.

PIG IRON, STEEL, AND FERRO- AND OTHER ALLOY PRODUCERS, 1934

Company	Location
Abrasive Company of Canada, Ltd.[1] [2]	Hamilton.
Algoma Steel Corporation, Ltd.[2] [3] [4]	Sault Ste. Marie.
Canadian Atlas Steels, Ltd.[4]	Welland.
Canadian Carborundum Co., Ltd.[1] [2]	Niagara Falls.
Canadian Electro Castings, Ltd.[4]	Orillia.
Canadian Furnace Co., Ltd.[2] [3]	Niagara Falls.
Dominion Foundries and Steel, Ltd.[4]	Hamilton.
Electro-Metallurgical Co. of Canada, Ltd.[2]	Welland.
Exolon Company, Ltd.[1] [2]	Thorold.
Kennedy, Wm., and Sons, Ltd.[4]	Owen Sound.
Lionite Abrasives, Ltd.[1] [2]	Stamford.
Steel Company of Canada, Ltd.[3] [4]	Hamilton.
Superior Alloys, Ltd.[5]	Sault Ste. Marie.
Welland Electric Steel Foundry[4]	Welland.

[1]These firms produce ferro-silicon as a by-product in the manufacture of ferro-alumina.
[2]Ferro-alloys.
[3]Pig iron.
[4]Steel.
[5]Calcium molybdate.

Iron and Steel

During 1934 the output of pig iron increased from 110,562 to 271,725 long tons, and although the increase amounts to 145.6 per cent. in quantity this figure remains considerably below the 769,359 tons produced in 1929, the peak

[2]Dividends paid by the International Nickel Company of Canada, Limited, on the common stock in 1929 were 90 cents per share, and $1.00 per share in 1930. Common stock was increased to 15,000,000 shares of no par value on July 25, 1930; as a result shares issued were increased from 13,758,208 to 14,584,025. Seven per cent. preferred stock (cumulative) now stands at $27,627,825. Dividends on common stock aggregated 45 cents a share in 1931.

[3]Upon completion of the exchange of stock under the amalgamation of the Mond and International companies, effective December 31, 1928, stock issued or issuable was as follows: $27,627,825 of 7 per cent. cumulative preferred, and 13,758,208 common shares without par value. Dividends paid on February 16, 1929, by the Mond company cover the 8 months' period ending December 31, 1928.

year. The Algoma Steel Corporation at Sault Ste. Marie had a 450-ton furnace in blast until June 16, which remained banked until October 16. It was again banked November 24 until the end of the year. The Steel Company of Canada at Hamilton operated a 550-ton unit throughout the year, and the Canadian Furnace Company at Niagara Falls operated its 350-ton furnace from July 12 to the end of the year.

The following tables give details of the iron blast furnace operators:—

IRON BLAST FURNACES IN OPERATION, 1934

Company	Stacks operating	Furnaces		Location
		No. of stacks	Daily capacity	
			long tons	
Algoma Steel Corporation, Ltd....	1	4	1,600	Sault Ste. Marie.
Canadian Furnace Company, Ltd..	1	1	350	Port Colborne.
Steel Company of Canada, Ltd....	1	2	825	Hamilton.

Ferro-Alloys

Of the fourteen plants listed in the 1931 report only six reported production, which with an additional plant, namely, the Canadian Carborundum Company, Limited, not listed in 1931, produced a total of 32,932 long tons of various kinds of ferro-alloys in 1934 as against 30,569 tons in the previous year. The production of these materials during the past five years in Ontario was as follows:—

STATISTICS OF FERRO-ALLOYS PRODUCTION IN ONTARIO, 1928–1934

Year	No. of producing companies	Quantity produced	Kind of material
		long tons	
1928	3	44,842	Ferro-silicon, ferro-manganese, silicon spiegel, spiegeleisen, calcium manganese silicon, zirconium manganese silicon, calcium molybdate.
1929	4	81,137	
1930	5	60,545	
1931	8	46,440	
1932	5	15,595	
1933	6	30,569	
1934	7	32,932	

Coke

The coking industry in Ontario is carried on by the large iron and steel metallurgical works and by chartered companies operating in the cities supplying artificial gas to householders and industries.

Coke statistics for the past five years, as collected by the Dominion Bureau of Statistics, are shown in the following table:—

COKE STATISTICS, 1930–1934

	1930	1931	1932	1933	1934
	short tons	short tons	short tons	short tons	short tons
Production	1,489,415	1,113,509	1,087,122	1,153,509	1,411,516
Imports	993,753	694,982	605,307	615,818	881,235
Total	2,483,168	1,808,491	1,692,429	1,769,327	2,292,751
Deduct exports	317	106	.....	.....	54
Apparent consumption	2,482,851	1,808,385	1,692,429	1,769,327	2,292,697

The statistics shown in the following table are combined and show raw materials used and products made. These figures were supplied by the Dominion Bureau of Statistics.

THE COKING INDUSTRY, 1934

	Quantity	Cost at works
MATERIALS USED:		
Coal ..... tons	1,912,620	$8,559,510
Coke ..... tons	40,485	280,626
Oil ..... Imp. gals.	6,190,940	360,388
Absorbing and wash oil ..... Imp. gals.	137,013	19,989
Caustic soda ..... lbs.	511,085	16,626
Lime ..... tons	706	6,402
Oxide for purification ..... tons	3,357	38,067
Sulphuric acid 66° Be. purchased ..... lbs.	25,180,960	186,741
All other materials	.....	12,401
Total	.....	$9,484,340
GAS MADE:	M cu. ft.	
Retort coal gas	5,267,740	.....
Coke oven gas	15,051,798	.....
Straight water gas	3	.....
Carburetted water gas	2,313,889	.....
Oil gas	12,378	.....
Total	22,645,808	.....
GAS CONSUMED:	M cu. ft.	
Sold	10,199,903	$7,877,086
Used in producing plants	6,425,562	1,015,095
Used in associated metallurgical works	6,170,354	943,186
Otherwise accounted for	680,887	138,354
Not accounted for	807,762	682,333
Total	24,284,468	$10,656,054
COKE AND BY-PRODUCTS MADE:		
Coke, including breeze ..... tons	1,388,709	$10,200,363
Tar ..... Imp. gals.	17,020,066	937,842
Ammonia liquor ..... lbs. NH_3	1,863,266	18,633
Ammonium sulphate ..... lbs.	30,853,599	306,970
Benzol ..... Imp. gals.	2,908,126	538,799
Other light oils	271,628	28,305
Total	.....	$12,030,912
COKE SOLD AND USED, AND STOCKS:	tons	
Used by reporting companies	407,609	.....
Sold for domestic use	762,374	.....
Other uses	180,732	.....
On hand, December 31, 1932	233,494	.....

Chromite

The Chromium Mining and Smelting Corporation, Limited, in 1934 shipped 40 tons of chromium from the Obonga Lake deposits, west of Lake Nipigon, all of which was used for experimental purposes. From this material, ferrochrome was made in the electric furnaces of General Abrasives at Niagara Falls, N.Y. The company estimated that 1,100 tons of ore were mined from surface open cuts between June and December, and the material shipped was valued at $12 per ton. A considerable amount of diamond-drilling was done in 1934.

An average of 16 men was employed at the mine, in addition to about 50 on road construction. Tractors will be used for conveying high-grade ore some 28 miles north to Collins station on the Canadian National railway.

Radium and Uranium

Although pitchblende, which is the source of radium and uranium, has not been produced in commercial quantities in Ontario, there is now a well-equipped extraction plant in successful operation at Port Hope, owned by Eldorado Gold Mines, Limited, for the treatment of pitchblende concentrates from Great Bear lake, some 4,000 miles distant. The refinery was placed in commission in 1933, and considerably enlarged in the autumn of 1934. In January, 1935, the concentrator of the company, at Labine point, Great Bear lake, commenced operations. It has a capacity of 75 tons of ore daily. A 2-ton Bellanca air-cruiser will be used to transport the silver-pitchblende concentrate a distance of about 1,200 miles to the rail-head at Waterways, Alta., thus ensuring a constant supply to the refinery during winter months.

The initial output of radium needles in 1933 (approximately 788 milligrams) was purchased by the Ontario Government for use in cancer clinics in four of the larger cities. An economic extraction process was perfected in 1933 for both radium and uranium products. The chemical process employed is intricate and will not be described here. Recovery of radium is in the form of a readily soluble bromide and less soluble sulphate, the latter being used for hospital work. Special care is taken at all stages to prevent the loss of radium by emanation and to protect the workers by fan ventilation.

Uranium yellow and orange (two sodium salt pigments) are produced for use in porcelain manufacture. Europe is the chief market for these pigments. The black oxide of uranium is also produced. Satisfactory arrangements for marketing both radium and uranium products were completed in 1934. This is a most creditable Canadian performance, as heretofore radium production was practically a Belgian monopoly. The Department of Mines, Ottawa, reports production to the end of 1934 as 6.1 grams of radium, from 61 tons of concentrates; uranium compounds, totalling 60,000 pounds; and 30,500 ounces of silver as a by-product. Henceforth, with the production of high-grade concentrates at the mine, the grade shipped will, it is expected, be considerably enhanced.

NON-METALLICS

With the exception of arsenic, mica, mineral waters, salt, and talc, every non-metallic mineral showed an increase in value in 1934; and salt actually increased in quantity, although the selling value was lower. As these minerals are consumed in a wide list of manufacturing industries, the record of increases, even though small in some cases, is indicative of a definite recovery in the industrial life of the country. The total value of the non-metallic group in 1934 was $7,553,571, as against $7,094,636 in 1933, a slight increase. The details of quantities and values marketed are set out in the table, "Summary of Mineral Statistics, 1934," on page 2.

Arsenic

Arsenic in the native state is a metallic mineral, but since it is produced in Ontario in the oxide form, called in the trade "white arsenic," it has been customary to include it with non-metallics. The whole production is recovered

in the smelting of the silver-cobalt arsenides of Northern Ontario by the Deloro Smelting and Refining Company. The production in 1934 was 1,647,513 pounds, valued at $56,412, as against 1,468,022 pounds, worth $56,534, in the previous year.

Barite

A small output of barite was reported in 1933, after being absent from the list since 1923. Several deposits of this mineral are known to exist in the province. Although considerable investigation into markets has been undertaken, and several enquiries have been received from outside sources, no steady development work was under way at any of the Ontario deposits. Canada Night Hawk Mines, which is equipped for milling, did not report any work. The deposits in Yarrow township and at Tionaga were idle, and no shipments were reported.

Diatomite

Several deposits of this mineral have been under development for a number of years in Muskoka, but the production to date has been small. In 1934 shipments totalling 46 tons, having a value of $1,920, were reported, as against 28 tons worth $1,298 in 1933.

Feldspar and Nepheline Syenite

Feldspar

Production rose from 4,387 tons in 1933 to 7,302 tons in 1934. This increased consumption of ground spar in domestic manufacturing plants is a positive indication that a distinct business revival has been made in the enamelling, glazing, and porcelain-insulator manufacturing trades.

As exports to the United States are practically non-existent the increase in the output of feldspar, although small in actual money value, is of signal importance, showing as it does the industrial recovery now apparent. The only domestic grinding plant in Ontario is that of the Frontenac Floor and Wall Tile Company, Limited, at Kingston, which draws its supply of crude spar mainly from Lanark county. The Ontario spar is particularly rich in potash and alumina.

Nepheline Syenite

The Nepheline Company, Limited, was incorporated in Ontario on August 10, 1934, with a capital of $100,000. Headquarters are at Lakefield, and it is the purpose of Wm. Morrison, the promoter, and associates to develop a deposit of nepheline syenite at Mountain lake in Methuen township, Peterborough county. This particular rock has a chemical composition that makes it suitable for use in the glass industry. The combined alkalies, soda and potash, run about 15 per cent. Low silica and high alumina content give this rock a low fusion or fluxing point.

Markets have been canvassed in the United States, and in England some members of the Glass Manufacturers' Federation have reported satisfactory tests and are prospective buyers, provided the price is right. It is proposed to quarry the rock, crush to 20-mesh, transport by truck to Stony lake, ship by barge to Lakefield, and thence by rail.

Other deposits of nepheline syenite occur in Eastern Ontario, and some are being investigated.

Fluorspar

Although Ontario's production of this mineral is insignificant and is drawn from old mine dumps near Madoc in Hastings county, the output increased from 73 tons in 1933 to 150 tons in 1934. The material, which is consumed at smelters as a flux and in various chemical industries, has a ready sale. Some foreign spar is imported; consumption, however, is not large.

Graphite

There is only one producer in Ontario, the Black Donald Graphite Company, Limited. Its mine is on lots 16, 17, and 18, concession III, Brougham township, Renfrew county, near the village of Calabogie. The total value of the production in 1934 was $64,998, as against $16,145 in the preceding year. A new feature in the development of the graphite industry in Ontario is its successful application to the manufacture of leads for pencils. In this connection the following excerpt from *The Financial Post* of January 12, 1935, is of interest:—

> Overcoming the chief obstacle to the use of Canadian graphite, in the making of lead pencils, the Dixon Pencil Company, Limited, of Newmarket, Ont., states that for the first time in history, Canadian graphite from the well-known Black Donald mines at Calabogie is now being used by that company. Canadian graphite has always been noted for its strength, high grade, and true intensity of colour, but owing to its texture, it could not successfully be employed in pencil-lead making, as ordinary methods of refining and pulverizing would not prepare the Canadian graphite in workable form for pencil leads. Now, however, the technical staff of the Dixon Pencil Company has successfully devised a patented process called "impact pulverizing," license for which is held exclusively by this company. The result, it is claimed, is a stronger, smoother writing lead of true black colour. The company states that it hopes to extend the use of this graphite not only to the market of Canada but to the markets of the world, thereby increasing the demand for Canadian graphite.

Gypsum

The output of gypsum in Ontario rose from 24,460 tons in 1933 to 33,234 in 1934, and came from two companies: Gypsum, Lime and Alabastine, Canada, Limited, with plant at Caledonia, and the Canadian Gypsum Company at Hagersville. The increase of about 26 per cent. in quantity coincides with the general revival in the building industry of Ontario.

Sales in 1933 fell to a very low ebb, as will be noted in the table which follows:—

GYPSUM SALES, 1930–1934

Grade	1930	1931	1932	1933	1934
	tons	tons	tons	tons	tons
Crushed	25,130	10,263	5,656	2,753	5,636
Fine-ground	1,190	451	364	795	376
Calcined, sold	3,515	1,606	217	165	226
Calcined, used in products	65,111	41,038	29,418	20,747	26,996
Total sold or used	94,946	53,358	35,655	24,460	33,234
Total value	$776,069	$374,469	$186,176	$112,319	$141,389
No. of workers	[1]92	155	[1]98	[1]79	[1]69
Wages paid	$92,918	$87,263	$85,036	$46,782	$53,718

[1]Exclusive of wage-earners employed in the manufacturing division of the Caledonia plant.

Iron Pyrites and Sulphuric Acid

The sulphur content of the acid manufactured at Copper Cliff by Canadian Industries, Limited, from sulphur fumes derived from nickel-copper smelting was

14,598 tons, worth $145,980, in 1934, as against 8,196 tons, valued at $81,960, in 1933. No pyrite ore was shipped.

Mica

The mica industry, which is principally in the hands of small producers, is almost entirely dependent on the electrical manufacturing business. The decline in consumption was particularly marked in 1932 and there were fewer producers than during the past two decades.

The prices for the various sizes and grades of thumb-trimmed mica, as reported by the producers in 1934, were as follows:—

Size	Price per lb.	Size	Price per lb.
1 by 1 inch	$0.07	2 by 4 inches	$0.45
1 by 2 inches	.15	3 by 3 inches	.60
2 by 2 inches	.20	3 by 4 inches	.91
2¼ by 2½ inches	.40	3 by 5 inches	.95
2 by 3 inches	.30–.50	4 by 6 inches	1.35–1.75

Scrap mica, $9.00 per ton (net).
Rough-cobbed, 20 cents per pound.

By grades the shipments in 1932, 1933, and 1934 were as follows:—

SHIPMENTS OF MICA, 1932, 1933, AND 1934

Grade	1932		1933		1934	
	Quantity	Value	Quantity	Value	Quantity	Value
	pounds		pounds		pounds	
Ground and rough	.....	.....	19,000	$239	2,459	$514
Thumb-trimmed	232	$224	44,219	3,287	30,315	3,094
Splittings and knife-trimmed	.....	.....	11	19	303	110
Scrap	536,980	2,528	1,268,200	5,820	1,203,225	5,341
Total	537,212	$2,752	1,331,430	$9,371	1,236,302	$9,059

Mineral Waters

The output in Ontario from five or six mineral springs during the past decade has ranged from 21,775 to 309,000 Imperial gallons. During 1931 six wells, all in Eastern Ontario, produced 197,540 Imperial gallons, worth $8,578 at the shipping point; and in 1932 four wells produced 61,208 gallons. In 1933, the production was 29,794 gallons, valued at $2,347, from three wells; and in 1934, 21,775 gallons, worth $1,622.

Natural Gas and Petroleum

The Natural Gas Commissioner of Ontario supplied the following notes:—

Natural Gas

The production of natural gas in the year 1934 was 7,682,851 M cubic feet, and the value $4,741,368, a small increase over 1933. An annual increase of 150,000 M cubic feet is so small that it is difficult to attribute it to any particular cause, unless it is to slightly reduced rates in the cities in Essex, Kent, and Lambton. Certainly there has been a considerable increase in the sale of more efficient appliances, which would stimulate the demand for gas. The past year has been a successful one in the search for gas. A new field was discovered in Bayham township, Elgin county, east of the village of Eden. The Declute field in Raleigh township and the Dover field in Dover township, Kent county, have been extended. In each of these fields several large wells were drilled, and this has helped to maintain public interest in the development of natural gas fields.

Petroleum

The year 1934 has shown an increase in petroleum production for the fourth consecutive year, as noted in the table below. This new production came from the Bothwell field and from Brooke township in Lambton county, where sixteen wells were drilled in the past year. At Bothwell old wells were opened that have not been operated for 20 or 30 years, and an extension of the Bothwell field was discovered south of the Thames river. This oil is all from the Onondaga formation at about 500 feet from the surface.

CRUDE PETROLEUM PRODUCTION, 1930–1934[1]

Field	1930	1931	1932	1933	1934
	barrels	barrels	barrels	barrels	barrels
Petrolia and Enniskillen township	55,130	57,515	58,871	57,298	57,938
Oil Springs	29,160	30,792	31,438	31,343	29,863
Moore township	1,576	3,739	3,272	2,192	2,963
Sarnia township	1,149	1,466	1,227	2,181	825
Plympton township	296	296	274	211	202
Bothwell	21,176	18,084	19,460	22,935	32,133
Dover township	457	891	453	763	558
Dawn township	.....	.....	5,061	8,589	4,169
Onondaga township	231	34	543	946	601
Mosa township	7,166	8,517	8,429	8,168	9,031
Thamesville	447	462	534	847	614
Dunwich township (Dutton and Iona)	365	628	781	346	283
Tilbury East township	149	.....	.....	.....	.....
Raleigh township	.....	.....	.....	239	264
Brooke	.....	.....	.....	.....	1,941
Total quantity	117,302	122,364	130,343	136,058	141,385
Value	$235,746	$219,993	$247,468	$253,486	$299,874
Average price per barrel	$2.00	$1.80	$1.89	$1.87	$2.12

[1]Information furnished by the Imperial Oil Refiners, Limited, of Sarnia, and others.

Peat

During the past year or two considerable interest has been noted in the peat bogs of Ontario. The names of operators and locations are given on page 61. The production by seven operators during 1934 was 1,878 tons, valued at $7,343, excluding 224 tons of humus having an estimated value of $224.

Quartz, Quartzite, and Silica Brick

The production of quartz and quartzite, which in 1933 was below that of previous years, showed a marked recovery in 1934. Silica brick advanced in 1933 over the preceding year, and increased its gain in 1934. Production figures for the past five years follow:—

QUARTZ, QUARTZITE, AND SILICA BRICK, 1930–1934

Year	Rock sold or used		Silica brick sold or used		Total value
	Quantity	Value	Quantity	Value	
	tons		M		
1930	167,487	$274,674	378	$19,120	$293,794
1931	97,888	148,642	279	13,702	162,344
1932	66,135	93,574	93	4,303	97,877
1933	66,562	86,146	183	7,351	93,497
1934	89,838	134,572	369	14,730	149,302

Salt

During 1934 six companies produced salt (or brine, which is used in the manufacture of chemicals by Canadian Industries, Limited, and Brunner Mond,

Canada, Limited). The Warwick Pure Salt Company was a newcomer on the list in 1933, and Kincardine Salt, Limited, owned by Canadian Industries, Limited, reported no production. This industry, which is located in the south-western part of the province, is well organized, and the fluctuations shown in the figures of output reflect fairly closely the general progress of industry in the province. Production figures covering a 5-year period follow:—

SALT SOLD OR USED, 1930–1934

Schedule	1930	1931	1932	1933	1934
	tons	tons	tons	tons	tons
Table and dairy	49,467	115,180	59,620	61,231	69,779
Fine	52,604		59,036	63,786	67,777
Coarse	21,085	17,678	15,673	14,086	14,730
Land	245	513	557	283	347
Other grades (pressed blocks)[1]	7,655	.....	.....	.....	.....
Total	131,056	133,371	134,896	139,386	152,633
Brine (salt equivalent)	114,737	97,928	96,242	104,721	124,118
Total sold or used	245,793	231,299	231,138	244,107	276,751
Value	$1,568,250	$1,760,388	$1,789,752	$1,755,087	$1,734,196
Wage-earners[2] ..... No.	263	233	215	242	252
Wages	$288,237	$259,646	$253,579	$261,214	$296,116

[1]Pressed blocks included with table and dairy grade after 1930.
[2]Workers at the Sandwich salt and chemical works are included.

The Walker Salt Corporation, Limited, of London, Ont., has drilled a salt well 1,485 feet deep at Port Franks in Lambton county. This company has completed the foundations of the salt plant and ordered the machinery for open-pan production early in 1935. This grade of salt is particularly suited for dairy use, and will supply the local market. The Goderich Salt Company is putting in a triple effect vacuum-pan evaporation, which is expected to be in operation early in 1935. An important feature is that for the first time all the machinery in connection with this plant has been manufactured in Canada. Formerly all salt-making machinery was imported from the United States. This will give a capacity equal to the Sandwich plant.

Talc

A fairly stable market has been developed for this mineral, both in the ground and prepared condition. The domestic consumption is steady, and exports are made to the United States and Europe. The production record, as reported by two companies at Madoc, in Hastings county, for the last five years, follows:—

TALC STATISTICS, 1930–1934

Year	Sales		Wage-earners, mine and mill	Wages paid
	Quantity	Value		
	tons		No.	
1930	11,664	$133,213	36	$32,718
1931	11,806	122,044	36	29,419
1932	12,064	111,585	38	30,587
1933	15,114	142,134	43	31,813
1934	13,934	135,978	47	33,796

Increased talc sales in 1933 were due partly to the gradual betterment in some lines of business using talc products, such as textiles, cosmetics, etc. Some of the buying, however, may have arisen from the fear of possible higher prices, which would account for the falling off in the demand during 1934.

STRUCTURAL MATERIALS

Building Permits

In 61 Canadian cities building permits in 1934 were valued at $27,457,524. Of this total 30 Ontario cities accounted for $14,351,380, as noted in the following table abstracted from the *Annual Review of Building Permits in Canada in 1934*, issued by the Dominion Bureau of Statistics, Department of Trade and Commerce, Ottawa:—

BUILDING PERMITS, 1920–1934

Year	30 Ontario cities, value	Wholesale prices index[1]	Toronto metropolitan area,[2] value	Wages index 1913=100[3]
1920	$58,636,365	[4]144	$30,049,413	180.9
1921	59,315,845	122.8	31,979,346	170.5
1922	81,396,259	108.7	36,405,625	162.5
1923	74,673,080	111.9	39,530,877	166.4
1924	57,330,141	106.6	29,636,428	169.1
1925	59,888,867	102.9	32,408,636	170.4
1926	65,373,757	100	31,588,124	172.1
1927	79,883,344	96.1	37,316,511	179.3
1928	104,777,566	97.4	59,817,568	185.6
1929	95,055,827	99	57,522,927	197.5
1930	69,042,946	90.8	38,371,587	203.2
1931	44,371,578	81.9	27,950,136	195.7
1932	16,887,761	77.2	9,461,050	178.2
1933	9,116,743	78.3	5,114,351	158
1934	14,351,380	83	8,396,775	154.8

[1]Applies to average index numbers for Canadian wholesale prices of building materials on the basis of 1926=100, as compiled by the Dominion Bureau of Statistics. In 1913 the index was 67, dropping to a low of 60.5 in 1915.

[2]Includes York and East York municipalities.

[3]Average index numbers of wages in Canadian building trades as compiled by the Federal Department of Labour on the basis of 1913=100

[4]Peak year.

Construction Contracts

The value of Canadian construction contracts awarded for 1934, reported by the *McLean Building Review*, was $125,811,500, as compared with $97,289,800 in 1933. Ontario contracts in 1934 amounted to $63,358,300, or 50.4 per cent. of the total. Prices of materials were considerably below the peak of 1920, and decided drops were recorded in 1930, 1931, and 1932, but a perceptible recovery is recorded in 1934. Canadian construction contracts in 1933 were on a par with the war years, 1916–18, dropping below the $10,000,000 mark. Figures by classes of construction for a 5-year period follow:—

VALUE OF CONSTRUCTION CONTRACTS, 1930–1934

Classification	1930	1931	1932	1933	1934
Residential	$44,427,000	$39,274,300	$14,143,200	$12,653,800	$17,578,600
Business	52,636,400	28,819,400	16,925,600	9,716,100	15,795,600
Industrial	12,787,400	6,836,300	1,871,000	4,699,700	4,305,200
Engineering	65,608,800	50,522,300	16,352,000	15,503,800	25,678,900
Total	$175,459,600	$125,452,300	$49,291,800	$42,573,400	$63,358,300

Cement

Ontario's production of cement came from four plants: Belleville, Lakefield, and Port Colborne, of the Canada Cement Company, and the St. Marys plant of the St. Marys Cement Company.

Production during the past decade is given in the following table:—

PORTLAND CEMENT STATISTICS, 1925–1934

Year	Operating plants	Sales		
		Quantity	Value	Average price per barrel
	No.	barrels[1]		
1925	4	3,462,358	$5,253,911	$1.52
1926	3	3,398,860	4,792,857	1.41
1927	4	3,751,786	5,144,326	1.34
1928	4	3,911,795	5,520,897	1.41
1929	4	4,624,712	6,608,246	1.43
1930	4	3,942,690	5,779,404	1.47
1931	4	3,470,056	5,006,826	1.44
1932	4	1,599,342	2,288,975	1.44
1933	3	1,095,845	1,587,812	1.45
1934	4	1,702,128	2,403,590	1.41

[1]350 pounds.

The cement industry and the building and construction trades are interdependent. This is well illustrated by the annual report of the president of the Canada Cement Company for the fiscal year ending November 30, 1934. He says in part:—

Referring more particularly to the building industry, in which you are vitally interested, some progress has been made, but less progress than in the majority of other lines of business. In no other important country is this industry at so low a point relatively as in Canada. It will be recalled, however, that the building industry in Canada was one of the industries that was late in feeling the effects of the depression, and it is, therefore, probably natural that its revival should lag. The improvement which took place during the year is indicated by the building permits, which increased 34 per cent. over 1933, a substantial improvement as expressed in percentages, but bearing in mind the extremely low volume of 1933, the volume increase is not of great proportions. It should be said that the public works programme of the Federal Government will not be reflected in demand for materials in substantial quantities until 1935.

Your company's business showed an increase in volume of sales during the year in line with the somewhat better conditions prevailing in the building industry. We might state that the total consumption of cement in Canada was on a very restricted scale. While improvement was made over the 1933 volume, the total sales were disappointing when compared with normal years.

It is difficult to make a forecast for the coming year, but, from information gained from various sources at your company's command, we are inclined to believe that improvement in the building industry will be slow for the immediate future. Nevertheless, the year should show some improvement over that of 1934.

Cement Products

In recent years the cement products industry in Ontario has assumed considerable importance. Since 1924 no data have been included in the tables of mineral production, as the raw materials entering into the manufacture of these products have all been accounted for. Cement products being so closely allied to the building industry, statistics are included so that complete information covering all structural materials is available under one cover. Monolithic construction is not included. The following tables give the record of materials used and products made during the past two years and general statistics for a 5-year period:—

CEMENT PRODUCTS MANUFACTURE, 1933 AND 1934[1]

Materials used	1933		1934	
	Quantity	Cost at works	Quantity	Cost at works
Portland cement ..... bbls.	37,900	$90,461	64,755	$154,039
Quicklime ..... bu.	81	43	8	8
Sand ..... cu. yds.	13,017	14,207	21,985	23,233
Gravel ..... cu. yds.	7,481	8,068	10,621	14,078
Crushed stone ..... cu. yds.	2,624	4,798	4,298	5,958
Cinders ..... cu. yds.	.....	9,277	2,867	6,159
Boxes, crates, lumber, etc.	.....	6,345	.....	7,340
Reinforcing ..... tons	.....	5,707	145	9,741
Haydite ..... cu. yds.	4,780	16,730	9,120	31,921
Brass	.....	16,717	.....	11,350
Other materials	.....	39,857	.....	57,258
Total	.....	$212,210	.....	$321,085
Products made	**Quantity**	**Selling value**	**Quantity**	**Selling value**
Artificial stone	.....	$37,417	.....	$32,314
Cinder blocks ..... M	237	39,377	617	72,509
Cement bricks ..... M	166	4,140	372	7,645
Cement hollow building blocks ..... M	.....	122,689	1,251	179,814
Cement laundry tubs ..... No.	2,697	19,576	2,204	17,115
Cement posts, poles, etc.	.....	694	.....	6,610
Cement sewer, culvert, and drain pipe	.....	133,300	.....	119,086
Cement stucco	.....	5,424	.....	8,215
Burial vaults	.....	9,444	.....	9,805
Crushed stone	.....	3,162	.....	.....
Haydite blocks ..... tons	835	7,103	5,019	$40,248
Haydite roof slabs ..... tons	2,352	66,414	2,084	55,517
Other products	.....	98,680	.....	137,647
Custom work and repairs	.....	2,765	.....	651
Total	.....	$550,185	.....	$687,176

[1]Supplied by Dominion Bureau of Statistics, Ottawa.

PRINCIPAL STATISTICS OF THE CEMENT PRODUCTS INDUSTRY, 1930-1934[1]

Year	No. of plants	Wage-earners, average No.	Salaries and wages	Cost of fuel and electricity	Capital invested	Value of products at work
1930	88	533	$658,381	$44,697	$13,148,950	$1,921,018
1931	92	562	599,640	43,429	2,995,610	1,782,400
1932	69	352	308,898	27,692	2,286,460	737,326
1933	48	245	199,056	19,008	1,642,244	550,185
1934	54	251	274,045	24,394	1,784,166	687,176

[1]Supplied by Dominion Bureau of Statistics, Ottawa.

Lime

Lime is used quite extensively for chemical purposes in addition to being an ingredient of mortar and sand-lime brick. During 1934, 19 companies and individuals, operating 22 plants, reported sales that totalled 191,041 tons, valued at $1,536,288, as against 146,193 tons, worth $1,227,196, in 1933. Statistics for the past five years follow:—

. LIME STATISTICS, 1930–1934

Year	Lime marketed or used						Fuel costs	Wage-earners	Wages
	Hydrated			Quicklime					
	Quantity	Total value	Per ton	Quantity	Total value	Per ton			
	tons			tons				No.	
1930...	42,726	$504,178	$11.80	209,340	$1,673,409	$7.99	$343,237	330	$352,768
1931...	34,284	379,996	11.08	113,267	841,194	7.43	177,310	287	216,337
1932...	23,518	255,223	10.85	143,185	1,018,007	7.11	204,546	203	154,361
1933...	19,733	220,291	11.16	126,460	1,006,905	7.96	188,317	210	111,637
1934...	22,281	249,038	11.18	168,760	1,287,250	7.63	173,951	187	116,020

Distribution of the quicklime and hydrated lime sold in 1934, as reported by the producing companies, was as follows:—

Industrial consumption	Quicklime		Hydrated lime	
	Quantity	Value	Quantity	Value
	tons		tons	
Building trades: finishing and masons	15,885	$104,492	19,375	$223,836
Sand-lime brick	2,321	16,912	635	4,516
Agriculture	162	1,121	461	4,393
Chemical and metallurgical industries:				
Smelters	2,635	14,598	102	918
Iron and steel	8,612	60,255	8	72
Gold-milling	6,168	38,868	.....	.....
Pulp and paper	3,239	19,784	110	990
Glass	2,226	16,472	.....	.....
Sugar	3,198	47,573	.....	.....
Tanneries	2,189	15,210	257	2,313
Fertilizers and insecticides	747	5,229	397	3,573
Dealers and others	2,059	13,881	154	1,386
Other chemicals[1]	119,319	932,857	782	7,041
Total	168,760	$1,287,250	22,281	$249,038

[1]Uses for lime under this heading include the manufacture of alkali, acetate of lime, and calcium carbide, the last-mentioned being used largely for making cyanamid.

Sand and Gravel

Preliminary figures for the year 1934 show a marked rise in the quantity of sand and gravel produced, but the selling value did not increase proportionally. The figures, however, are encouraging, reflecting as they do a greatly increased consumption by a revived construction industry.

OUTPUT OF SAND AND GRAVEL, 1933 AND 1934

Source	1933		1934	
	Quantity	Value	Quantity	Value
	tons		tons	
Private pit operators	2,429,042	$1,145,316	551,145	$249,980
Dredged from Great Lakes and rivers	243,633	135,352	464,507	292,467
Department of Northern Development	1,038,108	207,624	4,345,694	225,332
Department of Highways	408,700	204,350	620,000	310,000
Miscellaneous counties and townships[1]	1,550,547	775,274	1,273,580	636,790
Total	6,670,030	$2,467,916	7,254,926	$1,714,569

[1]Figures for 1933 used as an estimate for 1934.

Sand-Lime Products

The past three years have been dull for marketing sand-lime brick. This is in part owing to a depressed construction industry, but competition of other products, such as cinder blocks and kindred materials has cut into this trade considerably. Four companies were active in the Toronto metropolitan area, and in addition to brick produced sand-lime building blocks, ready mixed mortar, and plaster. These items have been included in the table "Summary of Mineral Statistics, 1934," on page 2, under the title "sand-lime products," and the selling value as a result shows a decided increase. It should be pointed out, therefore, that, prior to 1934, the figures of value refer to sand-lime brick only. The selling value in 1934 was $146,009, as against $69,785 in the previous year.

Stone

The output of limestone, trap, granite, and sandstone in 1934, was almost double that for 1933 in quantity, but the proportional increase in value was not quite so great. A partially revived building industry and a larger highway construction programme were instrumental in reopening many quarries.

A new feature in the stone-production industry was the inclusion of slate, which has been absent from the list of building materials for several decades. A slate quarry situated in the northwest corner of lot 5, concession VI, Madoc township, was worked fifty years ago and supplied roofing slates for a few buildings in various towns of Eastern Ontario. It was reopened in 1934. There is a potential market for roofing shingles, blackboards, granules, and slate flour. The new operator is Ontario Slate Mines, Limited. An initial shipment of 120 tons of granules was made during the year.

OUTPUT OF STONE, 1932, 1933, AND 1934

Variety	1932		1933		1934	
	Quantity	Value	Quantity	Value	Quantity	Value
	tons		tons		tons	
Limestone and marble	1,827,858	$1,459,224	1,225,754	$931,501	2,374,671	$1,808,663
Trap	36,915	52,659	17,201	26,629	48,298	96,314
Granite	36,357	133,698	2,449	12,804	27,227	32,072
Sandstone	4,008	9,435	8,889	12,334	10,105	28,458
Slate	.....	.....	.....	.....	120	600
Total	1,905,138	$1,655,016	1,253,907	$983,268	2,460,421	$1,966,107

CLAY PRODUCTS

Refractory Clays

The following information has been furnished by W. S. Dyer, former geologist of the Ontario Department of Mines, who visited the Hilder deposit during the summer of 1934:—

It is well known that fire clay and sedimentary clay exist in the Moose River basin in Northern Ontario. Deposits that are near the railway, like the grey and black fire clays of the Onakawana lignite field, are covered under 50 to 100 feet of glacial debris and would have to be mined by underground methods. Deposits under shallow overburden, like the highly refractory white and mottled clays of the Missinaibi river, are 30 miles across the muskeg from a railway.

The only development at present in operation is known as the Hilder deposit, now being investigated by Minefinders, Limited. It is located on the west side of the Mattagami river,

7 miles north of Smoky falls, the terminus of a 50-mile logging railway from Kapuskasing. The work to date has indicated that a good body of clay rises above the water level of the Mattagami river and is overlain by overburden of about 35 feet. In the summer of 1934, Minefinders, Limited, built a road into the property, erected camps, took in a shovel with 1½ cubic yards capacity, and completed an open cut 350 by 150 feet. In the bottom of the open cut, which is 25 to 30 feet in depth, Cretaceous refractory clay and silica sand are exposed.

Heavy Clay Products

The following table shows in detail the quantities and values of the several kinds of clay products made and sold by Ontario producers:—

HEAVY CLAY PRODUCTS MARKETED, 1934

Kind		Quantity	Value
Brick:			
Soft-mud process	face, No.	3,514,125	$64,642
	common, No.	7,192,829	96,776
Stiff-mud (wire cut) process	face, No.	15,060,236	311,490
	common, No.	6,875,503	97,323
Dry-press	face, No.	4,835,905	103,718
	common, No.	2,046,158	33,177
Fancy or ornamental brick (including special shapes, embossed and enamelled brick), No.		14,277	835
Sewer, No.		307,147	5,992
Tile:			
Structural (hollow blocks, including fireproofing and load-bearing tile), tons		13,576	102,243
Roofing tile, No.		44,115	1,852
Floor tile (quarries), sq. ft.		77,604	16,886
Drain, No.		6,017,379	137,699
Sewer pipe (including copings, flue linings, etc.)		.....	226,005
Pottery (flower pots), from domestic clay		.....	52,578
Haydite		.....	9,790
Total value		.....	$1,261,006

The value of clay products marketed for the last pre-war year, 1913, for the year of maximum output, 1922, and for the past five years is given below:—

VALUE OF CLAY PRODUCTS SOLD OR USED, 1913, 1922, AND 1930–1934

Product	1913	1922	1930	1931	1932	1933	1934
Brick:							
Common	$3,283,894	$2,614,120	$792,234	$662,777	$305,566	$167,021	$227,276
Pressed, fancy, building tile, etc.	1,162,860	2,899,205	2,683,983	1,707,297	704,342	425,743	607,658
Pottery	52,875	88,889	89,381	73,860	67,866	[1]52,740	52,578
Drain tile	292,767	368,180	593,980	244,368	144,579	179,015	137,699
Sewer pipe	600,297	973,824	834,361	696,694	451,786	185,048	226,005
Haydite	.....	.....	227,275	167,533	16,366	15,012	9,790
Total	$5,392,693	$6,944,218	$5,221,214	$3,552,799	$1,690,505	$1,024,579	$1,261,006

[1]Includes fire-clay blocks and shapes worth $90.

MISCELLANEOUS STATISTICS

Mining Company Incorporations

A summary of mining companies incorporated and licensed in Ontario from 1913 to 1934, inclusive, is given hereunder:—

MINING COMPANIES INCORPORATED AND LICENSED, 1913–1934

Year	Incorporated				Extra-provincial and mortmain companies licensed	
	No.	Nominal capital	"No par" companies		No.	Capital for use in Ontario
			No.	Shares		
1913	119	$78,000,000	.....	.....	12	$21,735,000
1914	80	39,030,000	.....	.....	13	5,445,000
1915	59	42,005,000	.....	.....	2	10,200,000
1916	83	109,079,500	.....	.....	8	7,011,650
1917	100	117,183,000	.....	.....	7	7,302,000
1918	59	49,800,000	.....	.....	7	15,000,000
1919	149	223,600,000	.....	.....	10	9,554,197
1920	119	146,094,000	.....	.....	12	9,435,000
1921	67	105,715,000	.....	.....	6	1,030,500
1922	91	181,040,000	.....	.....	6	830,000
1923	88	179,295,500	.....	.....	6	1,775,000
1924	85	156,485,000	.....	.....	2	200,000
1925	70	107,400,000	4	9,010,000	3	162,510
1926	145	165,655,750	28	22,386,500	6	4,850,000
1927	199	344,145,000	30	40,034,000	10	3,260,000
1928	211	495,575,000	28	30,778,400	17	7,208,500
1929	97	142,390,000	27	32,557,200	13	1,540,000
1930	37	23,234,600	20	16,808,909	6	5,525,000
1931	44	60,670,000	15	5,909,000	1	400,000
1932	43	58,766,000	12	5,844,000	0	.....
1933	95	158,365,000	21	23,165,000	8	1,290,000
1934	212	488,335,000	82	86,183,000	9	925,000

Of the 294 companies incorporated in 1934, 212 had specified capital only, 82 were companies having shares without nominal or par value exclusively, and 4 companies had shares of both kinds.

MORTMAIN AND EXTRA-PROVINCIAL COMPANIES LICENSED BY ORDER-IN-COUNCIL IN 1934

Name of company	Place of incorporation	Date of license (O.C.)	Value of land holdings in Ontario
Clark Gold Mines, Limited	Quebec[1]	Oct. 30	$100,000
Cobnor Silver Mines, Limited	Canada[1]	Oct. 25	50,000
Consolidated Chibougamau Goldfields, Ltd.	Quebec[1]	April 5	100,000
Lake Rowan Gold Mines, Limited	Canada[1]	Oct. 25	100,000
Manitoba and Eastern Mines, Limited	Canada[1]	Dec. 14	100,000
Pamour Porcupine Mines, Limited	Canada[1]	Mar. 23	100,000
Red Crest Gold Mines, Limited	Canada[1]	Oct. 25	100,000
Reliance Gold Mining Company	Delaware[2]	May 8	25,000
Sakoose Gold Mines, Limited	Quebec[1]	July 10	250,000
Total (9 companies)	.....	.....	$925,000

[1]Incorporation under The Companies Act, Revised Statutes of Canada, 1906, Part 1 of Chapter 79. Licenses are issued pursuant to the provisions of The Mortmain and Charitable Uses Act, Province of Ontario, "to acquire, hold and assure land in mortmain in Ontario." This applies also to Quebec province.

[2]Where a company is of foreign incorporation, or is incorporated in a province of Canada other than Quebec with which a reciprocity agreement exists, it is necessary for it to take out an Extra-Provincial license to do business in Ontario and to declare the amount of capital for use in Ontario.

MINING COMPANIES INCORPORATED IN ONTARIO IN 1934 HAVING SHARES WITHOUT NOMINAL OR PAR VALUE

Name of company	Head office	Date of incorporation	No. of shares
Alcanada Mining Corporation, Limited	Toronto	June 21	1,000,000
Algold Mines, Limited	Toronto	Feb. 13	2,500,000
Algoma Steel Corporation, Limited[1]	Sault Ste. Marie	Dec. 12	130,000
Amalgamated Mills and Mines, Limited	Toronto	May 7	200,000
Associated Mine Managers, Limited (private)	Toronto	July 9	4,000
Atigo Gold Mining Company, Limited	Port Arthur	April 30	100,000
Atnel Mines, Limited	Sault Ste. Marie	Sept. 4	3,000,000
Banner Gold Mines, Limited	Toronto	Nov. 2	3,000,000
Bathurst Gold Mines, Limited	Ottawa	April 20	4,000,000
Belmore Syndicate, Limited, The	Toronto	April 3	6,000
Belorrain Mines, Limited	Cobalt	Dec. 1	1,000,000
Bilmac Gold Mines, Limited	Toronto	Sept. 11	2,000,000
Blue Eagle Gold Syndicate, Limited	Toronto	June 18	7,000
Boundary Lake Mining Company, Limited	Toronto	June 19	30,000
Bruce-Matachewan Gold Syndicate, Limited	Toronto	July 13	10,000
Bruell Gold Syndicate, Limited	Toronto	July 27	10,000
British United Natural Gas, Limited	Toronto	Aug. 3	1,000,000
Canadian Gold Refining Company, Limited	Windsor	Feb. 15	10,000
Canadian Slate Mines, Limited	Toronto	May 22	1,000,000
Cardiff Waters, Limited	Toronto	Nov. 28	100,000
Chromium Mining and Smelting Corporation, Ltd	Hamilton	May 12	3,000,000
Concordia Gold Mining Company, Ltd	Toronto	May 12	3,000,000
Custom Smelters of Canada, Limited	Toronto	July 25	100,000
Dominion Royalty Corporation, Limited	Toronto	Mar. 17	350,000
Ensign Gold Mines, Limited	Toronto	April 30	1,500,000
Germac Exploration Company, Limited (private)	Toronto	Aug. 10	40,000
Howard Holdings, Limited	Toronto	Sept. 7	40,000
Inez, Limited (private)	Toronto	Dec. 5	40,000
Jackpine-Sturgeon Gold Syndicate, Limited	Toronto	Oct. 5	100,000
Jomac Gold Syndicate, Limited	Toronto	June 6	10,000
Karl Springer Exploration Company, Limited	Toronto	Feb. 9	40,000
Kawinogan Gold, Limited	Toronto	May 1	40,000
Kenogamisis Gold Mines, Limited	Toronto	Sept. 26	3,000,000
Key Properties, Limited (private)	Toronto	May 14	40,000
K. L. Exploration Company, Limited	Toronto	Sept. 12	40,000
Knox Sturgeon River Mines, Limited	Toronto	Oct. 11	3,000,000
Koch Daneff Gold Mines, Limited	Toronto	Nov. 16	4,000,000
Lac-Teck Gold Mines, Limited	Toronto	Sept. 26	3,000,000
La Fond Gold Mines, Limited	Toronto	April 12	2,000,000
Long Lac Inlet Mines, Limited	Toronto	Aug. 20	2,000,000
McLaren-Porcupine Gold Mines, Limited	South Porcupine	Aug. 21	3,000,000
McNeil Longlac Gold Mines, Limited	Windsor	Oct. 18	40,000
Margo Mines, Limited	Toronto	May 4	150,000
Mat-a-Lac Gold Syndicate, Limited	Toronto	June 5	6,000
Minemakers, Limited	Toronto	May 16	20,000
Mining Claims Mart, Limited (private)	Toronto	July 4	100,000
Murray-Algoma Mining Company, Limited	Toronto	Jan. 19	40,000
Nepheline Company, Limited, The[1]	Lakefield	Aug. 10	50,000
Neville Canadian Gold Mines, Limited	Toronto	Mar. 23	3,000,000
Newfoundland South Coast Syndicate, Limited	Toronto	Sept. 13	100,000
Northern Mining Syndicate, Limited	Toronto	Oct. 17	10,000
Nu Sigma Gold Syndicate, Limited	Toronto	June 14	10,000
Oklend Gold Mines, Limited	Toronto	Aug. 28	3,000,000
Oliver Severn Gold Mines, Limited	Toronto	Sept. 27	3,000,000
Ontario Chemical Minerals, Limited (private)	Toronto	Nov. 21	300,000
Orecana, Limited	Toronto	May 21	100,000
Pershing Gold Syndicate, Limited	Toronto	Nov. 8	25,000
Playfair Iron Mines, Limited (private)	Toronto	May 3	20,000
Quebec Eureka Gold Mines, Limited	Toronto	Feb. 21	3,000,000
Rahn Lake Mines Corporation, Limited	North Bay	June 25	3,000,000
Security Gold Mines, Limited	Uxbridge	April 18	2,000,000
South Porcupine Mines, Limited	Toronto	Mar. 20	2,000,000
Springer Sturgeon Gold Mines, Limited	Toronto	Sept. 6	3,000,000

MINING COMPANIES INCORPORATED IN ONTARIO IN 1934 HAVING SHARES WITHOUT NOMINAL OR PAR VALUE—*Continued*

Name of company	Head office	Date of incorporation	No. of shares
Sterling Exploration Company, Limited[1]	Toronto	May 23	10,000
Strathy Explorers, Limited	Toronto	Oct. 17	40,000
Straw Lake Beach Gold Mines Syndicate, Limited	Toronto	Aug. 21	115,000
Sturgeon Aurora Mines, Limited	Toronto	Oct. 19	100,000
Sturgeon Bridge Gold Mines, Limited	Toronto	Sept. 17	3,000,000
Sturgeon River Gold Basin Syndicate, Limited	Toronto	Oct. 3	10,000
Summit Range Gold Mines, Limited	Toronto	April 6	1,000,000
Sweet-Sturgeon Syndicate, Limited	Toronto	Oct. 30	25,000
Tasmijopen Mining Company, Limited	Toronto	Sept. 20	3,000,000
Temagami Development Company, Limited	Toronto	May 28	60,000
Trans-Canada Mining Corporation, Limited	Toronto	April 13	40,000
Universal Exploration Syndicate, Limited	Toronto	Oct. 12	20,000
Vanquelin-Sifton Lake Mines, Limited	Toronto	Aug. 22	3,000,000
Velma Gold Mining Syndicate, Limited	Toronto	Sept. 15	10,000
Walker Salt Corporation, Limited, The	London	Sept. 20	250,000
William Irwin and Company, Limited (private)	Toronto	July 24	50,000
Wilmac Trusts, Limited[1] (private)	Toronto	Aug. 29	25,000
Woman River Gold Mines, Limited	New Liskeard	Oct. 22	5,000,000
Yellow Metal Syndicate, Limited	Toronto	Oct. 17	10,000
Total (82 companies)			86,183,000

[1]See also list with specified capital. Four companies having both specified capital and "no par" shares are included in both lists.

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1934

Name of company	Head office	Date of incorporation	Capital
Ace Exploration and Holding Company, Limited	Toronto	Mar. 21	$100,000
Algoma Steel Corporation, Limited[1]	Sault Ste. Marie	Dec. 12	2,700,000
Algoma Summit Gold Mines, Limited	Toronto	May 17	5,000,000
Amity Gold Mines, Limited	Toronto	Feb. 21	3,000,000
A. R. L. Gold Mines, Limited	Toronto	Sept. 22	3,000,000
Atlas Securities Company, Limited	Toronto	May 9	40,000
Austin Rouyn Gold Mines, Limited	Toronto	Oct. 27	4,000,000
Avocalon Mining Syndicate, Limited	Toronto	June 5	400,000
Ballantyne Long Lac Mines, Limited	Toronto	June 28	3,000,000
Bankfield Gold Mines, Limited	Toronto	April 18	3,000,000
Bessey and Company, Limited, N.R. (private)	Toronto	June 20	25,000
Big Divide Gold Mines, Limited	Toronto	Sept. 28	3,000,000
Bigstone Bay Gold Mines, Limited	Kenora	June 22	2,500,000
Birch Bay Gold Mines, Limited	Toronto	June 25	2,000,000
Boyles Brothers Drilling (Eastern), Limited	Kirkland Lake	May 30	10,000
Bouchard Clericy Gold Mines, Limited	Toronto	Aug. 29	3,000,000
Bourbeau Lake Chibougamau Mines, Limited	New Liskeard	May 15	30,000
Bramor Mining (Ontario), Limited	Toronto	Feb. 9	1,500,000
Brennan and Kenty Brothers Prospecting Co., Ltd.	Toronto	Feb. 20	1,000,000
British Guiana Goldfields, Limited	Toronto	July 27	2,000,000
Bur-Ley Long Lac Gold Mines, Limited	Toronto	July 3	3,000,000
Burmas Mines, Limited	Toronto	May 2	3,000,000
Burwash Yellowknife Mines, Limited	Toronto	Oct. 16	3,000,000
Calder-Bousquet Gold Mines, Limited	Toronto	Feb. 23	3,000,000
Canadian Gold and Metals Mining Company, Limited	Toronto	July 10	10,000,000
Canadian Leviathan Exploration Company, Limited	Toronto	Nov. 5	100,000
Canador Mining, Limited	Toronto	Mar. 17	40,000
Canamerican Corporation, Limited (private)	Toronto	Sept. 17	40,000
Cardinal Gold Mines, Limited	Toronto	Feb. 24	75,000
Centralac Mining Company, Limited	Toronto	Dec. 7	3,000,000
Central Malartic Mines, Limited	Toronto	June 28	3,000,000

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1934—*Continued*

Name of company	Head office	Date of incorporation	Capital
Central Porphyry Contacts, Limited	Toronto	Jan. 3	3,000,000
Craig Gold Mines, Limited	Madoc	May 19	5,000,000
Chappie-Mammoth Gold Mines, Limited	Toronto	Sept. 19	3,000,000
Chieftain Gold Mines, Limited	Toronto	Aug. 28	3,500,000
Cintorico Gold Mines, Limited	Toronto	Sept. 8	3,000,000
Cripple Creek Mining and Milling Company, Ltd	Toronto	Aug. 9	3,000,000
Crossroads Gold Mines, Limited	Toronto	Dec. 3	1,000,000
Darwin Gold Mines, Limited	Toronto	Aug. 16	3,000,000
Delhi (Temagami) Gold Mines, Limited	Toronto	Sept. 5	3,000,000
Delnite Mines, Limited	Toronto	Oct. 23	3,000,000
Dimbarr Gold Mines, Limited (private)	Toronto	Dec. 19	50,000
Dime Long Lac Gold Mines, Limited	Toronto	Aug. 17	3,000,000
Dominion Explorers, Limited	Toronto	Mar. 14	3,000,000
East Lamaque Gold Mines, Limited	Toronto	Mar. 17	3,000,000
Edgecreek Consolidated Gold Syndicate, Limited	Toronto	June 27	150,000
Edgelake Gold Mining Company, Limited	Schumacher	Sept. 21	3,000,000
Edwalt Corporation, Limited	Toronto	Aug. 1	40,000
El-Bonanza Mining Corporation, Limited	Toronto	Jan. 13	5,000,000
Ellen Gold Mines, Limited	Toronto	May 30	3,000,000
Federated Mining Corporation, Limited	Toronto	April 27	5,000,000
Foley-O'Brien Corporation, Limited	Porcupine	May 21	2,100,000
Fort Hope Consolidated Gold Mines, Limited	Toronto	July 12	3,000,000
Franklin Gold Mining Company, Limited	Toronto	Aug. 17	3,500,000
Frontier Red Lake Gold Mines, Limited	Toronto	May 3	3,000,000
Gale Gold Mines, Limited	North Bay	April 3	3,000,000
Gardner Silver Mines, Limited	Toronto	Jan. 26	2,000,000
General Mining and Development, Ltd. (private)	Trafalgar tp	May 30	500,000
General Ventures Mining Corporation, Limited	Toronto	April 3	2,000,000
Goderich Matachewan Gold Mines, Limited	Goderich	April 3	3,000,000
Goldcrest Mines, Limited	Toronto	Aug. 31	3,000,000
Gold Eagle Gold Mines, Limited	Toronto	Feb. 13	3,000,000
Golden Arm Mines, Limited	Red Lake	April 27	3,000,000
Golden Arrow Mining Company, Limited (private)	Trafalgar tp	Aug. 28	150,000
Golden Gate Mining Company, Limited	Toronto	July 30	3,000,000
Golden Spur Syndicate, Limited	Toronto	Feb. 2	120,000
Golden Star Consolidated Mines, Limited	Toronto	Feb. 15	2,000,000
Goldfinders, Limited	Toronto	Nov. 28	40,000
Gold Range Mines, Limited	Toronto	July 14	3,000,000
Gold Valley Mines, Limited	Toronto	Mar. 23	5,000,000
Goodwin Gold Mines, Limited	Toronto	Aug. 7	2,000,000
Gosark Golds, Limited	Toronto	May 18	1,000,000
Graham Bousquet Gold Mines, Limited	Toronto	May 15	3,000,000
Greater Canada Mines Corporation, Limited	Toronto	Feb. 5	6,000,000
Grierson Sturgeon River Mines, Limited	Toronto	Sept. 26	3,000,000
Groundhog Gold Mines, Limited	Toronto	June 18	3,000,000
Hard Rock Gold Mines, Limited	Toronto	Jan. 6	2,500,000
Hargreaves Kirkland Gold Mines, Limited, Ed.	Kirkland Lake	Aug. 24	3,000,000
Harkness-Hays Gold Mines, Limited	Toronto	July 6	3,000,000
Harlake Gold Mines, Limited	Toronto	April 11	3,000,000
Harrison and Company, Limited, W. F. (private)	Toronto	Dec. 21	40,000
Harwood Lake Mines, Limited	Toronto	Feb. 21	3,000,000
Hillside Gold Mines, Limited	Sault Ste. Marie	Aug. 21	3,000,000
Hudson-Patricia Gold Mines, Limited	Toronto	April 3	2,500,000
Interlac Gold, Limited	Toronto	Aug. 10	500,000
James Kirkland Mines, Limited	Toronto	April 17	3,000,000
Jaroba Sturgeon Gold Mines, Limited	Toronto	Oct. 2	3,000,000
Jellicoe Gold Mining Company, Limited	Toronto	May 17	3,000,000
Kert-MacDonald Red Lake Gold Mines, Limited	Toronto	July 6	3,000,000
Keyroc Gold Mining Company, Limited	Toronto	Aug. 14	5,000,000
Killoran-Horne Mines, Limited	Toronto	May 4	2,000,000
Kinghorn Sturgeon Mines, Limited	Toronto	Oct. 12	3,500,000
Kirkland Consolidated Mines, Limited	Toronto	June 11	7,000,000
Kirmaque Gold Mines, Limited	Kirkland Lake	Sept. 20	3,000,000

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1934—*Continued*

Name of company	Head office	Date of incorporation	Capital
Kozak Gold Mines, Limited	Toronto	May 31	2,000,000
Lac Development, Limited (private)	Leaside	May 22	100,000
Lake Caswell Mines, Limited	Toronto	June 26	3,000,000
Lakeland Gold, Limited	Hamilton	Aug. 23	2,000,000
Lake St. John Company, Limited	Longford Mills	May 15	40,000
Langmuir Longlac Gold Mines, Limited	Toronto	July 9	3,000,000
Lapa Cadillac Gold Mines, Limited	Toronto	Oct. 26	3,000,000
L. B. United Mines, Limited	Toronto	May 9	3,500,000
Leader Gold Mines, Limited	Toronto	April 17	100,000
Lois Lake Gold Mines, Limited	Kirkland Lake	April 24	3,000,000
Longacre Long Lac Gold Mines, Limited	Ottawa	April 3	3,000,000
Longlac Adair Mines, Limited	Toronto	Mar. 27	3,000,000
Longlac Lagoon Gold Mines, Limited	Toronto	Feb. 23	3,000,000
Lucky Kirkland Gold Mines, Limited	Toronto	April 6	3,000,000
Macandrew Red Lake Gold Mines, Limited	Toronto	Oct. 3	3,000,000
MacFarlane Long Lac Gold Mines, Limited	Toronto	July 9	3,000,000
Macjoe Sturgeon Gold Mines, Limited	Toronto	Oct. 4	3,500,000
McQuaig Red Lake Gold Mines, Limited	Toronto	Feb. 28	3,000,000
Magnet Lake Gold Mines, Limited	Toronto	Mar. 26	3,000,000
Magwell Long Lac Gold Mines, Limited	Toronto	Dec. 6	3,000,000
Mahood and Company, Limited, Grant (private)	Toronto	Jan. 26	50,000
Manitario Investments and Exploration, Limited	Walker's Point	Oct. 10	300,000
Manitou Gold, Limited	Toronto	Dec. 1	3,000,000
Manley Gold Mines, Limited	Toronto	April 7	3,500,000
Manley Quebec Gold Mines, Limited	Toronto	Aug. 29	3,000,000
Matheson District Gold Mines, Limited	Toronto	Nov. 9	3,000,000
May-Spiers Gold Mines, Limited	Toronto	June 7	3,000,000
Michipicoten Gold Mines, Limited	Toronto	Mar. 19	2,500,000
Middle Bay Mines, Limited	Toronto	May 18	3,000,000
Mid-Tyrrell Gold, Limited	Toronto	Jan. 16	2,500,000
Millar Mineral Exploration Company, Limited	Toronto	April 28	100,000
Mine Seekers and Developers, Limited	Toronto	Mar. 15	500,000
Monarch Mines, Limited	Toronto	Nov. 3	5,000,000
Monetary Metals, Limited	Toronto	Mar. 20	1,000,000
Mooshla Gold Mines, Limited	Toronto	July 18	200,000
Mosher Long Lac Gold Mines, Limited	Toronto	May 2	3,000,000
Murwood Gold Mines, Limited	Toronto	June 8	3,000,000
Muton-Champagne Gold Mines, Limited	Toronto	June 22	3,000,000
Naybob Gold Mines, Limited	Toronto	Jan. 3	3,500,000
Neda Gold Mines, Limited	Toronto	Oct. 16	3,000,000
Nepheline Company, Limited, The[1]	Lakefield	Aug. 10	100,000
Neswoba Mines, Limited	Kirkland Lake	April 21	1,000,000
Net Lake Timagami Mines, Limited	Toronto	Dec. 17	2,500,000
Nezah Long Lac Gold Mines, Limited	Toronto	Aug. 17	3,000,000
Nipsona Mines, Limited	Toronto	April 3	3,000,000
Norbell Gold Mines, Limited	Toronto	April 27	2,000,000
Norco Thompson Mines, Limited	Toronto	Mar. 20	3,000,000
Nordic Sturgeon Gold Mines, Limited	Toronto	Oct. 22	2,000,000
Norontic Gold Mines, Limited	Toronto	April 3	30,000
Northern Quebec Prospectors, Limited	Toronto	Sept. 11	1,000,000
North Tiblemont Gold Mines, Limited	Toronto	Sept. 28	4,000,000
North Whitney Gold Syndicate, Limited	Toronto	Mar. 17	300,000
Nugold Mines, Limited	Toronto	May 16	3,000,000
Otter Lake Gold Syndicate, Limited	Toronto	Oct. 19	150,000
Patricia Participators, Limited	Sioux Lookout	July 19	40,000
Paulore Gold Mines, Limited	Toronto	July 26	3,000,000
Payore Gold Mines, Limited	Toronto	May 25	4,000,000
Pickle Crow Gold Mines, Limited	Toronto	Jan. 8	3,000,000
Pike Consolidated Gold, Limited	Toronto	April 18	1,000,000
Pilgrim Gold Mines, Limited	Toronto	Aug. 31	500,000
Plator Longlac Gold Mines, Limited	Toronto	June 28	3,000,000
Porcupine Ores and Metals, Limited (private)	Toronto	Feb. 9	10,000
Porcupine Watborn Gold Mines, Limited	Toronto	April 28	2,000,000

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1934—*Continued*

Name of company	Head office	Date of incorporation	Capital
Quebec Viking Gold Mines, Limited	Toronto	Sept. 20	2,500,000
Queen Lebel Gold Mining Company, Limited	Kitchener	April 26	3,000,000
Rahill Red Lake Mining Company, Limited	Toronto	April 30	3,000,000
Ramore Gold Mining Company, Limited	Toronto	Sept. 27	2,000,000
Raven River Mines, Limited	Toronto	Nov. 23	2,500,000
Raymond Tiblemont Gold Mines, Limited	Toronto	Sept. 15	3,500,000
Richelieu Gold Mines, Limited	Toronto	May 18	3,000,000
Rickard Ramore Gold Mines, Limited	Toronto	Oct. 29	3,000,000
Richland Gold Mines, Limited	Smiths Falls	July 10	4,000,000
Richmond Development Company, Limited(private)	Toronto	Oct. 25	40,000
Rocdor Gold Mines, Limited	Toronto	July 23	2,000,000
Roche Long Lac Gold Mines, Limited	Toronto	May 7	2,500,000
Rouyn Reward Gold Mines, Limited	Toronto	April 25	3,000,000
Rupert's Land Gold Syndicate, Limited	Toronto	April 10	10,000
Scadding Gold Mines, Limited (private)	Scadding tp	July 11	100,000
Schreiber Pyramid Gold Mines, Limited	Toronto	Dec. 8	3,000,000
Seal Harbor Gold Mines, Limited	Toronto	Jan. 3	1,000,000
Shawkey Gold Mining Company, Limited	Toronto	Mar. 6	3,500,000
Sinclair Mines, Limited	Sault Ste. Marie	May 15	1,000,000
Smith and Co., Canada, Ltd., C. Morrison	Toronto	Mar. 19	40,000
Sol-D'Or Gold Mines, Limited	Grace Lake	Sept. 24	3,000,000
South McKenzie Island Mines, Limited	Toronto	April 17	3,000,000
South Vermillion Gold Mines, Limited	Toronto	April 27	1,500,000
Springbrook Sturgeon Gold Mines, Limited	Toronto	Oct. 10	3,000,000
Stabell Lake Gold Mines, Limited	Toronto	April 27	2,500,000
Standard Minerals of Canada, Limited	Toronto	July 23	2,000,000
Sterling Exploration Company, Limited	Toronto	May 23	40,000
Stillar-Temagami Gold Mines, Limited	Toronto	Sept. 10	2,500,000
Strathy Basin Mines, Limited	Toronto	Aug. 7	3,000,000
Sturgeon River Gold Mines, Limited	Toronto	Aug. 22	3,000,000
Supreme Gold Mines, Limited	Toronto	Feb. 20	2,000,000
Swayze Gold Field, Limited	Toronto	July 11	2,000,000
Tamarac Gold Mining Company, Limited (private)	Trafalgar tp	Oct. 25	150,000
Thunder Bay Gold Mines, Limited	Toronto	May 21	3,000,000
Tiblemont Central Gold Mines, Limited	Toronto	April 21	3,000,000
Timagami Gold Mines, Limited	Toronto	May 19	2,000,000
Trafalgar Gold Mines, Limited	Toronto	May 10	3,000,000
Trident Gold Mines, Limited	Toronto	April 25	100,000
Tylac Sturgeon Gold Mines, Limited	Toronto	Oct. 15	1,000,000
Valora Gold Exploration Company, Limited	Toronto	April 4	2,000,000
Vanguard Long Lac Mines, Limited	Toronto	July 26	3,000,000
Vimy Gold Mines, Limited	Timmins	Aug. 7	1,000,000
Wanapitei Basin Mines, Limited	Toronto	June 7	3,000,000
Wells Longlac Mines, Limited	Toronto	June 18	3,000 000
West Red Lake Gold Mines, Limited	Toronto	Mar. 26	3,000,000
West-Side Long Lac Mines, Limited	Toronto	Aug. 11	3,000,000
Wildor Gold Mines, Limited	Kirkland Lake	Dec. 19	3,000,000
Williamson Mines, Limited	Timmins	Nov. 5	2,000,000
Wilmac Trusts, Limited[1] (private)	Toronto	Aug. 29	15,000
Wilton Gold Mines, Limited	Toronto	Dec. 12	3,000,000
Windigokan Lake Gold Mines, Limited	Toronto	Sept. 10	40,000
Witch Bay Gold Mines, Limited	Toronto	July 25	50,000
Woodhouse, Limited, H. (private)	Toronto	May 14	40,000
Yellowknife Gold Mines, Limited	Toronto	Mar. 28	3,000,000
York Investments, Limited (private)	Toronto	Sept. 11	40,000
Total (212 companies)			$488,335,000

[1]"No par" shares issued in addition. See list of companies having shares without nominal or par value.

Mining Revenue and Expenditures

The revenue of the Department of Mines for the fiscal year ending October 31, 1934, was $1,487,886.94, as compared with $942,721.62 in the previous year. Expenditures were $298,520.74. Details of revenue follow:—

REVENUE, DEPARTMENT OF MINES, 1934

ORDINARY:		
Sand and gravel—		
Royalties	$21,690.17	
Licenses	1,600.00	
		$23,290.17
Casual fees	$1,732.33	
Sale of record books, Unwrought Metal Sales Act	84.00	
Gas leases	4,100.00	
Boring permits	100.00	
		6,016.33
Inspection—cable-testing fees		4,269.53
Assessment—		
Acreage tax	$35,446.84	
Profit tax	1,073,824.46	
Gas tax	32,001.80	
		1,141,273.10
Chemical and assay—fees		3,024.80
Mine rentals—		
Mining leases	$7,599.73	
Licenses of occupation	5,908.31	
Miners' licenses	71,034.62	
Fees—		
Recording	148,985.60	
Miscellaneous	5,691.15	
Maps—sales	3,654.45	
Sale of old mill	350.00	
		243,223.86
Natural Gas Commissioner—permits		1,875.67
Sulphur Fumes Arbitrator—damages		7.09
Temiskaming Testing Laboratories—fees		10,178.79
Sale of old equipment		135.85
		$1,433,294.47
CAPITAL:		
Mining recorders—mining land sales		54,592.47
Total revenue		$1,487,886.94

The figures of monies derived from sales and leases, divided according to district, do not agree with corresponding items of the preceding revenue statement, which records collections of monies actually received during the fiscal year. Details are given in the following table:—

MINING LANDS SOLD AND LEASED FOR FISCAL YEAR ENDING OCT. 31, 1934

District	Sales			Leases			Total sales and leases		
	No.	Acres	Amount	No.	Acres	Amount	No.	Acres	Amount
Algoma	36	1,238.70	3,262.76	....	.....	.....	36	1,238.70	3,262.76
Cochrane	30	1,221.72	12,703.57	....	.....	.....	30	1,221.72	12,703.57
Kenora	28	914.05	2,332.93	....	.....	.....	28	914.05	2,332.93
Nipissing	....	.....	.....	11	365.14	204.23	11	365.14	204.23
Patricia	100	3,251.90	8,199.44	....	.....	.....	100	3,251.90	8,199.44
Rainy River	6	245.74	614.35	....	.....	.....	6	245.74	614.35
Sudbury	95	3,542.10	10,990.94	19	704.97	327.65	114	4,247.07	11,318.59
Thunder Bay	11	397.10	1,012.75	2	105.60	164.10	13	502.70	1,176.85
Timiskaming	75	2,849.39	7,270.16	95	4,031.96	942.43	170	6,881.35	8,212.59
Elsewhere	32	2,125.00	1,557.00	....	.....	.....	32	2,125.00	1,557.00
Total	413	15,785.70	47,943.90	127	5,207.67	1,638.41	540	20,993.37	49,582.31

SUMMARY OF BUSINESS TRANSACTED IN THE SEVERAL MINING DIVISIONS DURING 1934

Schedule item	Fort Frances	Sudbury	Porcupine	Larder Lake	Sault Ste. Marie	Port Arthur	Kowkash	Timiskaming	Gowganda	Montreal River	Kenora	Red Lake	Total
1. Letters rece ved	1,056	4,680	2,391	5,682	1,470	4,529	1,514	1,519	720	1,396	1,644	3,194	29,795
2. Letters written	1,320	4,029	2,384	6,158	1,034	4,293	1,573	1,191	754	1,515	1,530	2,943	28,724
3. Miner's Licenses issued	126	645	386	921	208	2,218	111	371	.....	205	321	437	5,949
4. Miner's Licenses renewed	107	779	384	729	247	481	56	400	71	223	103	282	3,862
5. Mining claims recorded[1]	313	1,549	785	2,611	532	6,842	231	688	207	627	933	1,036	16,354
6. Mining claims cancelled	190	536	505	1,575	167	368	53	308	128	362	371	478	5,041
7. Agreements, transfers, etc., recorded	65	1,270	308	550	308	2,807	148	215	89	422	315	577	7,074
8. Receipts for Miner's Licenses, Permits, Recording Fees, etc.	$4,109.25	$23,317.80	$12,220.27	$29,655.00	$7,356.25	$72,906.00	$2,771.00	$9,739.75	$2,274.00	$9,185.25	$10,974.25	$16,772.75	$201,281.55
9. Receipts as Purchase Money or Rental	$1,958.75	$13,476.72	$3,576.42	$7,916.83	$5,769.13	$3,119.16	.....	$893.38	$78.74	$1,804.88	$2,000.01	$14,435.18	$55,029.20
10. Total remitted to Department	$6,068.00	$36,794.52	$15,796.67	$37,571.83	$13,125.38	$76,025.16	$2,771.00	$10,633.13	$2,352.74	$10,990.13	$12,974.26	$31,207.93	$256,310.75
11. Claims of which surveyors' plans were filed	6	106	8	32	36	290	6	15	2	144	30	171	846
12. Disputes entered	9	3	.....	31	7	2	.....	.....	.....	.....	12	1	65
13. Disputed cases decided by Recorders	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14. Appeals to Mining Court	.....	.....	.....	27	.....	.....	.....	.....	.....	.....	.....	.....	27
15. Extensions of time granted	180	966	677	934	164	699	48	129	73	594	304	1,212	5,980
16. Certificates of Record granted	20	90	28	75	51	119	.....	18	2	23	25	147	598
17. Certificates of Performance of Work granted	20	98	29	84	53	40	.....	10	2	20	25	151	532
18. Claims for which papers were forwarded to the Department for issue of title	21	120	32	71	51	35	.....	14	2	25	24	161	556
19. Forest Reserve Permits issued	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20. Substitute Miner's Licenses issued	5	20	7	16	.....	38	.....	6	3	5	1	3	104
21. Abstracts issued	385	2,603	859	1,616	401	5,056	318	331	308	1,127	722	1,608	15,334
22. Blue-prints sold	299	1,173	897	2,991	403	1,369	122	549	84	724	257	331	9,199

[1] In addition, the claims recorded at the Department of Mines at Toronto were 534, making a total of 16,888 for the province, as compared with 3,886 in 1930; 5,779 in 1931; 4,945 in 1932; and 8,077 in 1933. The previous peak year was 1927 when 15,564 claims were recorded.

STATEMENT OF MONIES REMITTED BY MINING RECORDERS FOR THE FISCAL YEAR ENDING OCTOBER 31, 1934

Mining division	Name of recorder	Address	Purchase price	Maps	Miscellaneous fees	Miner's licenses	Recording fees	Total
Fort Frances	Alexander, J. A.	Fort Frances	$1,414.35	$113.00	$869.25	$1,066.00	$2,075.00	$5,537.60
Kowkash	O'Rourke, M. F.	Tashota	2,867.64	215.25	230.75	3,516.00	8,925.75	15,755.39
	Bolduc, J. P.	Tashota	.....	26.75	75.40	750.00	1,918.25	2,770.40
Montreal River	Coghill, J. M.	Elk Lake	1,464.60	202.25	334.50	2,023.00	7,239.50	11,263.85
Gowganda	Coghill, J. M.	Elk Lake	78.74	21.00	76.75	386.00	1,971.75	2,534.24
Porcupine	Dixon, R.	South Porcupine	588.15	.....	.....	.....	618.94	1,207.09
Larder Lake	Ginn, H. G.	Swastika	6,106.98	718.75	525.00	7,494.00	19,635.60	34,480.33
Red Lake	Holland, H. E.	Goldpines	12,067.47	147.25	698.75	3,581.00	12,738.50	29,232.97
Sudbury	McArthur, T. A.	Sudbury	12,034.04	307.00	998.75	6,575.00	17,286.00	37,200.79
Timiskaming	McAulay, N. J.	Haileybury	891.88	135.75	124.50	3,710.00	5,758.00	10,620.13
Port Arthur	McGregor, C. F.	Port Arthur	1,447.63	540.00	1,272.50	11,505.00	53,647.50	68,412.63
Sault Ste. Marie	Miller, W. N.	Sault Ste. Marie	5,433.23	137.25	239.00	2,129.00	5,010.50	12,948.98
Kenora	Smith, J. D. C.	Kenora	1,795.49	121.75	246.00	1,899.00	7,472.25	11,534.49
Total	.....	.....	$46,190.20	$2,686.00	$5,691.15	$44,634.00	$144,297.54	$243,498.89

MINING CLAIMS RECORDED IN THE SEVERAL MINING DIVISIONS, 1907 AND 1915–1934

Mining division	1907	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934
Coleman[1]	291	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Frances	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	70	75	175	98	137	313
Gowganda	.....	14	51	113	52	145	215	101	55	33	444	220	96	24	40	34	244	377	114	122	207
Kenora	.....	23	45	32	48	31	25	53	168	150	77	229	935	140	520	348	194	109	203	329	933
Kowkash	.....	.....	160	135	2	9	31	3	148	206	438	150	28	250	368	319	12	56	40	84	231
Larder Lake	3,813	915	783	160	423	1,015	712	918	2,344	1,736	1,219	890	1,532	3,141	1,781	891	424	628	790	1,730	2,611
Montreal River	866	2	56	294	293	134	81	143	174	400	471	471	290	126	156	48	661	1,127	156	444	627
Parry Sound[2]	102	.....	10	25	12	39	33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Porcupine	.....	262	401	236	48	136	192	273	760	1,424	556	620	1,297	3,127	611	650	135	307	387	613	785
Port Arthur	317	641	172	180	66	171	108	120	296	222	300	494	1,278	982	1,269	691	338	609	475	900	6,842
Red Lake	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,827	2,018	1,100	973	305	298	185	343	1,036
Sault Ste. Marie	291	92	44	135	199	90	90	216	541	498	284	451	395	735	702	487	318	276	92	450	532
Sudbury	456	233	464	262	168	673	267	319	701	436	559	546	1,367	3,351	6,424	2,164	807	1,597	1,986	2,362	1,549
Timiskaming	7,860	222	156	269	184	244	329	159	328	971	735	634	438	875	499	346	202	78	63	256	688
At Toronto	.....	92	128	95	39	231	87	145	171	116	139	226	203	795	1,576	1,186	171	142	356	307	534
Total	13,996	2,519	2,470	1,936	1,534	2,918	2,160	2,459	5,686	6,092	5,222	4,751	13,496	15,564	15,046	8,207	3,886	5,779	4,945	8,077	16,888

[1]Joined with Timiskaming since 1911. [2]Office at Parry Sound was closed in 1921, and records are now kept at the Department of Mines, Toronto.

The following is a comparative statement of mining licenses and renewals issued, mining claims recorded in Ontario, and profit tax and total mining revenue during the past ten years, 1925 to 1934, inclusive:—

PROSPECTING ACTIVITY, PROFIT TAX, AND TOTAL REVENUE, 1925–1934

Year	Calendar year				Fiscal year ending Oct. 31	
	New miner's licenses issued	Miner's licenses renewed	Total licenses and renewals	Mining claims recorded	Profit tax	Total mining revenue
1925	2,391	4,439	6,830	4,751	$287,186.88	$613,411.96
1926	6,631	5,521	12,152	13,486	410,974.17	838,415.81
1927	6,923	7,221	14,144	15,564	340,890.08	839,793.43
1928	6,059	8,688	14,747	15,046	356,033.83	968,243.84
1929	3,271	8,049	11,320	8,207	397,004.41	882,026.05
1930	1,554	5,885	7,439	3,886	502,525.38	1,017,030.67
1931	2,174	4,808	6,982	5,779	480,300.69	799,240.06
1932	2,035	3,670	5,705	4,945	515,153.59	793,759.20
1933	3,365	3,911	7,276	8,077	679,731.07	942,721.62
1934	7,409	4,757	12,166	16,888	1,073,824.46	1,487,886.94

Under *The Mining Tax Act*, a graduated tax is levied on the net profits of mining companies in excess of $10,000 per annum. The basic rate is 3 per cent. on profits up to $1,000,000. On profits over $1,000,000 and up to $5,000,000, the tax is 5 per cent.; and on profits in excess of the latter amount, the rate is 6 per cent. A part of this money is returned to organized municipalities.

The following statement, prepared by the Accounts Branch of the Department, gives details of the profit tax collected under the supervision of G. R. Mickle, Mine Assessor, for the fiscal year ending October 31, 1934:—

DETAILS OF PROFIT TAX

GOLD:		
Anglo-Huronian, Limited	$1,420.35	
Buffalo Ankerite Gold Mines, Limited	3,235.85	
Coniaurum Mines, Limited	455.65	
Dome Mines, Limited	133,289.12	
Hollinger Consolidated Gold Mines, Limited	200,747.92	
Howey Gold Mines, Limited	1,716.94	
Kirkland Lake Gold Mining Company, Limited	721.47	
Lake Shore Mines, Limited	297,466.39	
McIntyre-Porcupine Mines, Limited	93,790.81	
Parkhill Gold Mines, Limited	61.29	
Sylvanite Gold Mines, Limited	7,399.05	
Teck-Hughes Gold Mines, Limited	87,805.11	
Toburn Gold Mines, Limited	4,116.41	
Wright-Hargreaves Mines, Limited	65,766.65	
		$897,993.01
SILVER:		
Cobalt Properties, Limited	$533.26	
Mining Corporation of Canada, Limited	782.53	
O'Brien, M. J., Limited (O'Brien mine, $1,735.29; Miller Lake O'Brien mine, $4,037.35)	5,772.64	
		7,088.43
NICKEL-COPPER:		
Falconbridge Nickel Mines, Limited	$12,265.27	
International Nickel Company of Canada, Limited	156,477.75	
		168,743.02
Total		$1,073,824.46

Temiskaming Testing Laboratories

This plant, located at Cobalt and equipped for sampling and assaying, has been operated by the Ontario Department of Mines since July, 1921, under the management of A. A. Cole, mining engineer, of the T. & N.O. Railway Com-

mission, and George Dickson, superintendent. The following is a comparative financial report for the calendar years 1922 to 1934, inclusive:—

COMPARATIVE FINANCIAL STATEMENT OF THE TEMISKAMING TESTING LABORATORIES, 1922–1934

Year	Cash receipts	Earnings	Expenditures	Operating profit	Operating loss
1922	$18,096.19	$17,749.51	$19,173.19	.....	$1,424.68
1923	18,699.22	20,117.81	19,781.25	$336.56	.....
1924	26,032.20	25,417.61	23,206.66	2,200.95	.....
1925	19,922.37	20,041.08	20,043.31	.....	2.23
1926	20,302.51	21,119.98	20,658.19	461.79	.....
1927	19,387.66	19,400.55	20,012.09	.....	611.54
1928	14,875.58	14,369.66	18,181.68	.....	3,812.02
1929	19,604.70	21,690.60	18,088.41	3,602.19	.....
1930	25,070.27	24,316.82	24,153.03	163.79	.....
1931	18,522.88	20,770.06	23,553.61	.....	2,783.55
1932	13,323.28	11,150.42	15,219.64	.....	4,069.22
1933	6,206.68	6,508.49	13,318.18	.....	6,809.69
1934	9,816.20	11,359.81	12,762.68	.....	1,402.87
Gross operating profit and loss	.....	.....	.....	$6,765.28	$20,915.80

The following is a brief summary of operations for the year 1934:—

ASSAYING: Gold, 1,896 samples; silver, 1,107; copper, 832; silver bullion, 71; cobalt,40; lead, 1; nickel, 487; zinc, 355; silica, 3; arsenic, 5; iron, 3; sulphur, 1; lime, 3; platinum, 82; manganese, 2.

SILVER ORE MILLED AND SAMPLED: Weight, 233.23 tons; silver content, 354,575 ounces.

BASE BULLION MELTED: 71 bars, containing 55,929 ounces of silver (gross).

GOLD ORE SAMPLED AND ASSAYED: 1 lot of 2,000 pounds.

Provincial Assay Office

As an aid in the development of the mineral resources of Ontario an Assay Office was established at Belleville in July, 1898, by the Bureau (now Department) of Mines. The office was moved to 5 Queen's Park, Toronto, in November, 1911, and in the spring of 1927 to the East Block, Queen's Park. W. K. McNeill, Provincial Assayer and Chemist, reports as follows for 1934:—

The activity in prospecting in the province during the year was reflected in the Chemical Branch of the Department by the large number of samples received for investigation. A total of 5,901 chemical determinations were made and reported on. These determinations may be classified as follows:—

COMPLETE ASSAY RETURNS, 1934

Assay	Free assays under *The Mining Act*	General custom and Department work	Total
Gold	3,135	1,966	5,101
Silver	244	149	393
Platinum	11	4	15
Copper	74	47	121
Lead	22	5	27
Zinc	14	1	15
Nickel	27	14	41
Cobalt	4	2	6
Iron	6	18	24
Limestone	.....	14	14
Miscellaneous	12	132	144
Total	3,549	2,352	5,901

In addition, complete analyses of 16 rocks were made for the geologists of the Department; and 222 samples for identification were received by mail and reports issued. A large number were brought directly to the Laboratory; of these no record was kept.

Several samples of water were analysed for the Natural Gas Commissioner. The work in this Branch was carried on with the assistance of T. E. Rothwell and W. F. Green, assayers and chemists, and William Ley, laboratory assistant.

The schedules of charges for the Provincial Assay Office and Chemical Laboratory may be obtained on application. Minerals and rocks not requiring chemical analysis are identified free of charge. Tests for radio-activity are free.

Draughting Office, North Bay

As mining claims are recorded in each mining division, sketches and recording notices are forwarded by the recorders to the Draughting Office, North Bay, and the same practice applies when surveys are filed. Tracings are prepared from the data furnished and blue-prints supplied to the recorders and to the general public at a nominal charge. North Bay is a convenient centre, and considerable time for Northern Ontario residents is saved through the mails compared with former practice when blue-prints were prepared at Toronto. The office was established in February, 1920. It is now in charge of A. D. Williams.

LIST OF MINES, QUARRIES, AND WORKS, 1934

METALLICS

Operator	Mine	Manager	Address
CHROMIUM			
Chromium Mining and Smelting Corp., Ltd...	Obonga Lake	A. R. Globe	Collins.
GOLD			
Algold Mines, Ltd	Algold	R. F. Mitchell	Goudreau.
Algoma Summit Gold Mines, Ltd	McCarthy-Webb	F. A. Brant	Goudreau.
Alschbach Gold Mining Co., Ltd	Alschbach	Clarence Alschbach	Goldthorpe.
Amalgamated Gold Fields Corporation, Ltd...	Blue Quartz	C. D. Salkeld	Painkiller Lake, via Matheson.
Anglo-Huronian, Ltd	Vipond	Robert E. Dye	Timmins.
Ardeen Gold Mines, Ltd	Moss	N. O. Lawton	Tip Top Spur, via Port Arthur.
Ashley Gold Mining Corporation, Ltd. (operated by Mining Corp. of Canada, Ltd.).	Ashley	Eric Hargreaves	Elk Lake.
Bankfield Gold Mines, Ltd	Bankfield	J. W. McKenzie	Geraldton.
Barry-Hollinger Mines, Ltd	Barry-Hollinger	Douglas Bryden	Boston Creek.
Bathurst Gold Mines, Ltd	Bathurst		Narrow Lake.
Bidgood Kirkland Gold Mines, Ltd	Bidgood	Oscar Knutson	Kirkland Lake.
Bidgood Kirkland Gold Mines, Ltd. (under lease).	Moffatt-Hall	Oscar Knutson	Kirkland Lake.
Bob Tough Gold Mines, Ltd	Bob Tough	E. B. Ratcliffe	Massey.
Bousquet Gold Mines, Ltd	Bousquet	Lionel Brooke	Willisville.
Buffalo Ankerite Gold Mines, Ltd	Buffalo Ankerite	Chas. L. Hershman	South Porcupine.
Canadian Kirkland Mines, Ltd	Canadian Kirkland	Hugh Jardine	Kirkland Lake.
Canusa Gold Mines, Ltd	Canusa	E. Y. Dow	South Porcupine.
Casey Summit Gold Mines, Ltd	Casey Summit		Casummit Lake, via Sioux Lookout.
Centennial Gold Mines, Ltd	Centennial		Wawa.
Central Canada Mines, Ltd	Central Canada		232 Grain Exchange, Winnipeg, Man.
Central Patricia Gold Mines, Ltd	Central Patricia	A. J. Anderson	Hudson.
Central Porcupine Mines, Ltd	Central Porcupine	Frank G. Stevens	Schumacher.
Churchill Mining and Milling Co., Ltd	Churchill		45 Richmond St. W., Toronto.
Cole Gold Mines, Ltd	Cole	J. Y. Cole, Jr.	Red Lake.
Concordia Gold Mining Co., Ltd	Jones Porter	John Pringle	Timmins.
Coniaurum Mines, Ltd	Coniaurum	John Redington	Schumacher.

Consolidated Mining and Smelting Co. of Canada, Ltd. (under option).	Afton		1010 St. Catherine St., Montreal, Que.
	McKenzie		
	Mackey Point		
Cooper, W. D., and Barry, P. A. (under lease)	McIntyre Birch Lake	W. D. Cooper	Birch Lake, via Sioux Lookout.
Coulson Consolidated Gold Mines, Ltd.	Coulson	C. D. Salkeld	Painkiller Lake, via Matheson.
Craig Gold Mines, Ltd.	Craig	J. G. A. Stevenson	Madoc.
Darwin Gold Mines, Ltd.	Grace	M. H. Frohberg	Wawa.
Delnite Mines, Ltd.	La Roche	J. F. Akehurst	Timmins.
De Santis Gold Mining Co., Ltd.	De Santis	Peter De Santis	Box 1299, Timmins.
Dome Mines, Ltd.	Dome	H. P. De Pencier	South Porcupine.
Duport Mining Co., Ltd.	Damascus	J. G. Cross	Box 591, Kenora.
Ed. Hargreaves Kirkland Gold Mines, Ltd.	Ed. Hargreaves	J. A. MacVichie	Kirkland Lake.
Excello Mines, Ltd.	Excello		159 Bay St., Toronto.
Federated Mining Corporation, Ltd.	New York Porcupine	Geo. Doane	Box 501, South Porcupine.
Foley O'Brien Corporation, Ltd.	Foley O'Brien	P. C. Benedict	South Porcupine.
Foley Syndicate (under agreement with British Canadian Mines, Ltd.).	Foley	Russell Cone	Mine Centre.
Four Nations Consolidated Gold Mines, Ltd.	Four Nations		372 Bay St., Toronto.
Fox Lake Gold Syndicate	Fox Lake	L. W. Adams	Box 175, Espanola.
Gold Eagle Gold Mines, Ltd.	Gold Eagle	Alex. Gillies	Red Lake.
Gold Lands Syndicate of Algoma	Edwards	H. C. Miller	29 Melinda St., Toronto.
Gold Range Mines, Ltd.	Gold Range	A. V. Hannam	1604 Royal Bank Bldg., Toronto.
Golden Gate Mining Co., Ltd.	Lucky Cross		59 Yonge St., Toronto.
Golden Star Consolidated Mines, Ltd.	Golden Star		306 Sterling Tower, Toronto.
Golden Star Consolidated Mines, Ltd. (under option)	Ferguson		306 Sterling Tower, Toronto.
Golden Summit Mines, Ltd.	Golden Summit	Wm. J. Simpson	Sesekinika.
Goodfish Mining Co., Ltd.	Goodfish	I. E. Mosher	Kirkland Lake.
Greenlaw Gold Mines, Ltd.	Greenlaw		244 Bay St., Toronto.
Halcrow-Swayze Mines, Ltd.	Halcrow-Swayze	Horace F. Strong	Chapleau.
Hard Rock Gold Mines, Ltd.	Hard Rock	J. C. Dumbrille	Geraldton.
Harkness-Hays Gold Mines, Ltd.	Harkness-Hays	J. F. Anderson	Schreiber.
Hillside Gold Mines, Ltd.	Hillside	D. S. Baird	Wawa.
Hollinger Consolidated Gold Mines, Ltd.[1]	Brennan David (Hislop)		Ramore.
	Hollinger	John Knox	Timmins.
Hollinger Consolidated Gold Mines, Ltd. (under option).	Cochenour-Willans		Red Lake.
Horseshoe Mines, Ltd.	Regina		302 Royal Bank Bldg., Toronto.
Howey Gold Mines, Ltd.	Howey	Edward Futterer	Red Lake.
Hudson Patricia Gold Mines, Ltd.	Hudson Patricia	J. M. Thompson	Narrow Lake, via Sioux Lookout.
J-M Consolidated Mines, Ltd.	Jackson-Manion	D. M. Thomson	Jackson Manion.
Kenora Prospectors and Miners, Ltd.	Cedar Island	Geo. H. Ince	Kenora.
	Mikado	Geo. H. Ince	Kenora.

[1] See also Young-Davidson Mines, Ltd.

Operator	Mine	Manager	Address
	GOLD—*Continued*		
Kenty Gold Mines, Ltd.	Kenty		8 Wellington St. E., Toronto
Kirkland Consolidated Mines, Ltd.	Kirkland Consolidated	Ralph Hurd	Sesekinika.
Kirkland Gold Belt Mines, Ltd.	Kirkland Gold Belt	Howard Brassaw	King Kirkland.
Kirkland Lake Gold Mining Co., Ltd.	Kirkland Lake Gold	P. J. Harris	Kirkland Lake.
Lake Caswell Mines, Ltd.	Westree (Champion Reef)	F. J. Sullivan	Westree.
Lake Shore Mines, Ltd.	Lake Shore	E. W. Todd	Kirkland Lake.
Lakeland Gold, Ltd.	Lakeland	Geo. Schmelzle	Bourkes.
Lakeside-Kirkland Gold Mines, Ltd.	Queen Lebel	Richard Callin	Kirkland Lake
Lebel Oro Mines, Ltd.	Long Lake		703 Northern Ontario Bldg., Toronto.
Lee Gold Mines, Ltd.	Lee		244 Bay St., Toronto.
Little Long Lac Gold Mines, Ltd.	Little Long Lac	A. A. Barton	Geraldton.
Lucky Cross Leasing Syndicate[1] (under lease)	Lucky Cross		Bank of Commerce Bldg., Kirkland Lake
Lucky Kirkland Gold Mines, Ltd.	Lucky Kirkland	S. L. MacDonald	159 Bay St., Toronto.
Macassa Mines, Ltd.	Macassa	G. A. Howes	Kirkland Lake.
McIntyre-Porcupine Mines, Ltd.	McIntyre-Porcupine	R. J. Ennis	Schumacher.
McKenzie Red Lake Gold Mines, Ltd.	Martin-McNeeley	John W. Shaw	Red Lake.
McLaren-Porcupine Gold Mines, Ltd.	McLaren-Porcupine	Stanley Saxton	South Porcupine.
MacLeod-Cockshutt Gold Mines, Ltd.	MacLeod-Cockshutt	C. H. E. Stewart	Geraldton.
McMartin, J. Bruce	Dikdik	K. W. Fritzsche	Jellicoe.
McMillan Gold Mines, Ltd.	McMillan	J. G. McGregor	Footbanks.
Manitoba and Eastern Mines, Ltd.	Manitoba and Eastern		25 King St. W., Toronto.
Marbuan Gold Mines, Ltd.	March	Charles L. Hershman	South Porcupine
Martin Bird Syndicate	Martin Bird	S. J. Bird	284 Inglewood Drive, Toronto.
Matachewan Consolidated Mines, Ltd.	Matachewan Consolidated	Thos. L. Wells	Elk Lake.
Miller Independence Mines (1924), Ltd.	Miller Independence		39 New Bank of Toronto Bldg., London.
Minto Gold Mines, Ltd.	Jubilee	John Knox, Jr.	Wawa.
	Minto	John Knox, Jr.	Wawa.
Munro Croesus Mines, Ltd.	Munro Croesus	J. E. Grant	Haileybury.
Naybob Gold Mines, Ltd.	Hayden	R. J. Naylor	Timmins.
Neville Canadian Gold Mines, Ltd.	Wasapika-Ribble		710 Concourse Bldg., Toronto.
North Shores Gold Mines, Ltd.	North Shores	R. N. Palmer	Schreiber.
Northern Empire Mines Co., Ltd.	Beardmore	R. J. Hendricks	Empire.
O'Connell Gold Mines, Ltd.	O'Connell	J. J. Hollinger	Elk Lake.
Orecana Trusts, Ltd.	Kozak		1689 Board of Trade Bldg., Chicago, Ill.
	Michael-Boyle		1689 Board of Trade Bldg., Chicago, Ill.
Pamour Porcupine Mines, Ltd.	Pamour Porcupine	C. D. Stevenson	South Porcupine.
Parkhill Gold Mines, Ltd.	Parkhill	R. E. Barrett	Wawa.

[1] See also Golden Gate Mining Co., Ltd.

Paymaster Consolidated Mines, Ltd.	Paymaster	Chas. Cook	South Porcupine.
Pickle Crow Gold Mines, Ltd.	Pickle Crow	Alex. G. Hattie	Pickle Lake, via Sioux Lookout.
Porcupine Peninsular Gold Mines, Ltd.	Porcupine Peninsular	Robert E. Dye	Connaught.
Ramore Gold Mining Co., Ltd.	Ramore	W. V. Hocken	Ramore.
Red Crest Gold Mines, Ltd.	Rowan Discovery	J. M. Wilson	Golden Arm, Red Lake.
Red Lake Gold Shore Mines, Ltd.	Red Lake Gold Shore	M. L. Bouzan	Red Lake.
Richelieu Gold Mines, Ltd.	Richelieu	J. G. Harkness	Savant Lake.
Roche Long Lac Gold Mines, Ltd.	Roche Long Lac		Hardrock.
St. Anthony Gold Mines, Ltd.	St. Anthony	R. P. Teare	Savant Lake.
Sakoose Gold Mines, Ltd.	Sakoose	D. H. Traynor	Dyment.
Saundary Syndicate	Headlight	A. E. Saunders	Mine Centre.
Selected Canadian Golds, Ltd. (under option)	Sultana		Bank of Commerce Bldg., Toronto.
Sinclair Mines Syndicate	Sinclair Syndicate	Dr. Alex. Sinclair	Sault Ste. Marie.
Smith, S. B.	Van Sickle	J. C. Canfield	Wawa.
South Vermillion Gold Mines, Ltd.	South Vermillion	A. Pacitto	Mine Centre.
Stanley Gold Mines, Ltd.	Stanley		231 St. James St. W., Montreal, Que.
Stellar Gold Mines, Ltd.	Stellar	W. J. Hoover	Mine Centre.
Straw Lake Beach Gold Mines Syndicate, Ltd.	Straw Lake Beach	Frank Carnegie	Emo.
Swayze-Huycke Gold Mines, Ltd.	Swayze-Huycke		372 Bay St., Toronto.
Sylvanite Gold Mines, Ltd.	Sylvanite	C. E. Rodgers	Kirkland Lake.
Talisman Gold Mines, Ltd.	Gardner Guibord		364 Bay St., Toronto.
Tashota Goldfields, Ltd.	Tashota	J. D. Cumming	Tashota.
Teck-Hughes Gold Mines, Ltd.	Teck-Hughes	R. J. Henry	Kirkland Lake.
Teddy Bear Valley Mines, Ltd.	Teddy Bear Valley	Edward H. Orser	Lightning River.
Toburn Gold Mines, Ltd.	Toburn	M. W. Hotchkin	Kirkland Lake.
Tom Johnson–Nipigon Mines, Ltd.	Johnson-Nipigon	Sidney Muskin	Empire.
Vermilion Lake Gold Mines, Ltd.	Vermilion Lake		Northpines.
Wawa Goldfields, Ltd.	Wawa Goldfields	A. C. Melkman	Wawa.
Wells Longlac Mines, Ltd. (under option)	Stagee	A. S. Dawson	Mine Centre.
Wells Longlac Mines, Ltd.	Wells Longlac		347 Bay St., Toronto.
Wendigo Gold Mines, Ltd.	Wendigo	C. L. Spencer	Kenora.
West Red Lake Gold Mines, Ltd.	West Red Lake		609 Continental Life Bldg., Toronto.
Witch Bay Gold Mines, Ltd.	Witch Bay		357 Bay St., Toronto.
Wright-Hargreaves Mines, Ltd.	Wright-Hargreaves	M. W. Summerhayes	Kirkland Lake.
Young-Davidson Mines, Ltd. (under agreement with Hollinger Consol. Gold Mines).	Young-Davidson	A. F. Brigham	Elk Lake.
Young-Shannon Gold Mines, Ltd.	Young-Shannon	C. T. Young	Gogama.

MOLYBDENITE

Phoenix Molybdenite Corporation, Ltd.	Phoenix	F. L. Stinson	R.R. 2, Ashdad.

Operator	Mine	Manager	Address
NICKEL AND COPPER			
Cuniptau Mines, Ltd	Cuniptau	S. S. W. Cole	Goward.
Falconbridge Nickel Mines, Ltd	Falconbridge	Ernest Craig	Falconbridge.
International Nickel Co. of Canada, Ltd	Creighton	S. J. Kidder	Creighton.
	Frood	F. J. Eager	Frood.
RADIUM			
Canada Radium Mines, Ltd	Canada Radium	Frank Austin	Cheddar.
SILVER AND COBALT			
Cain, C. E., and Taylor, W. D	Beaver	C. E. Cain	Cobalt.
Cobalt Properties, Ltd	Cobalt Properties	Arthur Brocklebank	Cobalt.
Martin, George (under lease)	Crown Reserve	George Martin	Cobalt.
Nipissing Mining Co., Ltd	Nipissing	Hugh Park	Cobalt.
O'Brien, M. J., Ltd	Cross Lake	W. A. O'Flynn	Cobalt.
	Miller Lake O'Brien	H. G. Kennedy	O'Brien.
Peterson Cobalt Mines, Ltd	Peterson Cobalt		Cobalt.
Price, C. W. (under lease)	Foster	C. W. Price	Cobalt.
Sandoe, Richard, and Moyle, H. (under lease)	Temiskaming	Richard Sandoe	Cobalt.
Smith Cobalt Mines, Ltd	Smith Cobalt		320 Bay St., Toronto.
Wood, A. (under lease)	Dominion Reduction	A. Wood	Cobalt.

METALLURGICAL WORKS

Operator	Works	Manager	Address
Algoma Steel Corporation, Ltd	Iron blast furnace	Jas. H. Bell	Sault Ste. Marie.
Canadian Furnace Co., Ltd	Iron blast furnace	W. J. Higgins	Port Colborne.
Canadian Industries, Ltd	Acid and chemical plant	E. Jordan	Copper Cliff.

Deloro Smelting and Refining Co., Ltd.	Silver-cobalt refinery	S. B. Wright	Deloro.
Falconbridge Nickel Mines, Ltd.	Nickel-copper smelter	J. R. Gill	Falconbridge.
International Nickel Co. of Canada, Ltd.	Nickel-copper smelter	Peter Macdonald	Copper Cliff.
	Nickel-copper smelter	Peter Macdonald	Coniston.
	Nickel refinery	H. W. Walter	Port Colborne.
Ontario Refining Co., Ltd.	Electrolytic copper refinery	F. Benard	Copper Cliff.
Steel Company of Canada, Ltd.	Iron blast furnace	R. A. Gillies	Hamilton.

NON-METALLICS

Operator	Mine or Works	Manager	Address
ACTINOLITE			
Building Services, Ltd.	Actinolite, Elzevir tp., Hastings co.	A. P. Park	1429 Chomedy St., Montreal, Que.
ARSENIC			
Deloro Smelting and Refining Co., Ltd.	Silver-cobalt refinery	S. B. Wright	Deloro.
BARITE			
Barytes Products, Ltd. (idle in 1934)	Bellew, N. Burgess tp., Lanark co.	H. C. Bellew	Box 282, Montreal, Que.
Canada Night Hawk Mines, Ltd.	Canada Night Hawk		305 Sterling Tower Bldg., Toronto.
Glendinning, H. (idle)	Yarrow tp., Timiskaming dist.		387 Bloor St. E., Toronto.
Weaver (Minerals), Ltd.	Tionaga, Penhorwood tp., Sudbury dist.		34 King St. E., Toronto.
DIATOMITE			
Diatomite Products, Ltd. (idle 1934)	Martin's Siding, Muskoka dist.	C. Lindley Wood	409 Metropolitan Bldg., Toronto.
Dominion Diatomite, Ltd. (now F. P. Macklem).	Lot 3, con. I, Perry tp., Parry Sound dist.	F. P. Macklem	642 King St. W., Toronto.
Spence Lake Diatomite Ltd. (not yet in operation).	Muskoka Falls	A. J. P. Care	68 King St. E., Toronto.

Operator	Mine, Quarry, or Works	Manager	Address
FELDSPAR			
Anderson & Son, James G.	Britt, lots 3-5, con. I, Henvey tp., Parry Sound dist.	Jas. G. Anderson	Lucknow.
Barr, Walter J.	Renfrew, N. ½ lot 24, con. XVI, Fraser tp., Renfrew co.	W. J. Barr	Westmeath.
Bathurst Feldspar Mines, Ltd. (shipped only)	Bathurst, Bathurst tp., Lanark co.	B. S. Hyde	230 King St. E., Toronto.
Charette & Son, S.	Lot 1, con III, Burwash tp., Sudbury dist.	S. Charette	Estaire P.O.
Craig, T. H.	W. ½ lot 12, con. IX, Bathurst tp., Lanark co.	T. H. Craig	10 Victoria St., Perth.
Frontenac Floor and Wall Tile Co., Ltd.	Grinding plant, Kingston	A. M. Perryman	Box 178, Kingston.
Gunter, Judson A.	Sabine tp., Nipissing dist.	J. A. Gunter	Princes Lake.
MacDonald, P.	Hybla	P. MacDonald	Hybla.
FLUORSPAR			
Stoklosar, Chas. A.	W. ½ lot 3, con. I, Madoc tp., Hastings co.	Chas. A. Stoklosar	Madoc.
Wallbridge Estate	Lot 4, con. I, Madoc tp., Hastings co.	C. M. Wallbridge	Madoc.
GRAPHITE			
Black Donald Graphite Co., Ltd.	Black Donald, Brougham tp., Renfrew co.	R. F. Bunting	Calabogie.
GYPSUM			
Canadian Gypsum Co., Ltd.	Hagersville	W. E. Allen	Hagersville.
Gypsum, Lime and Alabastine, Canada, Ltd.	Caledonia	L. V. Robinson	Caledonia.
IRON PYRITES AND SULPHURIC ACID			
Canadian Industries, Ltd. (idle in 1934)	Acid plants, Coniston and Copper Cliff	G. G. Vincent	Copper Cliff.
Canadian Pyrites, Ltd. (idle in 1934)	Caldwell mine, Flower station	O. M. Hook, Sec.	1400 Guardian Bldg., Cleveland, Ohio.

MICA

Anderson & Son, J. G.	Wanup and Bancroft	J. G. Anderson	Lucknow
Kent Bros. (buyers)		W. C. Kent	114 Gore St., Kingston.
Lee & Son, W. W.	Bob's Lake mine	A. J. Lee	Bedford Mills
Loughborough Mining Co., Ltd.	Various prospects	General Electric Co.	Schenectady, N.Y.
Martin, A. G. (buyer)		A. G. Martin	236 Besserer St., Ottawa.

MINERAL WATERS

Carlsbad Ltd. (now T. R. Boyd)	Carlsbad Springs	T. R. Boyd	Carlsbad Springs.
Deneault, F.	Bourget Springs	F. Deneault	Bourget.
Gurd and Co., Ltd., Chas.	Caledonia tp., Prescott co.		1016 Bleury St., Montreal, Que.

NEPHELINE SYENITE

Morrison, Wm.	Lot 14, con. IX, Methuen tp., Peterborough co.	Wm. Morrison	64 Tyrrel Ave., Toronto.

PEAT

Countryman, Gordon	Lot 22, con. IX, Winchester tp., Dundas co.	G. Countryman	Chesterville.
Fleming, John	E. ½ lot 20, W. ½ lot 21, Winchester tp., Dundas co.	J. Fleming	Morewood.
Hummel, Wm. L.	Lot 18, con. VII, Winchester tp., Dundas co.	W. L. Hummel	Chesterville.
Leasa, Wm.	Lot 11, con. X, Ellice tp., Perth co.	W. Leasa	Milverton.
Roe, Stephen	Lot 35, con. XIV, Elma tp., Perth co.	S. Roe	Milverton, R.R. 2.
Stewart Bros.			Morewood.

QUARTZ, QUARTZITE, AND SILICA BRICK

Algoma Steel Corporation, Ltd.	Silica brick (quartz from Deroche tp. quarry).		Sault Ste. Marie.
Dominion Mines & Quarries, Ltd.	Killarney, north shore of Lake Huron, East Neebish island (idle).		340 University Ave., Toronto.
Falconbridge Nickel Mines, Ltd.	Quarry on property	Ernest Craig	Falconbridge.
MacDonald, P.	Hybla	P. MacDonald	Hybla.
Wright & Co.	Quarry, Deroche tp., Algoma dist.	Geo. S. Cowie	960 Queen St., Sault Ste. Marie.

Operator	Quarry, Pit, or Works	Manager	Address
SALT			
Brunner Mond, Canada, Ltd.	Amherstburg (brine for chemical use)	C. K. MacFetridge	Amherstburg.
Canadian Industries, Ltd.	Sandwich (brine for chemical use and salt)		P. O. Box 1260, Montreal, Que.
Dominion Salt Co., Ltd., The	Sarnia	W. H. Spence, Sec.-Tr.	1610 Bank of Commerce Bldg., Toronto.
Goderich Salt Co., Ltd.	Goderich	A. C. Dunlop, Asst. Sec.	Goderich,
Kincardine Salt, Ltd. (idle in 1934)	Kincardine (operated by Canadian Industries, Ltd.).		P. O. Box 1260, Montreal, Que.
Walker Salt Corporation, Limited[1]	Port Franks	G. C. Walker, Pres.	London.
Warwick Pure Salt Co., Ltd.	Highway No. 7, Warwick tp., Lambton co.	B. Witkon	R.R. 5, Watford.
Western Canada Flour Mills Co., Ltd.	Goderich		287 MacPherson Ave., Toronto.
Western Salt Co. (idle in 1934)	Courtright (controlled by Dominion Salt Co., Ltd.).		P. O. Box 1260, Montreal, Que.
TALC			
Canada Talc Co., Ltd.	Connolly—mill at mine	Roy Taylor	Madoc
Geo. H. Gillespie Co., Ltd.	Henderson mine—mill at Madoc	Geo. H. Gillespie	Madoc.

[1] Developing.

STRUCTURAL MATERIALS

Operator	Plant or Quarry	Manager	Address
CEMENT			
Canada Cement Co., Ltd.	Belleville, plant No. 5 (idle in 1934)		Box 290, Station B, Montreal, Que.
	Lakefield, plant No. 7[2]		
	Port Colborne, plant No. 8		
St. Marys Cement Co., Ltd.	St. Marys		357 Bay St., Toronto.
LIME			
American Cyanamid Co.	Quarry at Beachville, kilns at Niagara Falls	G. E. Cox	Niagara Falls, Ont.
Bell, Harry	N. ½ lot 23, con. XII, Sullivan tp., Grey co.	Harry Bell	R.R. 4, Chesley.

[2] Grinding clinker only.

Biederman, Albert G.	Wilberforce tp., Renfrew co.	Albert G. Biederman	Golden Lake, R.R. 1.
Brown's Lime Works	Owen Sound	Wm. Brown	491 9th Ave. E., Owen Sound.
Brunner Mond, Canada, Ltd.	Lots 6, 7, 8, con. I; lots 2, 3, con. II, Anderdon tp., Essex co.	C. K. MacFetridge	Amherstburg.
Cameron, W. M.	Ramsay tp., Lanark co.	W. M. Cameron	Carleton Place.
Canada Lime Co., Ltd.	Coboconk	Chas. R. Christie	114 Cluny Drive, Toronto.
Canada and Dominion Sugar Co., Ltd.	Wallaceburg	R. A. Lauper	Wallaceburg.
	Chatham	C. Moulthrop	Chatham.
Canadian Gypsum Co., Ltd.	Guelph	B. S. Bains	1221 Bay St., Toronto.
Chalmers Lime Works	Owen Sound	Miss M. Chalmers	689 7th Street W., Owen Sound.
Dominion Rock Products, Ltd.	Eganville	J. H. Robinson	941 Dominion Square Bldg., Montreal, Que.
Gallagher Lime & Stone Co., Ltd., The	Hamilton[1] [2]	Raymond Gallagher	Upper James St., Hamilton.
Gypsum, Lime and Alabastine, Canada, Ltd.	Beachville[2]	T. F. Robinson	Beachville.
	Elora[2] (idle in 1934)	J. H. Robinson	Elora.
	Hespeler[2]	M. M. Miller	Hespeler.
	Milton[2]	Robt. F. Adams	Milton.
	Limehouse (idle in 1934)	Wm. Gowdy	Limehouse.
Innerkip Lime and Stone Co., Ltd.	Beachville	C. E. Downing	Beachville.
Jamieson Lime Co.	Renfrew	J. A. Jamieson	Renfrew.
Morris, Stanley	Delta	S. Morris	Delta.
Rockwood Lime Co.	Lot 5, con. XI, Eramosa tp., Wellington co.	Geo. H. Dennis	Rockwood.
Shane Lime Co.	Eganville	Geo. R. Shane	Eganville.
Weppler, Henry	Lot 7, con. II, Glenelg tp., Grey co.	H. Weppler	R.R. 2, Priceville.

[1]No production in 1934.
[2]Hydrated lime plants.

STONE (LIMESTONE AND MARBLE)

American Cyanamid Co.	Beachville	G. E. Cox	Niagara Falls, Ont.
Bolender Bros.	Haliburton	Chas. Bolender	Haliburton.
Bonter Marble & Calcium Co., Ltd, The	Marmora tp., Hastings co.	J. W. Bonter	Box 61, Marmora.
Bourgie, J. B.	Gregnon, con. VIII, Russell tp., Russell co.	J. B. Bourgie	Box 50, Embrun.
Brunner Mond, Canada, Ltd.	Lots 6, 7, 8, con. I; lots 2, 3, con. II, Anderdon tp., Essex co.	C. K. MacFetridge	Amherstburg.
Canada Cement Co., Ltd.	Thurlow tp., Hastings co.	J. H. Legate	Belleville.
Canada Crushed Stone Corp., Ltd.	Dundas, Town of	J. Stephens	35 Cline Cres., Hamilton.
Hagersville Contracting Co., Ltd.	Walpole tp., Haldimand co.	Gordon Gilbertson	Hagersville.
Puslinch Quarry, Ltd.	Puslinch tp., Wellington co.	H. Hill	Dundas.
Queenston Quarries, Ltd.	Niagara tp., Lincoln co.	A. Michie	Box 148, Niagara Falls.
Coldwater Crushed Stone, Ltd.	Lots 19, 20, con. XIII, Medonte tp., Simcoe co.	Thos. Langton	Coldwater.
Decewsville Crushed Stone, Ltd.	Decewsville		52 Elgin St., Hamilton.

Operator	Quarry	Manager	Address
	STONE (Limestone and Marble)—*Continued*		
Dibblee Construction Co., Ltd	Stevens Quarry, 2 miles south of Hawkesbury.	T. Moffatt	246 Albert St., Ottawa.
Dufferin Paving and Crushed Stone Co., Ltd		H. H. Salmon	Fleet and Bathurst Streets, Toronto.
Hagersville Quarries, Ltd	Walpole tp., Haldimand co	W. L. McRae	Hagersville.
Kirkfield Crushed Stone, Ltd	Eldon tp., Victoria co	John Welch	Kirkfield.
St. Mary's Crushed Stone, Ltd. (idle)	St. Marys		St. Marys.
Foster, R. R	Merivale Road, Nepean tp., Carleton co	R. R. Foster	86 Spadina Ave., Ottawa.
Gow, James		J. Gow	Fergus.
Grenon, Jas	Casselman	F. Grattan	Casselman.
Gypsum, Lime and Alabastine, Canada, Ltd.	Lot 18, con. III, N. Oxford tp., Oxford co.	T. F. Robinson	87 Wellington St. N., Woodstock.
	Lot 3, cons. VI, VII, Nassagaweya tp., Halton co.	L. C. Lymburner	Milton.
Hagersville Contracting Co., Ltd	*See* Canada Crushed Stone Corporation.		
Hagersville Quarries, Ltd	*See* Dufferin Paving and Crushed Stone Co.		
Haldimand Quarries & Construction, Ltd	Hagersville	C. F. Anderson	Hagersville.
Halliday, Fred	Lot 23, Gloucester tp., Carleton co	F. Halliday	Cummings Bridge.
Henniger, M. G	Kitley tp., Leeds co	M. G. Henniger	Smiths Falls.
Highways, Department of	Various quarries	R. M. Smith	Parliament Bldgs., Toronto.
Innerkip Quarries, Ltd	*See* Dufferin Paving and Crushed Stone Co.		
Irvine Co., Ltd., The Edgar	Near Centreville	E. M. C. Goodwin	Alexandria.
Kingston Penitentiary	Portsmouth	Samuel Donaldson	Box 22, Kingston.
Kirby Co., Ltd., The T. Sidney	Gloucester tp., Carleton co		215 Sussex St., Ottawa.
Kirkfield Crushed Stone, Ltd	*See* Dufferin Paving and Crushed Stone Co.		
Lake St. John Quarry Co., Ltd	Rama tp., Ontario co	R. M. Craig	Longford Mills.
Law Construction Co., Ltd	Owen Sound and Collingwood	B. J. Williams	19 Delevan Ave., Forest Hill.
Limestone Products, Ltd	Con. V, Orillia tp., Simcoe co	Geo. F. Morse	R.R. 4, Orillia.
Middleton, J. N	Ancaster village	J. N. Middleton	Ancaster.
Noranda Mines, Ltd	Farr quarry, Haileybury		804 Royal BankBldg., Toronto.
Ontario Reformatory	Guelph tp., Wellington co	J. Hunter	Guelph.
Ornamental Stone Products	Portland tp., Frontenac co	S. H. Orser	Verona.
Owen Sound, City of	City quarry, 8th Street West	Robt. Crannie	323 8th St. W., Owen Sound.
Pembroke, Corporation of	Markus quarry	J. P. Howe	Pembroke.
Pirson, John	Hydro dump, Stamford tp., Welland co	John Pirson	Stevensville.
Puslinch Quarry, Ltd	*See* Canada Crushed Stone Corp.		
Queenston Quarries, Ltd	*See* Canada Crushed Stone Corp.		
Rayner Construction, Ltd	Madoc	W. J. Smyth	29 Commercial St., Leaside.
Routly, H. T	Rawdon tp., Hastings co	H. T. Routly	21 Dundas Square, Toronto.

Silverstone Black Marble Quarries	Lots 8, 9, con. XII, Finch tp., Stormont co.	Carl Burd	St. Albert.
Walker Bros., Ltd	Stamford tp., Welland co	J. G. Walker	145 Geneva St., St. Catharines.
Welland Ship Canal	Rock excavation	C. W. West	St. Catharines.
Wilford & Co., Ltd., R. F	Victoria co	C. Lindsay	Lindsay.
Windmill Point Crushed Stone Co., Ltd	Ridgeway	R. E. Law	Ridgeway.

STONE (GRANITE)

Appleby, Thos. A	Leeds co	T. A. Appleby	Garden St., Gananoque.
Billie, Chas. V	Bathurst tp., Lanark co	F. R. Billie	Smiths Falls.
Building Products, Ltd	Near Verona, Portland tp., Frontenac co	A. De Wolf	Verona.
Horne, Wm	Butler	Wm. Horne	Butler, via Ignace.
Mill Lake Stone Quarry	Mill Lake quarry, lots 24, 25, con. III, McDougall tp., Parry Sound dist.	J. B. Hall	Box 115, Parry Sound.

STONE (SANDSTONE)

Campbell Sandstone Quarries, Ltd	Carleton co	M. N. Cummings	Westboro.
Corner, Austin A	Peel co	A. A. Corner	Terra Cotta.
Eves, C	Peel co	C. Eves	Terra Cotta.
Logan, Harry	Georgetown	H. Logan	Box 400, Georgetown.
McAlpine Bros	Nassagaweya tp., Halton co	K. McAlpine	Milton.
Norrie and McHarg	Halton co		R.R. 4, Acton.
Norton, A. W	Halton co	A. W. Norton	Limehouse.
Presswood & Gibbs	Halton co	A. Presswood	Glen Williams.
Sykes, Thos	Halton co	Thos. Sykes	Georgetown.
Terra Cotta Quarries	Halton co	J. L. Craine	Terra Cotta.

STONE (TRAP)

Fort William, City of	Rifle range, City quarry	City Engineer	City Hall, Fort William.
Ontario Rock Co., Ltd	Belmont and Methuen tps., Peterborough co.	H. L. Scott	R.R. 3, Havelock.

STONE (SLATE)

Ontario Slate Mines, Ltd	W. ½ lot 5, con. VI, S. ½ lot 5, con. V, Madoc tp., Hastings co.	L. Ampleford	47 Yonge St., Toronto.

CLAY PRODUCTS

See The Ceramic Industry of Ontario, by R. J. Montgomery, Vol. XXXIX, Part 4, 1929.

Operator	Pit, Works, or Location	Manager	Address
SAND-LIME BRICK			
Harbour Brick Co., Ltd	Fleet St. at Bathurst	K. M. Goodings	Fleet St., Toronto.
Hinde Bros.	134 Northland Ave., Toronto	Jas. H. Hinde	Mount Dennis.
Toronto Brick Co., Ltd.	Scarborough		897 Bay St., Toronto.
York Sandstone Brick Co., Ltd.	447 Victoria Park Ave., Toronto	W. A. Smyth	447 Victoria Park Ave., Toronto.
SAND AND GRAVEL (Licensed Dredging Operations)			
Canadian Dredging Company	Lake Superior		Midland.
Cowley, Mrs. K.	Thames river		Chatham.
Hadley's Chatham, Ltd.	Thames river		47 Wellington St., Chatham.
McLean & Sons, A. B.	Lake Superior		Brock St., Sault Ste. Marie.
Montreal Trust Co., Ltd. (Trustee for Sin-Mac Lines, Ltd.).	Lake Superior		635 Common St., Montreal, Que.
National Sand & Material Co., Ltd.	Lake Erie		402 Harbour Bldg., Toronto.
Pyke Salvage Co.	St. Lawrence river		506 Princess St., Kingston.
Tees Transit Co.	Niagara bar		16 New St., Hamilton.
Wallaceburg Sand & Gravel Co., Ltd.	St. Clair river		Wallaceburg.
SAND AND GRAVEL[1] (Pit Operations)			
Barnes Co., Ltd., Wm. R.	Spring Vale, Waterdown, Brantford		243 Cumberland Ave., Hamilton.
Consolidated Sand & Gravel, Ltd	Paris		402 Harbour Bldg., Toronto.
Durham Stone & Sand Co., Ltd.	Durham.		
Fuller Gravel, Ltd.	Fuller.		
Waterford Sand & Gravel Co., Ltd.	Waterford.		
Foster, R. R.	Nepean and Gloucester tps., Carleton co.		86 Spadina Ave., Ottawa.
Hinde Bros.	Northlands Ave., York tp., York co.		134 Northlands Ave., Toronto.
Jupp Construction Co., Ltd., A. E.	Whitby tp., Ontario co.		170 Berkeley St., Toronto.
Newall, H.	Lot 35, con. VIII, Malahide tp., Elgin co.	H. Newall	R.R. 4, Aylmer.
Smythe Ltd., C.	Lambton Rd., Etobicoke tp., York co.		60 Carlton St., Toronto.
Woollatt Fuel & Supply Co., Ltd.	Essex co.		109 Ottawa St., Walkerville.

[1]Only operators producing 5,000 tons or over are listed.

MINES OF ONTARIO IN 1934

By

Chief Inspector of Mines, D. G. Sinclair, Toronto; Inspectors, E. C. Keeley, Kirkland Lake; D. F. Cooper, Sudbury; E. B. Weir, Timmins; A. R. Webster, Toronto

CHROMIUM

Chromium Mining and Smelting Corporation, Limited

The Chromium Mining and Smelting Corporation, Limited, was incorporated in May, 1934, succeeding the Chromium Alloy Company, Limited. It has a capitalization of 3,000,000 shares of no par value.

The officers and directors are: A. R. Globe, president; R. S. Hart, vice-president; R. O. Denman, secretary-treasurer; Scott Misener and F. J. Maw, directors. The head office is 700 Bank of Commerce Building, Hamilton.

The company's property consists of 44 claims, about 1,800 acres, situated 26 miles south of Collins on the main line of the Canadian National Railways, in the Obonga Lake area, Thunder Bay district.

Development to date on the property includes one 2-compartment shaft, 350 feet deep, and about 600 feet of lateral work on the 100-foot level; a second shaft, 25 feet deep; about 3,000 feet of surface trenching; and 33 diamond-drill holes, with a total footage of 6,150 feet.

Two carloads of ore have been shipped to Niagara Falls for test and demonstration purposes, and 1,400 tons of high-grade ore are now stock-piled at the mine for shipment, awaiting completion of a road from Collins to the mine. A gang of men were cutting the road early in January and were expected to finish that part of the work about the end of the month. A caterpillar tractor, run by a Diesel oil engine, capable of hauling 35 tons per load is used for transporting the ore from the mine to the railway.

The mine plant equipment consists of the usual early-stage boiler, compressor, hoist, etc. Buildings include 6 camps, with accommodation for 40 men, laboratory, boiler-house, and compressor-house.

An average of 38 men was employed at the property during the last seven months of the year. Operations were suspended at the property early in January, 1935, until the road from Collins is completed. No work was done underground in 1934. A. R. Globe is mine manager. The mine address is Collins.

GOLD

Algold Mines, Limited

Algold Mines, Limited, was incorporated in February, 1934, with an authorized capital of 2,500,000 shares of no par value. A first mortgage bond issue of $270,000, issued by New Goudreau Mines, Limited, stands against the property. The officers and directors were: W. R. Knox, president; J. G. Merrick, secretary-treasurer; M. C. Van der Voort, J. J. Gray, and J. A. McAndrew, directors. The head office is at 45 Richmond Street West, Toronto.

The property acquired included that of the New Goudreau Mines, Limited, located in township 28, range 26, district of Algoma. It is about 6 miles west of Goudreau station on the Algoma Central railway. The post-office address is Goudreau.

Previous operators sank a 425-foot and a 200-foot shaft, both of which are 2-compartment, 70-degree shafts. They established levels at 100, 200, and 400 feet, and sublevels at 130 and 160 feet. A 50-ton amalgamation mill was constructed in 1925.

Work was started in July, 1934. The underground workings were dewatered and a small amount of development work accomplished by the end of the year.

The plant used included an 1,100-cubic-foot Ingersoll-Rand electric compressor, and an 8½- by 10-inch air hoist. Electric power is obtained from the High Falls plant of the Great Lakes Power Company.

An average of 7 men was employed under the direction of R. F. Mitchell.

Algoma Summit Gold Mines, Limited

Algoma Summit Gold Mines, Limited, was incorporated in May, 1934, with an authorized capitalization of 5,000,000 shares of $1 par value. The officers and directors were: F. A. Brant, president; J. J. Gray, vice-president; E. O. Slingsby, secretary; J. J. Marth, treasurer; R. A. Hutchison and S. D. Terry, directors. The head office is at 514 McKinnon Building, Toronto. The mine office is at Goudreau.

On incorporation the company acquired the assets of McCarthy-Webb-Goudreau Mines, Limited, which included a group of 7 claims located in township 27, range 29, district of Algoma, about 5 miles east of Goudreau. Considerable surface work had been done on this property, and a small test mill had been constructed late in 1933, with which several test runs were made early in 1934.

This company started surface work in June. The mill was enlarged to 25-ton capacity and was operated intermittently on surface ore. The total tonnage milled during the entire year amounted to 421 tons.

Shaft-sinking was started late in December with a portable gasoline compressor, and by the end of the year the shaft was down 18 feet.

The mill equipment included a Bramor mill, small classifier, corduroy blanket tables, and amalgamation plates. It was operated by a 25 h.p. Diesel engine. Buildings included two bunk-houses, office, two dwelling-houses, cook-house, mill, garage, blacksmith shop, and powder-house.

An average of 12 men was employed under the direction of F. A. Brant.

Alschbach Gold Mining Company, Limited

The Alschbach Gold Mining Company, Limited, owns 6 claims in Grenfell township, district of Timiskaming. The officers are: Clarence Alschbach, president; F. W. Hendry, vice-president; F. L. Hutchinson, secretary-treasurer; Wesley McKnight, Donald McLellan, Frederick Lawrence, and W. A. Taylor, directors. The head office is at New Liskeard. The company is capitalized at 2,500,000 shares of $1 par value, of which 1,621,539 have been issued.

The property was operated in 1935 for three months; work was discontinued in November. The total amount of work done to the end of 1935 was: the sinking of a 2-compartment shaft to 250 feet, with levels at 125 and 250 feet; 875 feet of drifting and crosscutting on the 125-foot level; and 40 feet of crosscutting on the 250-foot level. An average of 15 men was employed under the direction of Clarence Alschbach while the property was in operation. The mine address is Goldthorpe.

Amalgamated Gold Fields Corporation, Limited

Amalgamated Gold Fields Corporation, Limited, is capitalized at 5,000,000 shares of no par value. The company took over the assets of the Blue Quartz

Gold Mines, Limited, for 2,000,000 shares pooled for an indefinite period. The company owns 600 acres in Beatty township, district of Cochrane; and 24 men were employed from May, 1933, to August 31, 1934, when the property was closed down.

The plant consisted of an Atlas Diesel engine, an Ingersoll-Rand belt-driven compressor of 700-foot capacity, and a 10- by 12-inch single-drum steam hoist. A 50-ton cyanide mill, driven by a Diesel engine, was constructed.

The development work done previous to 1933 was as follows: shaft, 500 feet; winze, 250 feet; raise, 400 feet; crosscuts and drifting, 6,000 feet. The development work done in 1934 was: stoping, 100 tons; tons milled, 1,768.

The officers and directors are: H. C. Crow, president; Dr. J. A. Tuck, vice-president; A. D. Van Horne, secretary-treasurer; H. W. Laird, A. G. Parker, and Lewis Payne, directors. C. D. Salkeld was mine manager. The mine office is at Painkiller Lake, via Matheson.

Anglo-Huronian, Limited

Anglo-Huronian, Limited, was incorporated in October, 1933. Its authorized capitalization is 2,000,000 shares of no par value. The total number of shares issued is 1,252,605, of which 927,063 shares were issued at the time of the formation of the company for properties and assets received from predecessors. These companies were the Huronian Mining and Finance Company, Limited; Keeley Silver Mines, Limited; and Vipond Consolidated Mines, Limited. Shareholders of each of these companies received one share of the new company for each five shares of the old companies.

The officers and directors of the company were: R. Home Smith, Toronto, president; Andre Dorfman, Toronto, vice-president and managing director; J. Ingram, Toronto, secretary-treasurer; J. H. Black, Toronto, F. H. Hamilton, Eric Turk, Sir A. Hamilton Grant, London, England, directors. The head office is 80 King Street West, Toronto.

The holdings of Anglo-Huronian now include all the assets of its predecessors and their subsidiaries, as follows: the Vipond property of 320 acres adjoining the Hollinger mine at Timmins; a three-quarter interest in 6 Ridgeley claims in the same area adjoining Coniaurum mine; Keeley mine and Keeley Extension in South Lorrain; and other claims of lesser importance. They hold 889,612 shares of the 1,150,000 issued shares of Inspiration Gold Mines, which has 3 claims adjoining the Vipond property; nearly half of the issued shares of the Minto Gold Mines, Limited, in the Michipicoten area; and interests in Gilgreer Mines, Limited, Prospectors Airways Company, Limited, and McWatters Gold Mines. The latest acquisitions are large interests in Porcupine Peninsular Gold Mines, Limited, and options on a large block of shares of Bousquet Gold Mines, Limited, in the Sudbury area, 65 miles west of Sudbury. J. Ingram, secretary-treasurer of Anglo-Huronian, has recently been made treasurer and director of Bousquet Gold Mines.

In 1934 the old Vipond mine was the only wholly owned property under production. This property has been developed to a vertical depth of 1,450 feet. It has a mill capable of handling 300 to 325 tons per day. During the fiscal year ending July 31, 1934, the mill treated 101,347 tons and produced bullion to the value of $647,015.87, an average of $6.38 per ton. During the same period the development work done at the mine was as follows: crosscutting, 1,630 feet; drifting, 2,847 feet; raising, 1,739 feet; diamond-drilling, 17,525 feet.

Robert E. Dye was mine manager at the Vipond property, employing an average of 179 men. The mine address is Timmins.

During the fiscal year ending July 31, 1934, the Anglo-Huronian's first year of operations, a surplus of $1,249,698, or $0.997 per share was earned.

The revenue and expenditures for the same period were as follows:—

STATEMENT OF REVENUE AND EXPENDITURE
for the year ended July 31, 1934

REVENUE:			
Metal recoveries, including premium		$647,015.87	
Dividends received		81,639.50	
Net profit on foreign exchange		38,381.81	
Interest earned, less interest paid		64,560.39	
Sundry earnings		3,128.08	
			$834,725.65
EXPENDITURE:			
Mine operating expense, including development		$521,091.87	
Insurance		4,898.50	
Municipal taxes		2,115.29	
General, administration, and organization expense, less portion charged to mine operations		90,463.33	
Examinations written off	$1,700.36		
Reserve for depreciation	10,560.32		
		12,260.68	
			630,829.67
Profit carried to surplus account			$203,895.98
SURPLUS ACCOUNT:			
Profit for the year ended July 31, 1934		$203,895.98	
Profit realized on investments		1,239,315.42	
			1,443,211.40
Deduct: reserved for taxes, etc.			193,513.39
Surplus, July 31, 1934, carried to balance sheet			$1,249,698.01

Ardeen Gold Mines, Limited

Ardeen Gold Mines, Limited, was incorporated in December, 1933, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: H. G. White, president; A. R. Miller, Jr., vice-president; W. A. Williams, secretary-treasurer; C. G. Greenshields, J. J. McInerney, and J. H. Kitchen, directors. The head office is at 132 St. James Street, Montreal, Que.

On incorporation this company took over the property and assets of Moss Gold Mines, Limited, which had gone into receivership in September, 1933. The property is located in Moss township, district of Thunder Bay, and is 18½ miles by road from the Fort Frances branch of the Canadian National railway. The post-office address is Tip Top Spur, via Port Arthur.

Underground operations were carried on continuously throughout 1934, but were suspended on January 5, 1935, owing to lack of finances.

The lateral work accomplished from January 1, 1934, to January 5, 1935, and the total done to the latter date, on the various levels, was as follows:—

Level	Drifting		Crosscutting	
	January 1, 1934, to January 5, 1935	Total	January 1, 1934, to January 5, 1935	Total
	feet	feet	feet	feet
125-foot	.....	1,499	.....	222
250-foot	549	2,369	64	393
375-foot	1,014	3,341	100	710
500-foot	119	1,506	33	192
625-foot	.....	1,906	10	289
750-foot	.....	1,561	.....	240
875-foot	1,156	1,156	190	190
1,000-foot	468	468	299	299
Total	3,306	13,806	696	2,535

During the year the 3-compartment vertical shaft was sunk an additional 268 feet to a total depth of 1,038 feet, and levels were established at 875 and 1,000 feet. When operations were suspended stoping had just been started on the 875-foot level. A total of 37,298 tons of ore and 10,763 tons of waste were hoisted from January 1, 1934, to January 5, 1935.

The 200-ton cyanide mill was operated until January 9, 1935, and treated a total of 39,072 tons of ore from January 1, 1934.

An average of 165 men was employed, of whom 89 were underground. N. O. Lawton was general manager, J. D. Tolman was mine superintendent, and J. E. Sullivan was mill superintendent.

Ashley Gold Mining Corporation, Limited

The Ashley Gold Mining Corporation, Limited, has a capitalization of $3,000,000, in shares of $1 par value. The officers and directors are: J. P. Watson, president; G. C. Ames, secretary-treasurer; E. H. Rose, H. A. Millman, C. E. Trafford, and J. G. Watson, directors. M. F. Fairlie is managing engineer. The head office is at 350 Bay Street, Toronto. The mine address is Elk Lake.

The mine in Bannockburn township, district of Timiskaming, was operated continuously throughout the year.

The following is taken from the report of the managing engineer for the year ending December 30, 1934:—

The tonnage treated at this property was increased over that of the previous year, with the double object of maintaining gold production and reducing the per-ton cost, in the face of lowered grade of ore.

Development

The fault conditions which govern vein occurrence were described in the last annual report, but it might be repeated that the original Ashley vein, striking north and south, is the normal-faulted section of a vein situated to the west, and this section extends only from the 5th level to the surface; a second faulted section of the same vein extends from the 5th level to above the 2nd level; and a 3rd faulted section extends from an unknown depth to above the 5th level. To reach the 3rd section, long crosscuts to the west from present workings are necessary, and this work was deferred during the year until the Ashley vein and its second section had undergone further development to the north and south. Any new ore so found would be much more cheaply developed and extracted.

A drift on the Ashley vein on the 250-foot level was advanced north of the porphyry dike for a distance of 700 feet, showing a strong quartz vein, but with the exception of one rich ore shoot, 50 feet in length, the values were generally below profitable grade. Recently raises have been put up at intervals, and values disclosed above the level show considerable improvement over those shown in drifting, but as yet this section cannot be included in ore reserves.

Long drifts were run north on the second vein section on the 375-foot level, also south on both the 375- and 500-foot levels, but were generally unproductive of ore. Late in the year a crosscut was started west to intersect the 3rd vein section on the 625-foot level, but the vein has not yet been reached. The Ashley vein has to date been proven to a total length of 2,000 feet, by underground work. Drifting and crosscutting completed during the year totalled 4,500 feet.

Ore Reserves

Development work failed to maintain the ore reserve position of approximately 50,000 tons at the beginning of the year. After extraction of 43,532 tons, the ore reserves at December 31 were 31,000 tons of slightly over 0.3-ounce grade.

Production

The tonnage treated during the year was 43,532 tons with average grade of 0.315 ounces, as compared with 37,975 tons with average grade of 0.456 ounces in the previous year. Gold bullion shipments for the year realized $456,831.86 in Canadian funds, compared with $497,969.00 in 1933. Total bullion shipments from inception of operations to December 31, 1934, have netted $1,024,942.27.

The average cost per ton, including mining, development, milling, and administration, was $8.68 per ton of ore milled, and in late months was further reduced below $8.00 per ton. Conditions at this property do not lend themselves to low costs and include exceedingly hard rock with high mining and grinding costs, excessive water with high pumping costs, as well as narrow vein and fault conditions, which increase development charges.

An average of 148 men was employed. Eric Hargreaves is resident manager.

Bankfield Gold Mines, Limited

Bankfield Gold Mines, Limited, was incorporated in April, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: C. D. H. MacAlpine, president; T. H. Stinson, vice-president; F. J. Bailes, secretary-treasurer; Jos. Errington, D. M. Morin, and J. H. C. Waite, directors. The head office is at 1006 Concourse Building, Toronto.

The property acquired by this company consists of a group of claims, totalling about 730 acres, in the Magnet Lake section of the Little Long Lac area, Thunder Bay district. It is reached by a 3-mile road from a siding on the Port Arthur–Long Lac branch of the Canadian National Railways, 1½ miles west of Bankfield station. The post office address is Geraldton.

Work was started on June 1, 1934. Following diamond-drilling and trenching a 3-compartment vertical shaft was commenced in August on claim T.B. 10,213. Shaft-sinking was still in progress at the end of the year, at which time the shaft had reached a depth of 158 feet, and a station had been cut at 150 feet. A total of 7,398 feet of diamond-drilling had been accomplished.

The plant installed included two 90 h.p. boilers, an 8- by 11-inch Ingersoll-Rand double-drum steam hoist, and a 750-cubic-foot Ingersoll-Rand steam compressor. Buildings erected included a power-house, blacksmith shop, dry-house, assay office, 2-storey bunk-house, 2-storey cook-house, stable, powder-house, office, and manager's residence.

An average of 68 men was employed, of whom 11 were underground, during the period of work. J. W. McKenzie was in charge of operations.

Barry-Hollinger Mines, Limited

Barry-Hollinger Mines, Limited, is capitalized at 4,000,000 shares of $1 par value. The officers and directors are: Dr. E. Herbert Greene, president; J. P. Patterson, vice-president; D. McKinnon, secretary-treasurer; H. K. Wood, director. The head office is at 57 Bloor Street West, Toronto.

The mine, in the township of Pacaud, district of Timiskaming, was operated throughout the year with an average force of 68 men.

The value of the production for the year was as follows:—

Value of production at $20.67 per ounce	$91,139.68
Plus premium on exchange	60,936.58
Total	$152,076.26

Underground development work during the year was as follows:—

	Feet
Drifting	822
Crosscutting	399
Diamond-drilling	2,343
Raising	1,171
	Cu. ft.
Diamond-drill stations	539
Shaft station	5,376

Douglas Bryden is mine manager. The mine address is Boston Creek.

Bathurst Gold Mines, Limited

Bathurst Gold Mines, Limited, was incorporated in 1934 with an authorized capitalization of 4,000,000 shares of no par value. This company succeeded Bathurst Mines, Limited. The officers and directors are: T. W. Bathurst,

president; E. P. Gleeson, vice-president; Dr. F. P. Quinn, secretary-treasurer; Leon Murr and P. Smith, directors. The head office of the company is at 51 Sparks Street, Ottawa. The mine office address is Narrow Lake.

The property of Bathurst Gold Mines is located in Skinner township, district of Kenora, Patricia portion. Gold was discovered on this property during the active prospecting season of 1926. Surface exploration was carried on, and in 1929 a plant was installed and a 10-ton Tremaine stamp mill was put in operation. The value of bullion sold amounted to $3,107, being production from a rich pocket on the surface and a small amount of ore from underground. Operations were suspended the same year. The property had then been explored to 300 feet, with levels established at 200 and 300 feet. Only about 300 feet of lateral work was done on the lower level. Nearly 4,000 feet of drifting and crosscutting was done on the first level.

Late in 1934, Bathurst Gold Mines started to deepen the shaft to 600 feet and intend to open up two more levels.

Bidgood Kirkland Gold Mines, Limited

Bidgood Kirkland Gold Mines, Limited, has an authorized capitalization of $2,000,000, in shares of $1 par value. The officers are: A. L. Herbert, president; S. H. Whitfield, vice-president; N. W. Byrne, secretary-treasurer; Harry Korson, Harry Koza, E. G. Budd, and Joseph Nichols, directors. Both the head office and mine office are at Kirkland Lake.

The company owns 753 acres in the township of Lebel, in the East Kirkland Lake area, district of Timiskaming.

A 100-ton mill was built and put into operation in July at the rate of 50 tons a day.

The following development work was done during the year in the Bidgood mine: raising, 10 feet; drifting, 870 feet; crosscutting, 697 feet; diamond-drilling, 2,382 feet. There were 2,560 tons of ore hoisted and 2,433 tons milled, which yielded a total value of $6,804.93.

Oscar Knutson was mine manager, employing an average of 45 men during the year.

In August, 1934, the company took a lease on 10 acres of the Moffatt-Hall property, which is also in Lebel township. Further details regarding this operation will be found on page 128 of this report.

Bob Tough Gold Mines, Limited

Bob Tough Gold Mines, Limited, was incorporated in September, 1933, with an authorized capitalization of 3,000,000 shares of no par value. The officers and directors were: R. R. Tough, president; H. J. Tiedt, vice-president, E. B. Ratcliffe, secretary-treasurer; F. H. Gage, R. E. Thompson, J. H. Stevens; and H. J. Simons, directors. The executive office is at 207 Turner Building, Hamilton.

The property is located in McKinnon township, district of Sudbury. There is a 16-mile winter road from Massey station on the Canadian Pacific railway. The post-office address is Massey.

Surface work was started in April, 1934. During April, May, and June, 2,500 feet of diamond-drilling was done. In September, the company started work on a 3-compartment, vertical shaft, using a gasoline compressor. By the end of the year the shaft had been sunk to a depth of 30 feet, a headframe was being erected, and a steam plant was being installed.

An average of 16 men was employed under the direction of E. B. Ratcliffe.

Bousquet Gold Mines, Limited

Bousquet Gold Mines, Limited, was incorporated in 1920, with an authorized capital of 2,000,000 shares of $1 par value. The officers and directors were: Lionel Brooke, president; C. H. Hitchcock, vice-president; W. B. McPherson, secretary-treasurer; L. P. Wood and H. P. Snelgrove, directors. The head office was at 171 Yonge Street, Toronto. The mine address is Willisville.

The property consists of 20 mining claims located in two groups in township 11, district of Sudbury. It is 7 miles by winter road from West River on the Algoma Eastern railway.

Operations were carried on throughout 1934. The sinking of the 2-compartment, vertical shaft was continued to the 150-foot level, where considerable lateral work was accomplished. Towards the end of the year the shaft was deepened to the 300-foot level, and development work started at that horizon.

The plant used included an 80 h.p. boiler, a 500-cubic-foot steam compressor, and an 8- by 10-inch steam hoist. Buildings included a power-house, blacksmith shop, stable, bunk-house, and cook-house.

An average of 25 men was employed under the direction of Lionel Brooke.

Buffalo Ankerite Gold Mines, Limited

Buffalo Ankerite Gold Mines, Limited, incorporated in 1932, has an authorized capitalization of $1,000,000, in shares of $1 par value, of which 577,307 shares have been issued.

The officers and directors are: Geo. R. Feine, president; G. R. Loesch, vice-president; H. Kobler, treasurer; R. P. Kinkel, assistant-treasurer; E. G. Kinkel, secretary and managing director; H. J. Tiedt, J. Betz, A. J. Baldeck, directors. The head office is at 902 Lumsden Building, Toronto. The mine address is South Porcupine.

The property, which consists of 3 claims, adjoining the property of the Paymaster Consolidated Mines, Limited, is situated in Deloro township, district of Cochrane. It has been developed by shafts and winzes to a depth of 1,000 feet. Prior to the formation of the present company the property had produced $862,115 worth of bullion. From 1932 to the end of 1934 the present company has produced $1,107,006 worth of bullion (old gold value). The mill has a rated capacity of 500 tons, which will allow a step-up in tonnage of about 100 tons above the highest monthly average milled to date.

The following is taken from the report of the managing director for the fiscal year ending December 31, 1934:—

Although diligent effort was made by the management to increase the milling capacity to 500 tons per day during the year 1934, it was found that the development work had not progressed sufficiently to enable the withdrawal of this amount of tonnage. The actual average tonnage treated during the year per day was 345.6, and the tons treated per 24 hours running time was 363.8. The daily average during the year 1933 was 321 tons; the average daily during the month of December was 401 tons.

In December, 1934, over $2,000 in precipitates were stolen from the mill, which theft was covered by insurance and which loss has been paid.

During the year 1934, Revere P. Kinkel acted as assistant to the managing director and was recently appointed assistant treasurer of the company. Mr. Kinkel spends practically his entire time at the property.

The winze was placed in operation in the early part of 1934 from the 600-foot level to the 1,000-foot level, but considerable difficulty has been encountered with unusual pressure of soft rock on the winze-frame from the 875-foot level to the 1,000-foot level, and the management intends to abandon this part of the winze as a safety element. However, crosscutting and drifting had already taken place on the 1,000-foot level enabling the company to utilize this level at a later date.

A substantial body of ore encountered in the No. 7 vein, north area of the property, made it advisable to construct a haulage drift directly from this ore body to the vicinity of the winze

station, and two Mancha locomotives and additional 2-ton mining cars were purchased and are now in operation. Although the ore in this area has not been definitely proven our mine manager has estimated that there is possible and probable ore from the surface to the 800-foot level in the No. 7 zone amounting to 369,000 tons with an assay value of $8.80, giving a total value of $3,247,200.00 (valued at $20.67 per ounce).

Because of the difficulty encountered in the sinking of the winze and the opening up of the ore bodies in the north zone of the property no further effort was made during the year 1934 to sink the main shaft, as the management desires a further study of the vein system before proceeding.

The management has decided to defer a part of its development costs to the year 1935, as it is anticipated that the recoveries will materially increase during the year 1935, the recoveries during the month of December, 1934, having been the largest for any month during the year.

The plant and equipment are in excellent condition, as considerable money was expended for this purpose during the year.

The following is taken from the mine manager's report for the year ending December 31, 1934:—

Production

Some 126,450 dry tons of ore were treated, yielding $712,898.29. The average value of all ore treated was 0.182 ounces per ton, with a recovery of $5.64 per ton (market price of gold).

Mining

	Tons
Ore broken in stopes	105,038
Ore broken in development	16,520
Ore hoisted and transferred	133,499
Waste hoisted	13,745

The major tonnages for the year were obtained from stopes on the Nos. 1, 2, and 5 veins on the 200-, 250-, 350-, 475-, and 600-foot levels. Stopes were started late in the year on the Nos. 5 and 7 structures on the 600-, 725-, and 875- foot levels. Minor tonnages were hoisted from these workings. Vein widths vary from 3 to 60 feet. The Nos. 784 and 884 stopes show maximum widths of from 50 to 60 feet. The No. 690 stope averages 3 feet.

Development

	Feet
Drifting	4,564
Crosscuts	1,104
Raises	573
Winzes	51
Total	6,292
	Cu ft.
Stations	7,368
Sumps	3,024
Total	10,392

Winze-sinking was finished early in January, 1934. The 1,050-foot level station and pump sump were completed and ore passes raised through to the 725-foot level. The objectives for the period were the development of the Nos. 5 and 7 vein structures on the 600-, 725-, 875-, and 1,050-foot levels. Lateral workings on the 725-, 875-, and 1,050-foot winze levels partially developed the No. 5 structure. Lengths of ore on this vein on these horizons total 429 feet. On the upper levels, i.e. 250, 365, 475, and 600 feet, the Nos. 2 and 7 structures development shows ore lengths of 534 feet. On the 600-foot level the No. 7 ore zone is 170 feet wide and includes four structures (Nos. 689, 690, 691, and 693). The deepest working at the end of 1934 was the No. 1 winze at a vertical depth of 1,035 feet.

New ore areas, as developed on all horizons, are indicated to be of a better grade than the tonnage milled during 1934.

Diamond-Drilling

	Feet
CONTRACT DRILLING:	
Surface	1,012
Underground	5,095
Total	6,107
COMPANY DRILLING:	
Underground	9,743
TOTAL DRILLING	15,850

Surface drilling prospected the No. 6 vein north and east of the main shaft. Results were negative. Underground drilling proved the downward and lateral extensions of the Nos. 2 and 5 veins. Results were favourable.

Milling

The mill treated 126,450 dry tons during the period at a cost of $0.871 per ton.

Percentage of total possible running time	95.11
Tons treated per day	345.6
Tons treated per 24 hours running time	363.8
Average mill head (at $20.67)	$3.68
Average mill tailings	$0.30
Indicated extraction ..... per cent.	.92

Tonnage milled for 1934 was obtained from the Nos. 1, 2, and 5 vein workings on the 200-, 250-, 350-, 475-, and 600-foot levels.

Plant Additions

The following installations were made in the mill: a Hardinge 6- by 14-foot counter-current classifier, operating in closed circuit with the Hardinge ball mill; pumps and air lifts, so that thickeners could be operated in either series or parallel circuits; a 10- by 16-foot string filter placed in mill circuit, having a capacity of 500 tons per day.

In the mine, the additions included 2 motor trammers; mine cars for main haulageway; drill machines; centrifugal pump having a capacity of 250 gallons per minute at 700-foot head, installed on the 600-foot level; pump installed on the 1,050-foot winze level.

A 2,620-cubic-foot Ingersoll-Rand compressor was installed, and three k.v.a. transformers were purchased and installed.

General

The main haulageway on the 600-foot level from the main shaft to the Nos. 690 and 691 stope areas was completed. The 600- and 400-foot level pockets were slashed to increase storage.

Development is at present behind production. It is planned to remedy this condition during 1935.

MINE OPERATING STATEMENT

for year ended December 31, 1934

EARNINGS:		
Gold bullion recovery (including premium)		$707,118.72
COST OF PRODUCTION:		
Mining	$261,165.67	
Milling	85,896.20	
Power and sundry	61,122.93	
General supervision	6,491.26	
Workmen's compensation	8,446.84	
Plant heating	7,164.01	
Miscellaneous	5,242.19	
Stable operation	2,796.10	
Insurance, fire, etc.	4,872.57	
Repairs to buildings	7,460.37	
Repairs to machinery and equipment	9,089.59	
Surface improvements and fire protection	2,479.44	
Hospital fees	1,883.50	
Box-holes	682.10	
Loading pocket	1,599.54	
Sump	1,986.63	
Air and water	289.47	
		468,668.41
GROSS PROFIT FROM MINING OPERATIONS		$238,450.31

Martin Knutson was mine manager until November, when he was succeeded by Chas. L. Hershman. An average of 277 men was employed.

Canadian Kirkland Mines, Limited

Canadian Kirkland Mines, Limited, owns 6 claims in Teck township, district of Timiskaming. The company is capitalized at $4,500,000, in shares of $1 par value. The officers and directors are: George Tough, president; F. J. Carew, vice-president; W. B. McPherson, secretary-treasurer; B. L. McLean and W. J. Beckett, directors. The head office is at 171 Yonge Street, Toronto. The mine office is at Kirkland Lake.

The following is a summary of the work done to January, 1935, when the property closed down. The No. 1 shaft had been sunk to a depth of 816 feet, and drifting and crosscutting done as follows: 80-foot level, 100 feet; 250-foot level, 120 feet; 400-foot level, 440 feet; 800-foot level, 1,442 feet. In addition, 20 feet of raising had been done.

No. 2 shaft had been sunk to a depth of 150 feet, and stations cut at 65 and 125 feet. On the 65-foot level, 25 feet of crosscutting had been accomplished; and on the 125-foot level, 375 feet of drifting and crosscutting.

Hugh Jardine is mine manager. An average of 20 men was employed during the year.

Canusa Gold Mines, Limited

Canusa Gold Mines, Limited, was incorporated in 1932. It is capitalized at 1,500,000 shares of $1 par value. The officers and directors for 1934 were: D. D. Wessels, president; Geo. Neukom, vice-president; Robt. Schram, treasurer; Thos. R. Deacon, secretary; H. Kendrick, P. Du Bois, R. E. Olds, and C. C. Drake, directors. The business office is at 3400 Union Guardian Building, Detroit, Mich. The mine address is South Porcupine. E. Y. Dow is in charge of operations. The property, which consists of 440 acres in Tisdale and Whitney townships, district of Cochrane, was bought from Canusa Mining and Exploration Company, Limited, in 1932.

The mine, formerly known as the Scottish-Ontario, has a 2-compartment shaft to the 100-foot level and a 3-compartment shaft from the 100-foot level to the 320-foot level. About 2,300 feet of lateral work was done on these levels by former owners.

No work had been done on the property for some time prior to the reopening of the mine in May, 1934, by the present company. In 1934, the mine was pumped out, the buildings and machinery were reconditioned, a 24-ton Myers mill was installed, and an assaying laboratory and machine shop were built.

Up to the end of the year the tonnage treated by the mill was small, the whole procedure being more or less an experiment.

About 14 men were being employed at the end of the year.

Casey Summit Gold Mines, Limited

Casey Summit Gold Mines, Limited, is capitalized at 5,000,000 shares, of no par value, 2,962,848 of which have been issued. The controlling interest is held by Maple Leaf Mines, Limited. The following were officers in 1934: R. G. Williamson, president; C. S. Kennedy, secretary-treasurer; Fraser D. Reid, managing director; R. S. Banbury, W. R. M. Williamson, Fraser Raney, and J. A. Wilson, directors. In November, 1934, C. S. Kennedy was succeeded as secretary-treasurer by Fraser Raney. The head office is at 465 Bay Street, Toronto.

The property consists of 800 acres at Casummit lake, about 100 miles north of Sioux Lookout, in the district of Kenora, Patricia portion. The plant is on claim K. R. L. 9,681. The first work on the property was done in 1931, when a shaft was sunk 85 feet and 140 feet of lateral work was done at the 75-foot level. The property was idle from the fall of 1931 until the late summer of 1933. The shaft was then deepened to 325 feet, and stations were cut at the 200- and 300-foot horizons.

The following lateral work is reported to have been done during 1934:—

Level	Drifting	Crosscutting
	feet	feet
75-foot	145	85
200-foot	670	80
300-foot	720	250
Total	1,535	415

A raise was run from the 300-foot to the 200-foot level.

A 50-ton mill was installed and put into operation in September, 1934. During the 82 days it operated, 4,094 tons, averaging 0.514 ounces of gold, were treated. Of this tonnage 3,310 tons were drawn from stopes and the balance from development or the ore dump on surface. Operating costs amounted to $8.00 per ton for mining and $1.78 per ton for milling, of which $3.42 was chargeable to power expense.

Operations were suspended in November, 1934, pending reorganization to meet liabilities incurred.

Clifford Gibson was manager in charge of operations. The mine address is Casummit Lake, via Sioux Lookout.

Centennial Gold Mines, Limited

Centennial Gold Mines, Limited, was incorporated in November, 1933 with an authorized capitalization of 2,000,000 shares of $1 par value. The officers and directors were: Fred Deagle, president; Lorne Burk, vice-president; A. A. Wishart, secretary; R. P. Scott, treasurer; Lloyd Deagle, J. C. Allan, and S. E. Fleming, directors. The head office is at Blind River.

The property consists of a group of 7 mining claims, formerly known as the Kitchigami property, located in township 29, range 22, in the Michipicoten area, district of Algoma. It is 12 miles by road from Wawa station on the Algoma Central railway. The post-office address is Wawa.

Work was started on the property in May, 1934. Previous operators sank five shafts, the deepest of which was 110 feet. These old shafts were dewatered and sampled, and the construction of a plant was started. Electric power was obtained from the High Falls plant of the Great Lakes Power Company, which is less than a mile away. In September a 7- by 11-foot, 30-degree shaft was started. Operations were suspended early in December, at which time the shaft had reached a depth of 130 feet.

The plant included a 218-cubic-foot Ingersoll-Rand electric compressor and an electric hoist. Buildings erected included a power-house, blacksmith shop, warehouse, and powder-house.

An average of 13 men was employed during the period of operation. W. H. Lewis was in charge of operations.

Central Canada Mines, Limited

Central Canada Mines, Limited, was incorporated in 1930 with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors are: C. G. Smith, president; C. S. Parsons, vice-president; F. F. Montague, secretary-treasurer; Harold Smith and Norval Leslie, directors. The executive office is at 232 Grain Exchange, Winnipeg, Man.

The property held by this company includes a group of claims in the Sapawe Lake area, Rainy River district, 125 miles west of Fort William on the Fort Frances branch of the Canadian National Railways, on which a 2-compartment vertical shaft had been put down to a depth of 92 feet in 1930.

Operations were resumed in the spring of 1934. Following a considerable amount of diamond-drilling a small steam plant and a 25-ton amalgamation mill were installed. The old shaft was cleaned out and timbered, and a small amount of lateral work done on the 92-foot level. The mill was used for test runs only.

The plant used included a 80 h.p. boiler, a steam hoist, and a 150-cubic-foot steam compressor. The mill equipment included a 50 h.p. boiler a Dodge crusher, and a double Tremaine stamp.

Work was suspended in January, 1935, pending further financing.

Central Patricia Gold Mines, Limited

Central Patricia Gold Mines, Limited, was incorporated in 1931, succeeding Central Patricia Mines, Limited, formed in 1927. It has an authorized capitalization of 2,500,000 shares of $1 par value.

The officers and directors are: F. M. Connell, president; W. H. Connell, vice-president; Alan Cockeram, secretary-treasurer; J. H. Rattray, L. Cohen, and G. B. Webster, directors.

The mine is situated in the Crow River area, district of Kenora, Patricia portion. The mine camp is about 110 miles north of Savant Lake Station on the Canadian National railway. It lies about 6 miles west of the property of the Pickle Crow Gold Mines, Limited. The holdings include 85 claims, which lie in several large groups in the surrounding district.

Most of the underground work was done in 1930. When the property was closed down in the fall of that year, the shaft had been sunk to a depth of 527 feet and lateral development on four levels at 125-foot intervals to the extent of 994 feet of crosscutting and 1,713 feet of drifting had been accomplished. This work disclosed in three ore zones approximately 45,000 tons of ore, having a gross value of about $600,000, averaging about $13.25 per ton (based on gold at $20.67).

Operations were again started in 1932, but the loss of much mill equipment through the ice delayed matters, and it was not until the winter of 1933-34 that the mill was finally finished. Production began in the spring of 1934 from a 50-ton cyanide unit powered by steam. Late in the summer the company decided to put in a second 50-ton unit. The equipment for this was taken into the property over the winter roads and will be put into operation when the Hydro-Electric Power Commission line from the Albany river to the property is completed. It is believed that electrical power will be available for the mine about the middle of March, 1935.

At the end of the year the 50-ton unit was producing about 1,000 ounces of gold per month.

The following is taken from the president's report to the shareholders for the year ending December 31, 1934:—

Production

Milling operations were commenced on May 27, 1934, with a 50- to 60-ton cyanide mill. During the period under review, 11,536 tons of ore were treated, the recovery therefrom amounting to $219,562.56. In the profit and loss statement you will notice an item of $38,159.43 (undistributed to mining and milling). This represents the cost of steam power during the period. This item will be greatly reduced when the hydro-electric power is available. You will also notice that after making allowances for depreciation and taxes there remains a net profit of $42,127.38.

Hydro-Electric Power Contract

On March 7, 1934, a contract was entered into with the Hydro-Electric Power Commission of Ontario. Your company paid $40,000 cash under the contract, and a bond for $10,000 is to be deposited with the commission when power is delivered at the mine. The cost of power for the first 5-year period is to be $65 per horse-power, and after that period $35.

Transportation

In order to materially improve the transportation facilities, arrangements were made between your company, Pickle Crow Gold Mines, Limited, and the Northern Development Branch of the Province of Ontario, whereby the Northern Development Branch undertook to construct a summer transportation route from Hudson to the east end of Lake St. Joseph, your company having paid $16,667 toward the cost of this development. This will enable transportation of supplies to be made in the summer months at a greatly reduced cost.

Addition to Mill

In August, 1934, it was decided that mine developments justified an increase in the milling capacity. The necessary equipment was purchased to double the capacity of the mill. This equipment has since been delivered to the property.

Financing

On March 1, in order to make the payments to the Hydro-Electric Power Commission and the Northern Development Branch, 100,000 shares of treasury stock was sold to Anglo-Huronian, Limited, to net the treasury $50,000. On August 29, after the decision to double the capacity of the mill, a further 68,940 shares, being the balance of the treasury stock, was disposed of to the same company to net the treasury $1.10 a share. The above sums, together with the moneys received from mine production, are sufficient to pay all capital commitments incurred until the increased production is effective.

Programme of Exploration and Development Work for 1935

During the coming year, it is proposed to sink the main shaft from the 500-foot to the 750-foot level, and also to carry on lateral exploration work on the upper levels.

Springer

It is proposed to sink a shaft 125 feet and to carry on underground exploration work on this level. Work will be commenced the early part of May. The necessary mining equipment has already been delivered to the property, and the necessary buildings have been erected in preparation for this work.

The following is taken from the mine manager's report for the year ending December 31, 1934:—

Mining

All development work was done in sections where ore had previously been indicated, and no new areas were explored. The development work proved the known ore occurrences to be of greater width and lengths than had previously been estimated. The continuity of the ore bodies between the levels was established by raising.

The following is a summary of the development work:—

	Footage	Tons ore	Tons waste	Per cent. in ore
Drifting and crosscutting	314	1,035	126	79.5
Raising	350	583	58	90
Slashing	262	944	267	78.5
Total	926	2,562	451	.....

Diamond-drilling, 2,035 feet.

The table below shows the ore estimate:—

	Tons	Grade
		ounces
"A" ore body	5,358	0.56
"B" ore body	19,825	.66
"C" ore body	30,358	.76
Broken ore in stopes	8,129	.63
	63,670	0.67
Probable ore in "B" and "C" ore bodies on the 500-foot level and 50 feet below level	14,000	0.64
Total	77,670	0.66

Milling

On May 27 the mill was put into operation. The extraction at the commencement of operations was very low, but a gradual improvement in the milling methods resulted in an improvement of recovery to 97 per cent. in September and for the following months.

The mill operation for the seven months is summarized as follows:—

Tons treated		11,536
Daily tonnage (average)		54
Heads (average)	ounces	0.634
Tails (average)	ounces	.048
Bullion shipped	ounces	6,369

In August it was decided to increase the mill to 100 tons daily capacity. The equipment for this increase, together with the necessary electrical equipment and material to electrify the entire plant, was ordered. The addition to the mill building was erected in readiness to receive the equipment.

Construction

The construction consisted of a refinery, a new bunk-house to accommodate seventy men, and the addition to the mill building providing for the 50-ton increase. The mine saw-mill manufactured the 110,000 feet board measure of lumber and timber used in the above construction.

Springer

A small crew of men started clearing and burning the area in the vicinity of the Springer vein, and camp buildings were erected in preparation for shaft-sinking, which will be commenced early in May, 1935.

Summary

The known ore has been opened up to greater widths and lengths than was previously reported. The treatment of the ore has been solved to a point where high recovery can be depended upon. The reagent and other milling costs have been gradually reduced, and with the increased tonnage further reductions are anticipated.

A. J. Anderson was mine manager, employing an average of 61 men. The mine address is Hudson.

It has been stated that the company plans to install, in the spring of 1935, a mine plant and sink a shaft on the Springer group of claims, belonging to Central Patricia Gold Mines, which lies 5 miles distant from the main property. This group has already been diamond-drilled. Finances for this work will be secured from the profits of the Central Patricia mill, which will then be operating on a 100-ton basis.

Central Porcupine Mines, Limited

The holdings of Central Porcupine Mines, Limited, comprise 9 claims held outright and 4 claims (Gold Centre Mines, Limited), in which the company holds the controlling interest, in the Porcupine area, district of Cochrane. The claims owned outright were formerly known as Parmac Porcupine Mines (2 claims), the Dignam group (3 claims), and the Digby Vet group (4 claims).

The holdings, which form a solid block, lie east of the McIntyre and Hollinger, south of the Coniaurum, and north and west of the Dome Mines, and are contiguous at some point to all four of the mines mentioned.

The company is capitalized at 5,000,000 shares of $1 par value, of which 2,600,007 are issued or to be issued. The officers and directors are: E. Ward Wright, president; C. D. H. MacAlpine, vice-president; Geo. G. Blackstock, secretary; W. J. Aikens, E. M. Buchanan, H. C. McCloskey, and Jos. Montgomery, directors. The general manager is Frank G. Stevens, and the consulting geologist is D. G. H. Wright. The mine address is Schumacher.

An average of 8 men was employed from May to the end of the year on company construction work. New buildings erected include a combined office and residence, boiler-house, powder magazine, fuse-house, carbide-house, blacksmith shop, oil-house, dry-house, and garage.

At the inception of operations the Central Porcupine Company made an agreement with Coniaurum Mines, Limited, whereby they might operate for a period of three years through the Goldale shaft of the latter company. Central Porcupine Mines repaired the original Goldale shaft and the compressor and hoist buildings, and a new compressor and hoist, operated by steam, was installed. This hoist is small and is only used for handling supplies. A new 150 h.p. Canadian Ingersoll-Rand single-drum electric hoist with Westinghouse motor, a new Babcock-Wilcox-Goldie-McCulloch vertical compressor, with a capacity of 1,030 cubic feet per minute, and a 200 h.p. Canadian Westinghouse motor have been set up to replace the smaller hoist and compressor and will be used when the hydro line is completed to the property.

In the meantime, Coniaurum Mines, on a contract basis, are crosscutting from the Goldale shaft area of their property into the property of the Central Porcupine Mines. This work is being done on the 1,000-foot level. At the end of December, 1934, some 1,303 feet of crosscutting had been accomplished. At the same rate, another three months' work will advance the crosscut close to the boundary between the two properties. By that time or earlier the power line should be completed, and Central Porcupine Mines will then be able to proceed with their own men on their exploration scheme.

Churchill Mining and Milling Company, Limited

The Churchill Mining and Milling Company, Limited, was incorporated in 1918, and has an authorized capitalization of 4,000,000 shares of $1 par value. The officers and directors were: W. R. Knox, president; J. G. Merrick, secretary-treasurer; D. Lieberman and F. H. Geddes, directors. The head office is at 45 Richmond Street West, Toronto.

This company holds a group of four claims in Churchill township, in the West Shiningtree area, district of Sudbury, on which a 7- by 9-foot vertical shaft was put down to a depth of 40 feet some years ago.

Operations were started on this property in May and suspended in October, 1934. A headframe was erected over the old shaft, a plant installed, and the shaft sunk to a depth of 109 feet. The plant used consisted of a 15 h.p. boiler and a 6- by 8-inch Jenckes hoist. Steam was used for drilling.

A 10-ton mill was installed on the property, and included a Straub stamp, concentrating table, regrind mill, and amalgamation equipment. It was operated by a gasoline engine and was only used for test runs.

An average of 9 men was employed under the direction of H. L. McClelland, who was later succeeded by R. F. Mitchell. The mine address is Shiningtree.

Cole Gold Mines, Limited

Cole Gold Mines, Limited, is the outgrowth of a private mining enterprise that was started on two claims in 1932. The property was then known by the owner's name, J. Y. Cole. A company capitalized at 3,000,000 shares of $1 par value was formed in 1933 to operate on this property.

The company now holds 24 claims, all in one group, situated in the Pipestone Bay section of Red Lake, district of Kenora, Patricia portion. The company has been operating since February, 1933, when a 2-compartment shaft was started. The shaft has been completed to a depth of 200 feet, and on the 200-foot level 1,500 feet of lateral work has been accomplished in crosscutting and drifting, on several veins. The following extract has been taken from a preliminary report on the Red Lake area by M. E. Hurst:—

> During the past year, underground exploration at the Cole property on Pipestone bay has been concentrated on the 200-foot level. Crosscuts run north and south in the vicinity of the shaft have intersected a broad area of sheared quartz porphyry in which occur strips of greenstone, diabase dikes, and zones containing auriferous quartz stringers. Drifting east and west of the shaft on the mineralized sections is now being carried on. Most of the drifting has been done on a zone, 1 to 4 feet wide, containing one or more narrow veins of bluish-grey quartz, which dip about 70° N. The quartz is well mineralized with pyrite, chalcopyrite, and pyrrhotite and, in places, contains visible gold.

The officers of the company are: J. Y. Cole, Jr., president and treasurer; Wm. Exton, Jr., vice-president; Cicily Cole, secretary. The head office of the company is at Red Lake. J. Y. Cole, Jr., is mine manager. The post-office address is Red Lake.

Concordia Gold Mining Company, Limited

Concordia Gold Mining Company, Limited, was incorporated in May, 1934, with a Quebec charter and took over the property of the Jones Porter Mines, Limited, in the southern part of Deloro township, district of Cochrane. At the time of organization the officers and directors were: Robert Starke, president; A. A. Ladoucer, vice-president; J. A. McInnis, G. C. Murdoch, and A. C. Kennedy, directors. The company is capitalized at 3,000,000 shares of $1 par value.

The Jones Porter property consisted of 14 claims. No underground work has been done on this property since 1928, when a 3-compartment shaft was sunk about 149 feet and a station cut at the 125-foot level. Parts of the old Croesus mining plant from Munro township were moved to the property in 1929 but were never used. No work was done from that time until the midsummer of 1934, when John Pringle was sent to the property by Concordia Gold Mines to recondition the plant preparatory to starting underground work. Three or four men were employed during the last four months of the year in renovating the buildings and equipment. It is expected that underground development will start in the spring of 1935.

John Pringle is manager. The mine address is Timmins.

Coniaurum Mines, Limited

Coniaurum Mines, Limited, has an authorized capitalization of 6,000,000 shares of no par value, of which 2,717,947 are issued or to be issued. The head office is at 25 King Street West, Toronto.

The officers and directors are: Thayer Lindsley, president; A. L. Bishop, vice-president; H. Whittingham, secretary-treasurer; D. M. Hogarth, Alex. Longwell, H. Lindsley, and T. H. Rea, directors. The mine address is Schumacher. John Redington is mine manager.

The Coniaurum mine in Tisdale township, district of Cochrane, adjoins the McIntyre property on its east boundary. Two additional claims purchased in 1934 make the total number of claims now held 19, or approximately 760 acres.

The following is taken from the president's report on behalf of the directors for the year ending December 31, 1934:—

Following the policy of active development in depth, your directors have authorized the erection of a new steel headframe and a large hoist capable of handling 1,500 tons per day from the 3,500-foot level. It is expected that this new plant will be in operation by next fall. Sinking from the present depth of 3,150 feet will commence shortly to open up a main working level at a depth of 3,500 feet. From this horizon it is planned to establish an interior hoisting plant to permit opening up the property to still greater depths. Geologically and structurally, the indications are that our most productive areas will be found in depth.

During the year, 138,114 tons were milled and, in spite of a heavy programme of mine development, an operating profit of $216,228.98 was realized. After making the necessary write-offs for taxes, deferred development, and depreciation, and taking credit for non-operating revenue, we show a net profit for the period of $17,693.32. Working capital was increased to approximately $745,000.

Two more claims lying between the Canadel claim (acquired last year) and your most southeasterly claim were purchased for the modest sum of $10,000. These purchases now make a row of four contiguous claims along your southern boundary.

Reviewing the past year, it may be said that your company has made marked progress in opening up the property to depth, in adding materially to its indicated ore reserves, and at the same time making a fair profit. During the coming year development work in depth will be pushed actively, as well as active exploration in the area between the 2,000-foot and 3,000-foot levels.

The following is an extract from the mine manager's report for the year ending December 31, 1934:—

Development

The year's development has been confined chiefly to Nos. 15A and 7A vein systems. Lateral development and raising have been extensively carried forward on the 1,000-foot, 1,250-foot, 1,500-foot, 2,000-foot, 2,750-foot, and 3,000-foot levels. The results of this work have been very gratifying, and all the different horizons have responded quite liberally to exploration. Of the two vein systems, No. 15A has been more fully developed.

Summary of Development

	Feet
Drifting	3,593
Crosscutting	6,350
Raising	3,599
Diamond-drilling	17,757

The footage driven in ore amounted to 3,384 feet, with an average value of 5.1 pennyweights per ton over a width of 5.3 feet. Vein No. 15A has been developed on the 1,000-, 1,250-, and 1,500-foot levels, and development is still in progress on the 2,000-foot level.

Exploration

The 3,000-foot level is being extensively explored by means of a main crosscut known as No. M2. This extends westerly from No. 10 crosscut to the east boundary of the McIntyre-Porcupine Mines. This crosscut has been driven parallel to our vein system. Vein No. 7A has been driven on for a length in ore of 483 feet. When this ore shoot is fully developed it will add considerably to our present ore reserves. It is not considered advisable to make any definite estimate of the tonnage and grade of this ore body until it has been further developed.

Nos. 20 and 22 veins are also under exploration on the 3,000-foot level. These two veins promise to be of considerable importance and will enlarge the reserves. They are new discoveries and are located in the northwest portion of the Goldale claim and somewhat north of the Pearl lake porphyry mass.

Diamond-drilling has been carried on quite extensively. The major portion of this work, or 56.9 per cent., has been done on the 3,000-foot level. The remainder is distributed between the 1,000- and 2,000-foot levels. Sixty-three holes were drilled, and 22 per cent. indicated ore.

Broken Ore Reserves

Broken ore reserves have been somewhat increased since last year and are now 134,113 tons. Stoping supplied 125,549 tons and development another 28,356 tons of ore. The mill drew 138,102 tons, leaving a carry-forward of 134,113 tons of ore available at the end of the year.

Milling

During the year the mill treated 138,114 tons of ore, with an average recovery of $7.108 per ton, extracting 95.14 per cent. of the gold content, operating 348.96 days, or 95.60 per cent.

of the possible running time. The mill was closed down for twelve days in March while the main shaft was under repairs, and this accounts for the low percentage of possible running time. Owing to the higher price of gold, the milling grade is considerably higher than that of last year.

New Equipment and Improvements to Buildings

The boiler-house has been enlarged to accommodate an additional boiler. This boiler was removed from the Goldale plant. Two Livingston automatic stokers were installed, making a very up-to-date heating unit. A vault has been constructed adjacent to the office building. This is of fireproof construction; concrete with brick lining. A new oil-house has been built with concrete foundations and oil tanks and pumps in cellar.

Tailings Dam

A tailings dam is under construction. When this is completed, it will take care of our mill tailings for some years in advance.

An average of 259 men was employed during the year.

Consolidated Mining and Smelting Company of Canada, Limited

This company is capitalized at $20,000,000, divided into 800,000 shares of $25. The officers and directors are: Jas. J. Warren, president; Jas. E. Riley, secretary-treasurer; Jas. J. Warren, E. W. Beatty, S. G. Blaylock, Henry Joseph, J. C. Hodgson, F. G. Osler, R. S. McLaughlin, Sir Herbert Holt, W. A. Black, R. H. McMaster, Thayer Lindsley, Hon. R. R. Bruce, W. J. B. Wilson, L. A. Campbell, directors. The head office is at 1010 St. Catherine Street, Montreal, Que. An office is maintained at 302 Bay Street, Toronto.

Afton Mine

In June, 1934, the company optioned the property of Afton Mines, Limited, located in Afton township, Timagami Forest Reserve, district of Sudbury.

Diamond-drilling was started in July and continued until November, during which period a total of 2,775 feet was drilled. During the rest of the year the old plant and buildings were renovated with the intention of dewatering the old workings and starting underground development early in 1935.

McKenzie Claims

The company has under option the McKenzie claims in Garrison township, district of Cochrane. The property consists of 8 claims, or about 360 acres. The following work was done in 1934: 5,071 feet of diamond-drilling in 21 holes, which explored the southeast corner of claim L. 26,343; approximately 1,500 feet of trenching, with blasting in most of them; a test pit 20 feet deep near the southeast corner of claim L. 26,344. At the end of March, 1935, a 2-compartment shaft at 60-degrees incline was down 65 feet near the southeast corner of claim L. 26,344.

The plant consists of a gasoline compressor with a capacity of 310 cubic feet and a small single-drum air hoist. About 16 men are employed at the property.

Mackey Point Property

The company optioned the Mackey Point property, located in township 29, range 23, in the Michipicoten area, district of Algoma, early in 1934 and started work on claim Y. 104 in April. Operations were suspended late in December.

A 2-compartment, 25-degree shaft was sunk to a depth of 252 feet, and levels were established at 130 and 230 feet. A total of 29 feet of drifting, and 22 feet of crosscutting was done on the 1st level; and 154 feet of drifting and 39 feet of crosscutting, on the 2nd level. A similar shaft was sunk to a depth of 41 feet. A total of 4,835 feet of diamond-drilling was also done.

The plant installed included a small boiler, a small steam hoist, and a gasoline compressor. An average of 13 men was employed under the direction of J. J. Hawkins.

Cooper and Barry

W. D. Cooper and P. A. Barry obtained from the McIntyre-Porcupine Mines, Limited, a lease on the property commonly known as the McIntyre Birch Lake, about two miles east of Casey Summit Gold Mines, Limited, in the Casummit Lake area, district of Kenora, Patricia portion.

The McIntyre company had prospected the property, doing a considerable amount of trenching and pit-sinking. This disclosed at one point a high-grade zone of gold ore. It is on this showing that Cooper and Barry are working. When the property was inspected in June they had installed a set of Tremaine stamps and were preparing to open-cut and sink on the showing and mill the ore removed.

Other equipment included a 25 h.p. boiler, a 235-cubic-foot Ingersoll-Rand portable compressor, and a 5- by 8-inch steam hoist.

At the time of the inspection of the plant 6 men were employed. The post-office address is Birch Lake, via Sioux Lookout.

Coulson Consolidated Gold Mines, Limited

Coulson Consolidated Gold Mines, Limited, has a capitalization of 3,000,000 shares of $1 par value, of which 1,378,980 shares have been issued. The officers and directors are: Nicholas Kinsella, president; Matthew Weimar, vice-president and treasurer; A. Ritchie, secretary; L. V. Sutton, Raymond Sutcliffe, G. S. Haines, and D. McKenna, directors The head office is at 1104 Northern Ontario Building, Toronto.

The property, consisting of 10 claims in Coulson township, district of Cochrane, was reopened in May, 1934.

The development work in 1934 was all done at the south shaft, which was down 200 feet with a level at 160 feet, as follows: crosscutting, 319 feet; drifting, 826 feet; sinking, 64 feet. Previous to 1934 the following work was done: crosscutting, 846 feet; drifting, 186 feet.

The plant at the south shaft consists of a new Ruston Diesel engine and Bellis-Morcome compressor; and an 8¼- by 10-inch Rand hoist, single-drum. At the north shaft there is a Fairbanks-Morse oil engine and an Ingersoll-Rand compressor, about 400 feet capacity. The north shaft is down 440 feet, and 1,500 feet of lateral work has been done.

C. D. Salkeld is manager, employing an average of 30 men. The mine address is Painkiller Lake, via Matheson.

Craig Gold Mines, Limited

Craig Gold Mines, Limited, is capitalized at 5,000,000 shares of $1 par value. The officers and directors are: H. L. Pearl, president; W. N. Agnew, vice-president; Geo. S. White, secretary; H. Lemmen, treasurer. The executive and mine offices are at Madoc. The property is in Tudor township, Hastings county.

Previous operators sank two shafts on the property, 210 and 165 feet deep, and did 1,800 feet of lateral work.

During 1934 a small crew was employed erecting plant and equipment. J. G. A. Stevenson is mining engineer.

Darwin Gold Mines, Limited

Darwin Gold Mines, Limited, was incorporated in August, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: Geo. Royce, president; H. H. Lang, R. E. Hore, Robert Fennell, and R. A. Darwin, directors. Corporation Management & Executives, Limited, is secretary-treasurer. The executive office is at 357 Bay Street, Toronto. The mine address is Wawa.

The company took over the property of the United Algoma Mines, Limited, which includes the old Grace mine. It is located in township 29, range 23, in the Michipicoten area, district of Algoma, and is about 7 miles by road from Wawa station on the Algoma Central railway.

Previous operators sank a 2-compartment, 60-degree shaft to a depth of 443 feet, and established four levels at 100-foot intervals. Stoping was done on the first three levels, the 100-foot level being stoped out.

The company started work in August, 1934, which consisted of surface construction and shaft-timbering until December, when underground development was started. No work had been done since 1930.

The development work accomplished during 1934, and the total to the end of 1934 on the various levels was as follows:—

Level	Drifting		Crosscutting		Raising	
	1934	Total	1934	Total	1934	Total
	feet	feet	feet	feet	feet	feet
200-foot	.....	640	.....	106	.....	50
300-foot	22	759	.....	226	.....	115
400-foot	35	1.304	25	381	78	118
Total	57	2,703	25	713	78	353

The plant used included a 750-cubic-foot Sullivan electric-driven compressor, and an electric hoist. Electric power is obtained from the High Falls plant of the Great Lakes Power Company. There is a 50-ton amalgamation-flotation mill on the property, which was constructed in 1929.

Buildings constructed in 1934 included a combined office and staff-house, two dwelling houses, and a stable.

An average of 16 men was employed, of whom 4 were underground from August. M. H. Frohberg was in charge of operations.

Delnite Mines, Limited

Delnite Mines, Limited, was incorporated in November, 1934, to develop the former La Roche property. This property was optioned by Erie Canadian Mines, Limited (a subsidiary exploration company wholly owned by Sylvanite Gold Mines, Limited) from July, 1934, until the new company was able to take it over. The company has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,999,990 shares are common and 10 are preferred. There were 840,000 shares issued to La Roche Mines, Limited, for the property. Sylvanite Gold Mines, Limited, has an option on 1,200,000 shares.

The officers and directors are: E. L. Koons, Buffalo, president; W. L. Marcy, Buffalo, vice-president; W. V. Moot, Buffalo, managing director; C. L. Ingham, Buffalo, treasurer; W. S. Walton, Toronto, secretary; Jas. E. Day,

James Savage, and Harry Yates, directors. The head office is 603 Royal Bank Building, Toronto. The mine address is Timmins. W. S. Maguire is general manager.

The property consists of 3 claims in Deloro township, district of Cochrane. They lie one mile west of the Marbuan and Ankerite mines. Two claims, H.R. 1,001 and H.R. 1,002 were formerly known as La Roche mine. The third claim, H.R. 944, the Rendix claim, was bought separately.

The following is taken from the report of the general manager for the period from July 19, 1934, to April 30, 1935:—

Prior to the commencement of operations by Erie Canadian Mines, Limited, there had been done on the two south claims, which then belonged to La Roche Mines, Limited, in addition to considerable surface trenching, 2,301 feet of diamond-drilling, 145 feet of shaft-sinking, and 610 feet of lateral work at the 125-foot level.

During the period July 19, 1934, to April 30, 1935, there was completed a total of 5,206 feet of diamond-drilling. Of this footage, 3,272 feet was drilled from surface prior to the commencement of underground operations. The balance of 1,934 feet was drilled from the 125-foot level while underground operations were in progress.

The 2-compartment shaft was dewatered and underground operations were commenced October 10, 1934. Three machine shifts per day were employed in addition to the diamond-drilling. During the period a total of 1,897 feet of lateral work was done on the 125-foot level, of which 465.5 feet was crosscutting and 1,432 feet was drifting.

In this lateral work, five ore shoots were developed with a combined ore length of 405 feet, which is estimated and classified as follows:—

Length	Width	Average value at $20.67	Average value at $35.00
	feet		
215 feet	5.2	$3.86	$6.53
190 feet	5.1	6.99	11.83

Preparations are now being made to deepen the shaft to the 250-foot level and to open up this horizon to establish the downward extensions of the above ore shoots. Lateral work on the 125-foot level will be continued.

The plant and equipment at the property are in satisfactory condition and are sufficient for the proposed development. The mine machinery is operated by electricity and consists of a 1,200-cubic-foot compressor driven by a 200 h.p. motor; an 8- by 10-inch single-drum, air-operated hoist; steel sharpener; machine-shop equipment; and electric-driven underground pump, with capacity for handling an increased flow of water.

The mine buildings include a headframe and shaft-house, hoist and compressor building, machine shop, carpenter shop, office, cookery, bunk-house with accommodation for thirty men, and mine superintendent's residence.

Mine communications have been improved during the year. The mine office has been connected by telephone with Timmins exchange. The road improvements made by the company now permit access from Timmins to the mine by motor in twenty minutes.

Exploration work has been in a strongly sheared and fractured zone in which the ore deposits are of an irregular character but have indicated encouraging values.

The ore sections developed to date on the 125-foot level and the diamond-drill intersections below this level warrant the continuation of the present shaft to the 250-foot level and the opening up of the mine at this horizon.

The manager in charge at the end of the year was Patrick Hamilton, who has since resigned. J. F. R. Akehurst is now mine manager. About 8 men are employed.

De Santis Gold Mining Company, Limited

De Santis Gold Mining Company, Limited, has a capitalization of 4,000,000 shares of $1 par value. The shares are all issued or under option. The following are the officers and directors: Peter De Santis, president and manager; Jos. V. Friel, vice-president; Giuseppe Giustini, secretary-treasurer; Luigi De Luca, Frank Prest, Biagio Ferreri, and Theodore Schulze, directors.

During 1934 the property in Ogden township, district of Cochrane, was worked from February until May and again from November until the end of the year. During that time about 1,600 feet of development work was accomplished. During the latter working period the results were very encouraging. Formerly indicated ore bodies have been developed on the 200-foot level and new bodies located on the western end of the same level in previously unexplored ground. Diamond-drilling has also indicated sections of ore in areas not yet reached by drifting. Development work is being continued aggressively.

There is no mill on the property. During 1933 some ore was trucked to the Hayden mine and milled there, when that company was inactive; during 1934 the work done at the De Santis has been entirely development and exploration work.

At the end of the year there were about 23 men employed at the mine. The superintendent in charge is Fred Knutson.

The head office of the company is located at 24½ Second Avenue, Timmins. The post-office address is Box 1299, Timmins.

Dome Mines, Limited

The authorized capital stock of Dome Mines, Limited, consists of 1,000,000 shares of no nominal or par value, of which 46,666 are held under an agreement in trust for the company; the dividends on these shares are returned to the treasury of the company. The mine is in the township of Tisdale, district of Cochrane.

The officers of the company are: Jules S. Bache, president and treasurer; H. P. De Pencier, first vice-president; G. C. Miller, second vice-president; Morton F. Stern, third vice-president; Alex. Fasken, secretary; E. P. Goetz, assistant treasurer and assistant secretary; C. C. Calvin, assistant secretary; John B. Robinson, assistant secretary.

The directors are: Jules S. Bache, Morton F. Stern, New York; G. C. Miller, Buffalo; Dwight B. Lee, Detroit; G. H. Harris, Innis P. Allen, Rochester; Alex. Fasken, Frank E. Maulson, Frederick Burnett, Toronto.

H. P. De Pencier is the general manager of the company, and J. H. Stovel is general superintendent.

The office of the executive and financial department is at 42 Broadway, New York. The Toronto office is at 36 Toronto Street. The mine address is South Porcupine.

The following is an extract from the general manager's report for the year ending December 31, 1934:—

During the year 587,200 tons were hoisted; of this 547,600 tons was ore which was sent to the mill and treated, and 39,600 tons was waste which was dumped on the surface. In addition, 16,200 tons of waste was dumped into old stopes.

The 547,600 tons of ore milled yielded bullion containing 203,896,878 ounces of gold, the yield per ton being 0.3723 ounces. In addition, there was recovered from the retreatment of by-product, 2,265.89 ounces.

All values of ore, etc., will be expressed in pennyweights throughout this report. One pennyweight equals one-twentieth of an ounce, troy weight.

The following statement gives particulars of revenue and expenditure for the year under review:—

OPERATING STATEMENT

for the year ended December 31, 1934

EARNINGS:		
Bullion production (after deduction of Dominion Government gold tax —$504,365.40)		$6,672,721.08
OPERATING AND MAINTENANCE EXPENDITURE:		
Development and exploration	$440,776.84	
Mining, including hoisting	802,717.15	
Crushing and conveying	100,385.15	
Milling	538,072.47	
Bullion expense	28,152.15	
Fire protection	7,407.36	
Warehouse expense	11,680.84	
Auditing expense	2,695.53	
Administrative expense:		
Mine office	82,794.29	
Executive office	59,063.19	
Registrar and transfer fees and expenses	13,812.15	
Municipal taxes	18,706.09	
Insurance	15,627.97	
Ontario corporation capital tax	1,213.00	
		2,123,104.18
NET OPERATING PROFIT FOR THE YEAR		$4,549,616.90

Development

The following table gives details of the development accomplished during the year:—

SUMMARY OF DEVELOPMENT BY LEVELS FOR YEAR 1934

Level	Stations	Drifts	Crosscuts	Drifts and crosscuts, slashing	Raises	Winzes	Boxholes	Raises, winzes, and boxholes, slashing	Total	Diamond-drilling
	feet	feet	feet	feet	feet	feet	feet	feet	feet	feet
1st	.....	571	117	169	26	6	580	84	1,553	.....
3rd	.....	.....	.....	14	42	.....	462	261	779	3,281
5th	.....	39	.....	24	15	.....	39	9	126	2,058
6th	.....	7	.....	2	247	.....	75	177	508	.....
10th	.....	113	56	27	194	25	125	57	597	.....
11th	.....	322	82	11	249	104	463	183	1,414	.....
12th	.....	366	455	79	285	40	694	318	2,237	2,346.5
13th	.....	320	28	28	478	73	275	67	1,269	4,326.5
14th	.....	360	363	23	220	.....	627	295	1,888	2,732
15th	.....	468	592	53	128	.....	26	.....	1,267	560
16th	.....	.....	8	.....	.....	.....	44	.....	52	2,135
17th	.....	248	272	12	.....	.....	.....	.....	532	.....
18th	.....	96	.....	18	11	.....	.....	.....	125	4,254.8
23rd	.....	45	70	46	388	.....	.....	95	644	.....
24th	.....	870	452	156	139	.....	.....	.....	1,617	2,732
25th	.....	611	160	62	113	120	.....	34	1,100	7,250.9
26th	26	1,172	192	161	246	150	.....	23	1,970	1,365
27th	26	733	655	80	197	122	.....	23	1,836	419
Total	52	6,341	3,502	965	2,978	640	3,410	1,626	19,514	33,460.7

Approximately 19,500 feet of drifting, crosscutting, raising, winzing, and box-holing, and 34,000 feet of diamond-drilling have been done in the course of searching for and opening up the various ore bodies.

Above the 6th level approximately 1,900 feet of development was done, mostly in connection with ore mined in the open pit area. This area yielded about 100,000 tons.

From the 6th to the 18th level about 7,600 feet of development was done, mostly in connection with known ore bodies or extensions of same.

In further development of the ore zone on and below the 23rd level, 2,968 feet of drifting, crosscutting, raising, and sinking has been done, also 9,982.9 feet of diamond-drilling. The winze has been sunk 386 feet, and 1,364 feet of drifting and crosscutting done on the 26th level and 1,388 feet on the 27th level, in partial development of these areas.

While no large mass of ore similar to that found on the 24th level has been disclosed by this work, the downward continuation of the vein structure in drift No. 2,504 described in last year's report has been located and drifted on for 560 feet on the 26th level and 60 feet on the 27th level. The 26th and 27th levels have been connected by raising, showing the ore to be continuous between these levels. From the appearance of the vein and its geological location it can safely be assumed that the vein is continuous to some point above the 25th level.

The presence of much visible gold in this vein makes it impossible to state definitely the grade of ore to be won but it will undoubtedly be high, possible about 15 dwt.

The work done to date indicates the possibility of securing upwards of 350,000 tons of good grade ore from the zone from the 23rd to 27th levels.

Development of a second entry to these levels is now under way. The work started will give needed ventilation to these lower levels and will permit of actual mining being done should further development not indicate the presence of ore bodies which would necessitate larger scale operations.

This new entry involves sinking from the 18th level and raising from the 23rd level. The raise from the 23rd level starts in a low-grade zone opened by No. 2,314 drift, which averages 3.09 dwt. for 120 feet. The raise shows this zone to extend upwards 160 feet above the 23rd level; also diamond-drilling indicates the possibility that it extends below the 24th level. The new entry will also enable further exploration to be done on the block of ground between the 18th and 23rd levels.

Of the tonnage milled, the stopes yielded 498,000 tons, averaging 7.8 dwt. per ton, and development work yielded 49,600 tons, averaging 5.06 dwt. per ton; a total of 547,600 tons, averaging 7.55 dwt. per ton.

Ore from stopes wholly in the sedimentary area yielded 95,171 tons, averaging 7.45 dwt. per ton. Ore from stopes wholly in the greenstones and partially in the greenstones yielded 402,829 tons, averaging 7.88 dwt. per ton.

The expenditure on mining was $802,717.15, or $1.47 per ton milled. The expenditure on development was $440,776.84, or $0.80 per ton milled.

Ore Reserves

The ore reserves are estimated at 2,000,000 tons. This includes 776,700 tons of broken ore but does not include the 350,000 tons indicated as possible ore between the 23rd and 27th levels. Ore in the sediments is estimated at 212,000 tons, and the ore in the greenstones and contact is estimated at 1,788,000 tons.

Exploration

As hitherto, we have continued to examine prospects and properties. Early in the year we took an option on control of a group of 21 claims in Bourlamaque township, Quebec. These claims are now held under the charter of Sigma Mines, Limited.

Mill

The following are the results of the mill operations during the year from a total of 547,600 tons treated.

	Value per ton	Extraction per cent.
	dwt.	
Heads	7.5499	.....
Recovery	7.4467	98.63

Under Mr. C. W. Dowsett's skilful guidance the recovery in the mill has reached the high figure herewith recorded.

The small plant treating old iron and other scrap has produced approximately 2,266 ounces of gold.

General

Operating costs for the year were $3.877 per ton milled, as against $3.729 in the year 1933. The increase is due to increase in broken ore reserves and underground conditions.

Duport Mining Company, Limited

Duport Mining Company, Limited, was incorporated in 1929, with an authorized capitalization of 2,000,000 shares of no par value. The officers and directors are: J. G. Cross, president; Thayer Lindsley, vice-president; W. J. Matthews, secretary-treasurer. The head office is at the Public Utilities Building, Port Arthur. The mine address is Box 591, Kenora.

The property held by this company includes Cameron Island, located in Shoal lake, Lake of the Woods area, district of Kenora, on which is situated the old Damascus mine. Former operators sank a 2-compartment inclined shaft to a depth of 132 feet in the early days, and established levels at 61 and 124 feet, where they accomplished 80 and 232 feet of drifting, respectively.

During the winter of 1933-34 a considerable amount of diamond-drilling was done through the ice around the island, and in July a mining plant was taken in to the property and the construction of buildings started. Underground work was begun in December, and by the end of the year 30 feet of drifting had been accomplished on the 124-foot level.

The plant included an 84 h.p. boiler, 40 h.p. boiler, 300-cubic-foot steam-driven compressor, and a 7- by 9-inch hoist. Buildings constructed during the year included a shaft-house, power-house, office, and cook-house.

J. G. Cross was in charge of operations, employing about 20 men, 9 of whom are underground.

Ed. Hargreaves Kirkland Gold Mines, Limited

Ed. Hargreaves Kirkland Gold Mines, Limited, is capitalized at 3,000,000 shares of $1 par value, 1,300,000 of which have been issued. The officers and directors are: Floyd J. Zuck, president; C. W. Zuck, vice-president; Harvey M. Willis, secretary-treasurer; S. A. Waugh, J. A. MacVichie, and D. R. Dewart, directors. The head office and mine office are at Kirkland Lake. A business office is maintained at 1007 Bank of Hamilton Building, Toronto.

The company owns 5 claims in Lebel township, district of Timiskaming, on which a shaft had previously been sunk to a depth of 162 feet. The present company began underground operations in December, 1934, driving a crosscut on the 160-foot level.

The plant consists of a 60 h.p. locomotive-type boiler, a 300-cubic-foot steam-driven compressor, and a 6- by 8-inch steam hoist.

J. A. MacVichie is mine manager, employing 20 men.

Excello Mines, Limited

Excello Mines, Limited, was incorporated in December, 1933. It is capitalized at 3,000,000 shares of $1 par value. The officers and directors are: John R. Serson, president; John J. Gardner, vice-president; Hugh Dougherty, secretary-treasurer; J. E. Dougherty, H. R. M. Turner, and Eric Horwood, directors. The head office is at 159 Bay Street, Toronto.

The property consists of 5 claims bordering on the boundary line between Deloro and Shaw townships, district of Cochrane, two claims being in the former township and three in the latter. The property was at one time held by Furness Mines, Limited, and later by the Dougherty Syndicate. It is 3 miles south of the town of South Porcupine, which is the post-office address.

A shaft has been sunk on the property to a depth of 185 feet and one level at the 125-foot level developed to the extent of about 1,200 feet of lateral work.

Some surface work consisting of trenching and diamond-drilling was done on the property during the summer of 1934, but the work was discontinued in the fall. No work was done underground during the year. There was no mining plant on the property when inspected in August, 1934. At that time there were 10 men employed at the property under the supervision of H. R. M. Turner.

Federated Mining Corporation, Limited

The authorized capitalization of the Federated Mining Corporation, Limited, is 5,000,000 shares of $1 par value. Officers and directors are: Maj.-Gen. Alex. McDougall, president; Frank E. Horne, vice-president; R. J. Kennett, secretary-treasurer; Ingersoll E. Haight, managing director; A. F. Kenning, Martin Knutson, and Thos. K. Smith, directors. The head office of the company is at 11 King Street West, Toronto.

The company acquired the assets of New York Porcupine Mines, Limited, which company surrendered its charter in 1933. The main asset of the company is a 40-acre claim (southwest quarter of the south half, lot 4, concession I), which adjoins the Dome mine on the south side, in the township of Tisdale, district of Cochrane. Other properties held are an additional 160 acres in the same area and 8 claims in the Kowkash area of Thunder Bay district.

On the old New York Porcupine property a shaft has been sunk to a depth of about 265 feet. Two levels, at 125 feet and 250 feet, have been partly developed. About 325 feet of development work has been done from the first level. On the second level, there has been approximately 4,000 feet of crosscutting and drifting done and several raises started and a winze sunk approximately 90 feet. This winze was full of water when the property was inspected. A short sublevel drift has also been driven from one raise from the 250-foot level.

Surface equipment on the property is fairly complete. The plant equipment includes a Jenckes hoist, driven by 75 h.p. motor; a Sullivan air compressor, 510-cubic-foot capacity, powered by an electric motor; an Atlas Diesel engine, type T2K, 100 h.p., not in use; a 75 h.p. locomotive-type boiler, used for heating only.

Buildings include a compressor-house, shaft-house, blacksmith shop, dry-house, carpenter shop and machine shop, cookery, bunk-house, office, power substation, and residence.

At the end of the year the company was reported to be making preparations to deepen the shaft to the 500-foot level. No work was done underground by the Federated Mining Corporation during 1934 other than pumping out the mine. Geo. Doane is mine manager. The mine address is Box 501, South Porcupine.

Foley O'Brien Corporation, Limited

The Foley O'Brien Corporation, Limited, was incorporated in 1934, with 2,100,000 authorized shares of $1 par value, of which 600,000 shares were paid to the shareholders of Foley O'Brien, Limited, for property purchased and as commission on the transaction.

The officers and directors of the company are: Wm. H. Kinch, president; Samuel J. Dark, secretary-treasurer; John G. Ullmann, A. J. McNab, and Carroll Searls, directors. The head office and mine office are at South Porcupine.

The property consists of 520 acres in concessions I and II of Tisdale township, district of Cochrane, and adjoins the holdings of Dome Mines, Limited, on the northeast corner.

Prior to taking over the property in 1934, a considerable amount of work had been done. No. 1 shaft had been sunk to a depth of 79 feet and the following lateral work done: on the 39-foot level, 80 feet; on the 50-foot level, 10 feet; on the 79-foot level, 65 feet. No. 2 shaft had been sunk to a depth of 165 feet. On the 160-foot level 700 feet of lateral work had been done, and from this level a winze had been sunk 90 feet; from the bottom of the winze on the 250-foot level 670 feet of lateral work had been done and 20 feet of raising.

No. 3 shaft has not been pumped out by Foley O'Brien Corporation, Limited, but it is said to be 235 feet in depth, and on the 80-foot level 145 feet of lateral work is said to have been done, and 130 feet more at the 230-foot level. The property has had no production.

Foley O'Brien started active work in July, 1934, and for the balance of the year employed an average of about 25 men.

Their work has consisted principally of diamond-drilling from surface and from underground, and of surface exploration work. About two-thirds of the labour has been employed at the former work. Two machines have been kept in operation on three shifts per day. The only other drilling done underground was the drilling of short raises to make room to set up the diamond-drills underground. Surface exploration has consisted of deep trenching, much of which has been done by mechanical shovels.

There is a small mining plant on the property. P. C. Benedict is superintendent in charge of the work.

Foley Syndicate

In November, 1932, British Canadian Mines, Limited, turned over their Foley mine near Mine Centre, in Rainy River district, to the Foley Syndicate, under an operating agreement.

This syndicate continued operations at the old south shaft until March 25 1934, when the agreement was cancelled. From January 1, 1934, until operations were suspended, about 300 tons of ore was obtained from open stoping on the 50-foot level, and milled in the small amalgamation mill on the property.

The property remained dormant until August 1, when British Canadian Mines, Limited, turned it over to Russell Cone, to whom they owed wages. Cone operated the mine until October 25, during which period about 200 tons of ore was obtained from underhand stoping on the 50-foot level, and milled for sufficient profit to pay his back wages.

About 8 men were employed during both periods of operation under the direction of Russell Cone.

Four Nations Consolidated Gold Mines, Limited

Four Nations Consolidated Gold Mines, Limited, own 6 claims (250 acres) in Gauthier township and 11 claims (416 acres) in Grenfell township, district of Timiskaming. Four Nations acquired a 90 per cent. interest in these claims for $100,000, payable over a period of 5 years. The company is capitalized at $5,000,000, in shares of $1 par value, and 2,673,261 shares are issued. The officers and directors are: H. W. Waters, president; W. G. Rook, vice-president and general manager; E. M. Williamson, secretary; Max Kaplan, treasurer; Sam Harris and Fred Killer, directors. J. F. R. Akehurst was mine manager. The executive office is at 372 Bay Street, Toronto.

Previous to 1933 a shaft was sunk 500 feet, with levels at 125, 250, 375, and 500 feet, and considerable lateral work had been done. Operations were resumed

on November 25, 1933, and ceased on November 1, 1934. During that time 1,065 feet of drifting and 1,451 feet of crosscutting was done. An average of about 40 men was employed.

Fox Lake Gold Syndicate

The officers of Fox Lake Gold Syndicate are: H. H. Childs, president, and J. W. Westervelt, trustee. The executive office is at the New Bank of Toronto Building, London. The mine address is Box 175, Espanola.

The property includes a group of 9 mining claims in Mongowin township, district of Sudbury. It is on the Espanola–Little Current highway, about 12 miles from Espanola. Surface work was started on this property in June, and in November the construction of a 25-ton amalgamation mill was commenced. By the end of the year it was nearly completed. It is planned to use this mill at first to treat ore from surface operations. No underground work was done in 1934.

Mill equipment includes a jaw-crusher, ball mill, concentrating table, and amalgamation plates. It is to be operated by a Diesel engine. Buildings erected included a mill, blacksmith shop, office, bunk-house, cook-house, and four dwelling houses.

An average of 19 men was employed under the direction of L. W. Adams.

Gold Eagle Gold Mines, Limited

Gold Eagle Gold Mines, Limited, is capitalized at 3,000,000 shares of $1 par value, about half of which have been issued. The officers and directors are: Chas. E. St. Paul, Toronto, president and managing director; Howard O. Babcock, Buffalo, vice-president; John T. Oliver, Toronto, secretary-treasurer; Nelson S. Taylor and William L. Marcy, Jr., Buffalo, directors. The head office is at 357 Bay Street, Toronto.

The property is situated on McKenzie island in Red lake, district of Kenora, Patricia portion. The holdings total approximately 960 acres.

A diamond-drilling campaign was commenced on this property in December, 1933, and completed in May, 1934. About 5,000 feet of drilling was done. The following buildings were constructed later in the year: 2 bunk-houses, each 20 by 24 feet; storehouse, 20 by 30 feet; dry-house, 16 by 24 feet; blacksmith shop, 16 by 24 feet; hoist-house, 24 by 30 feet; water tank, 15,000 gallons capacity; powder magazine; pump-house, 8 by 10 feet; office building, 16 by 24 feet. Equipment installed includes 2 steam, return tubular boilers, each 100 horse-power; Marsh hoist; 10 by 12 inches; Ingersoll-Sargent 4-drill compressor; steel sharpener and oil furnace; and a single-action pump, 1,500 gallons per hour capacity, powered by a 25 h.p. vertical steam boiler.

The entire plant was in operation by December, 1934; sinking was then begun. It is the intention to put the shaft down to the 500-foot level. The 1st level station at the 125-foot level was being cut about the end of the year. Alex. Gillies is the resident manager. An average of 6 men was employed. The mine address is Red Lake.

Gold Lands Syndicate of Algoma

In 1933 the Gold Lands Syndicate of Algoma took over a group of 9 mining claims, known as the Edwards property, in township 48, range 27, district of

Algoma. It is 6 miles southwest of Lochalsh station on the Canadian Pacific railway. H. C. Miller, 29 Melinda Street, Toronto, is trustee of the syndicate, which has a capitalization of $33,000.

Underground operations were suspended at the end of January, 1934, at which time 60 feet of crosscutting had been accomplished on the 100-foot level. Surface work was carried on until July. At the end of the year the property was optioned to Orecana Trusts, Limited, who then started examination work.

Gold Range Mines, Limited

Gold Range Mines, Limited, was incorporated in July, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: M. L. Piper, president; A. V. Hannam, vice-president; and E. Duguid, secretary-treasurer. The head office is at 1604 Royal Bank Building, Toronto.

The property acquired by this company consisted of a group of 47 claims, located about 2 miles east of Schreiber, on the main line of the Canadian Pacific railway, in Thunder Bay district. On claim T.B. 3,326 previous operators drove two adits, in which they accomplished a total of 190 feet of development work.

This company started work in August and suspended operations in December. A total of 45 feet of drifting was done in the old No. 2 adit.

The plant installed included a 20 h.p. vertical boiler, and a 220-cubic-foot Ingersoll-Rand gasoline compressor. Buildings on the property consisted of a power-house, warehouse, powder-house, 2 bunk-houses, 4 dwelling houses, cook-house, and office.

About 14 men were employed, under the direction of A. V. Hannam.

Golden Gate Mining Company, Limited

Golden Gate Mining Company, Limited, is capitalized at 3.000,000 shares of $1 par value. The officers and directors are: F. G. Fitzgerald, president; C. H. Kemp, secretary-treasurer; both of 59 Yonge Street, Toronto. S. A. Pain was mine manager. The mine address is Kirkland Lake. The property consists of 250 acres in the township of Teck, district of Timiskaming, which was acquired from Kirkland Gateway Gold Mines, Limited, through the Lucky Cross Leasing Syndicate, in return for the issue of 850,000 shares of Golden Gate to Kirkland Gateway and 250,000 shares to the syndicate.

The mine was dewatered by the Lucky Cross Leasing Syndicate in February, 1934, and sampled. The Golden Gate Mining Company, Limited, took over operations in August, 1934, and kept the mine dewatered for the balance of the year while financing was in progress. Two drills were put into operation underground on March 1, 1935; and 150 feet of drifting had been completed on the 200- and 350-foot levels when operations were suspended on March 24, 1935. The mine is being kept dewatered, and it is planned shortly to start diamond-drilling underground.

Golden Star Consolidated Mines, Limited

Golden Star Consolidated Mines, Limited, was incorporated in February, 1934, with an authorized capitalization of 2,000,000 shares of $1 par value. The officers and directors were: W. J. Beckett, president; Brig.-Gen. C. L. Hervey, vice-president; L. J. Vetter, secretary-treasurer; J. V. Ronaldson and T. S. Ronaldson, directors. The head office was at 306 Sterling Tower, Toronto.

The property acquired included the old Golden Star mine, which produced $161,000 in gold prior to 1901. It consists of three claims located about two miles south of Mine Centre, on the Fort Frances branch of the Canadian National railway, in the district of Rainy River. In addition, an option was taken on the adjoining Ferguson property.

Previous operators of the Golden Star mine sank a 2-compartment, 65-degree shaft to a depth of 480 feet on the incline, and established levels at 75, 155, 231, 306, 337, and 431 feet. Stoping was done on the first four levels. They left a small amalgamation mill on the property.

Work was started in March, 1934, and suspended in November. A mining plant was installed, and the old workings were dewatered and sampled. The old amalgamation mill was used intermittently from March until October, during which period it treated a total of 260 tons of ore. The major part of this ore was obtained from the surface dumps on the Ferguson property, and the balance from those on the Golden Star property.

The plant installed included two 30 h.p. boilers, a 175-cubic-foot compressor, and a 9- by 12-inch steam hoist. Buildings constructed included a power-house, hoist-house, blacksmith shop, cook-house, and bunk-house.

The mill equipment included a jaw-crusher, 5 gravity stamps, concentrating table, cone regrinder, and amalgamation plates. It was operated by steam.

An average of 26 men was employed under the direction of C. N. Thompson.

Golden Summit Mines, Limited

Golden Summit Mines, Limited, has a capitalization of 2,500,000 shares of $1 par value, of which 1,551,152 have been issued. The officers and directors are: Wm. J. Simpson, president; Benjamin Kerr, Jr., vice-president; Gordon Belyea, secretary-treasurer; John M. Calder, J. G. Jarvis, Dr. J. J. Matheson, and Theodore G. Miller, directors. The head office is at 2374 Bloor Street West, Toronto. The mine office is at Sesekinika.

The company owns 460 acres in the townships of Maisonville and Grenfell, district of Timiskaming.

The shaft was sunk from 142 feet to 405 feet during 1934. Lateral work consisted of 307 feet of crosscutting on the 250-foot level, and 330 feet of crosscutting and 50 feet of drifting on the 375-foot level.

During the year a new hoist, compressor, two 60 h.p. boilers, air-receiver, cage, and several mine cars were added to the equipment.

Wm. J. Simpson was manager, employing an average of 28 men.

Goodfish Mining Company, Limited

Goodfish Mining Company, Limited, owns 16 claims in Morrisette township, district of Timiskaming. The present company was formed as a reorganization of the Goodfish Gold Mines, Limited, and old shareholders were given 1,749,629 shares, on the basis of one of the new shares for two of the old. The company is capitalized at 3,500,000 shares of $1 par value. The directors are: A. J. Perron, president; Melvin G. Hunt, vice-president and secretary-treasurer; George Cooper, Jessie L. Hunt, and Ida Larkin, all of Kirkland Lake, directors. The head office and mine office are at Kirkland Lake.

Operations were resumed in July, 1934. Nos. 1 and 3 shafts were dewatered and sampled, and approximately 370 feet of drifting was done on the 200-foot level of No. 3 shaft. The mine was closed down in November, 1934.

I. E. Mosher was manager, employing an average of 12 men.

Greenlaw Gold Mines, Limited

Greenlaw Gold Mines, Limited, was incorporated in 1933, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: J. J. Byrne, president; W. B. McPherson, secretary-treasurer; M. J. Shunsby, J. C. Byrne, and M. D. Gray, directors. The head office is at 244 Bay Street, Toronto.

The property of the company includes a group of 19 claims in Greenlaw township, in the Swayze area, district of Sudbury.

In January, 1934, a 7- by 9-foot, 75-degree shaft was started. Operations were suspended in March after sinking the shaft to a depth of 50 feet and accomplishing about 50 feet of lateral work at that horizon. This work was done by hand-steel and windlass. Buildings consisted of a blacksmith shop, bunk-house, cook-house, and powder-house.

Three men were employed under the direction of Martin Shunsby.

Halcrow-Swayze Mines, Limited

Halcrow-Swayze Mines, Limited, was incorporated in 1932, with an authorized capitalization of 2,500,000 shares of $1 par value. The officers and directors were: Horace F. Strong, president; H. A. Butt, vice-president; J. B. Allen, secretary-treasurer; W. J. Yeoell and Martin Shunsby, directors. The head office is at 25 King Street West, Toronto.

The company continued operations throughout 1934 at their property in Halcrow township, in the Swayze area, district of Sudbury. The 2-compartment vertical shaft was sunk an additional 159 feet to a total depth of 371 feet, and a sublevel was established at 270 feet and a level at 354 feet.

The total development work accomplished to the end of 1934 on the various levels was as follows:—

Level	Drifting	Crosscutting	Raising
	feet	feet	feet
200-foot	1,198	420	30
270-foot sub	40	40	30
354-foot	306	170	42
Total	1,544	630	102

A total of 4,330 feet of diamond-drilling had been done to the end of 1934, of which 2,328 feet was from underground.

A 25-ton test mill was constructed on the property in the fall of 1934, and a total of 270 tons of ore was treated by the end of the year. The mill equipment included a jaw-crusher, ball mill, drag-classifier, and flotation cell. A 38 h.p. Diesel engine was installed as motive power but was found unsatisfactory and replaced by a gasoline engine.

The plant used included two 25 h.p. boilers, an 8¼- by a 10-inch steam hoist, and a 310-cubic-foot GD gasoline compressor.

An average of 24 men was employed during the year, of whom 8 were underground. Horace F. Strong was in charge. The mine address is Chapleau.

Hard Rock Gold Mines, Limited

Hard Rock Gold Mines, Limited, was incorporated in January, 1934, with an authorized capitalization of 2,500,000 shares of $1 par value. The officers

and directors were: T. H. Rea, president; Jos. Errington, vice-president; W. S. Walton, secretary-treasurer; A. B. Gordon and H. R. Aird, directors. The head office is at 603 Royal Bank Building, Toronto.

This company was formed to take over the property of the Hard Rock Syndicate, which comprises 15 claims, totalling about 810 acres, in Ashmore township, in the Little Long Lac area, Thunder Bay district. It is reached in summer by boat from Hardrock station, and in winter by road from Geraldton station. The post-office address is Geraldton.

During the spring and summer of 1934 a total of 10,109 feet of diamond-drilling was accomplished. A 3-compartment vertical shaft was started in September on claim T.B. 9,985, and sinking was still in progress at the end of the year, at which time the shaft had reached a depth of 140 feet.

Buildings erected included a power-house, boiler-house, blacksmith shop, warehouse, bunk-house, cook-house, powder-house, and manager's residence. The plant installed included a 100 h.p. boiler, a 9- by 8-inch Ingersoll-Rand double-drum hoist, a 530-cubic-foot Ingersoll-Rand Diesel compressor, and a 300-cubic-foot Ingersoll-Rand semi-Diesel portable compressor.

An average of 36 men was employed from August, under the direction of J. C. Dumbrille.

Harkness-Hays Gold Mines, Limited

Harkness-Hays Gold Mines, Limited, was incorporated in July, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: A. M. Nielsen, president; and H. L. Van Norstrand and Herbert Duncan, directors. The head office is at 372 Bay Street, Toronto.

The property acquired by this company consisted of a group of 8 claims, situated two miles east of Schreiber, Thunder Bay district, which included the property of Harkness-Hays Gold Mining Company, Limited. Three adits were driven by the latter company on claims T.B. 3,327 and 3,354, in which they accomplished a total of 1,270 feet of development work.

Operations were started by the present company in July. Two new adits were started, in which a total of 255 feet of development work was accomplished by the end of 1934. This work was done with a 220-cubic-foot Ingersoll-Rand gasoline compressor.

Buildings on the property consisted of a power-house, blacksmith shop, oil storage, 2 bunk-houses, and a cook-house.

About 10 men were employed, under the direction of J. F. Anderson. The mine address is Schreiber.

Hillside Gold Mines, Limited

Hillside Gold Mines, Limited, was incorporated in August, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. E. V. McMillan was president; G. E. McMillan, 45 Queen Street East, Sault Ste. Marie, was secretary-treasurer.

The property consists of 35 mining claims, located in the northeast part of township 29, range 23, in the Michipicoten area, district of Algoma.

Work was started on claim S.S.M. 4,925 in September and suspended early in December, during which period an adit was driven for a distance of 400 feet, using a gasoline compressor. Buildings erected included a power-house, blacksmith shop, office, 3 small bunk-houses, and a cook-house.

An average of 15 men was employed under the direction of D. S. Baird. The mine address is Wawa.

Hollinger Consolidated Gold Mines, Limited

The authorized capital of Hollinger Consolidated Gold Mines, Limited, is $25,000,000, in 5,000,000 shares of $5 par value; 4,920,000 shares were outstanding on December 31, 1934. The head office is at Timmins.

The officers of the company are: Noah A. Timmins, president; Jules R. Timmins, vice-president; John B. Holden, secretary-treasurer; A. F. Brigham, consulting engineer; John Knox, general manager. The directors are: Noah A. Timmins, John B. Holden, Jules R. Timmins, Wilson Bell, Senator W. L. McDougald, Leo H. Timmins, Allen A. McMartin, James Y. Murdoch, and John I. Rankin.

The following is taken from the general manager's report for the year ending December 31, 1934:—

PROFIT AND LOSS STATEMENT

for year ending December 31, 1934

SOURCES OF 1934 INCOME:			
Net proceeds from gold and silver (after deducting amount of Dominion bullion tax, $1,091,626.26)			$13,988,824.04
Interest on investments and other income			188,438.89
			$14,177,262.93
DISPOSAL OF 1934 INCOME:			
General charges		$648,070.62	
Mining charges		5,650,091.93	
Milling charges		1,131,857.10	
			7,430,019.65
			$6,747,243.28
DEDUCT:			
Taxes—			
Province of Ontario	$237,335.35		
Royalty to Town of Timmins	60,873.43		
Municipal to Town of Timmins	58,554.93		
Royalty to Township of Tisdale	12,126.91		
Municipal to Township of Tisdale	2,296.03		
Municipal to City of Toronto	33.82		
Dominion, provincial, and municipal, reserve for	282,406.33		
		$653,626.80	
Silicosis assessment, 1934		35,257.19	
			688,883.99
Net profit from operations before depreciation			$6,058,359.29
Depreciation:			
Plant		$15,017.60	
Investments in other companies and properties written down		2,662.76	
Expenditures on properties abandoned		48,234.09	
			65,914.45
NET PROFIT FROM OPERATIONS CARRIED TO SURPLUS ACCOUNT			$5,992,444.84

SURPLUS ACCOUNT

BALANCE BROUGHT FORWARD, JANUARY 1, 1934	$5,439,325.79
NET PROFITS FROM OPERATIONS	5,992,444.84
NET PROFITS FROM THE SALE OF SECURITIES AND OTHER ASSETS	512,917.83
TRANSFERRED FROM CONTINGENT RESERVE	246,324.33
	$12,191,012.79
PAID OUT IN DIVIDENDS	6,888,000.00
BALANCE CARRIED FORWARD, DECEMBER 31, 1934	$5,303,012.79

BULLION STATEMENT

INVENTORY, JANUARY 1,1934:		
Solutions		$104,257.24
Slags, litharge, and miscellaneous		880.00
Precipitates held over		2,435.00
Gold in process to scavenger		14,500.00
Silver		11,802.83
		$133,875.07
VALUES PRODUCED IN 1934:		
Ore milled	$14,601,036.80	
Tailings loss	612,212.76	
		13,988,824.04
		$14,122,699.11
INVENTORY, DECEMBER 31, 1934		
Solutions		92,403.20
Slags, litharge, and miscellaneous		880.00
Precipitates held over		3,671.00
Gold in process to scavenger		4,500.00
Silver		3,987.94
		$105,442.14
BULLION SHIPPED DURING 1934		14,017,256.97
		$14,122,699.11

YEARLY AVERAGE COSTS

Account	Sundries	Labour	Stores	Total	Per ton ore milled
General miscellaneous charges and administration	.....	$248,614.27	$129,807.49	$378,421.76	$0.1991
Surface services	.....	53,073.00	37,690.00	90,763.00	.0478
Fire insurance	$18,328.46	.....	.....	18,328.46	.0096
Group insurance	.....	53,399.80	.....	53,399.80	.0280
Marketing bullion	33,448.74	.....	.....	33,448.74	.0176
Workmen's compensation	.....	73,708.86	.....	73,708.86	.0388
Milling charges	.....	446,471.30	685,385.80	1,131,857.10	.5956
Mining charges	.....	3,983,770.85	1,666,321.08	5,650,091.93	2.9730
Silicosis assessment	.....	35,257.19	.....	35,257.19	.0186
Total charges	$51,777.20	$4,894,295.27	$2,519,204.37	$7,465,276.84	$3.9281

Employees

The average number of men employed during the year has been 2,660, distributed as follows:—

MINERS:		MECHANICS:		GENERAL:	
Exploration	31	Operation	112	Mill and refinery	213
Development	441	Maintenance	190	Technical	77
Production	1,386			Clerical	39
				Miscellaneous	133
				Outside properties	38
Total	1,858	Total	302	Total	500

There were also employed at outside properties on December 31, 1934, a total of 116 men, as follows: Hislop, 39; Cochenour-Willans, 37; Gold Island, 26; Long Lake, 14.

The Mill

Milling results were as follows:—

Ore milled	tons	1,900.490
Average value per ton		$7.68
Gross value	$14,601,036.80	
Deduct loss in tailings	612,212.76	
Net value received		$13,988,824.04

Average tons per day		5,236
Per cent. of possible time run		90.8
Tons per 100 per cent. running time		5,767
Solution precipitated per ton ore	tons	0.98
Value per ton tailings		$0.32
Cyanide consumed per ton of ore	lbs.	0.482
Zinc consumed per ton of ore	lbs.	0.045
Zinc consumed per ton of solution	lbs.	0.046
Lime consumed per ton of ore	lbs.	2.170
Lead acetate per ton of ore	lbs.	0.007
Average value of pregnant solution		$7.54
Average value received per ounce of gold sold		$32.16

Ore Reserves

Our ore reserves on the 31st of December, 1934, consisted of 7,061,926 tons, of a total value of $51,440,260, having an average value of $7.28 per ton. These figures compare with 6,487,559 tons of a total value of $48,430,451.00, having an average value of $7.47 per ton, at the end of 1933.

In the calculations dealing with ore reserves, the statutory price of gold, namely $20.67 per ounce, has been taken as the basis of value, and the same minimum ore grade as used in former years continued.

Hollinger Mill

During the year investigations have been carried on to determine the possibility of improving the extraction, having in mind the greater loss in tailings due to the increase in value of gold. As yet these investigations have not been productive of any positive results.

Hollinger Mine

As stated in the last annual report, operations have been carried on on all levels from the surface to the 3,950-foot level. About 35.8 per cent. of the ore milled came from above the 800-foot level. During the year 877,837 tons of backfill were placed. There has been a further increase in exploration in the backfilled areas mentioned in the last report, and as a result you will note that the total percentage of ore mined above the 800-foot level is slightly in excess of the figure of last year.

Operations in the block between the 2,750-foot level and the 3,950-foot level are still confined to development. It is gratifying to note that there has been a further increase of $3,000,000 in the ore reserves.

The drift west from the Schumacher shaft, mentioned in the last annual report, has been extended, and some interesting ore occurrences disclosed. Investigations have as yet not proceeded far enough to give these discoveries any weight in the general picture.

The shaft below the 3,950-foot level, known as No. 25 shaft, has been sunk to 50 feet below the 4,250-foot level, but no development commenced as yet.

Young-Davidson Mine

As noted in the president's remarks, the Young-Davidson mill went into operation September 8, 1934, and has continued to operate with a surprisingly small number of adjustments. There was some difficulty with the crushing due to the toughness of the ore; this has been overcome and the daily tonnage is now about 625 tons.

The open-pit operation has continued throughout the winter, but under many difficulties, and our experience indicates that underground mining will be more satisfactory during the winter months. Plans are under way for this development.

To date the gold content in the Young-Davidson ore has been $1.76 on $20.67 basis, or $2.88 on the new price. Bullion shipments are being regularly made. Some 51,842 tons had been treated to the end of the year, and operating profits amounted to $53,604.99.

The minor changes and alterations in methods have prevented us from arriving at a true cost, but operations to date have been conducted at a profit.

Hislop Property

A shaft was sunk to a depth of 150 feet and a crosscut driven to intersect the east ore body. In drifting on this level some encouraging assays have been obtained, but the work has not proceeded sufficiently to justify any definite statements as to average values and widths of ore body. The crosscut on the same level being driven to the west has not advanced sufficiently to intersect the west ore body.

The following is taken from the consulting engineer's report on outside properties as at December 31, 1934:—

During 1934, 108 prospects were examined, 96 in the province of Ontario, 10 in the province of Quebec, and one each in Manitoba and Nova Scotia. In many cases the properties were examined in considerable detail, but none showed sufficient merit to warrant our further interest.

The immediate vicinity of the Young-Davidson and Hislop Township properties were given very thorough investigations in order that similar occurrences of ore should not be overlooked.

Prospecting, development, and exploration work on outside properties (except the Young-Davidson) involved an expenditure of $320,000.

Cochenour-Willans

An option was obtained on the Cochenour-Willans property in the Red Lake area, district of Kenora, Patricia portion. This property consists of about 500 acres adjoining the claims of McKenzie Red Lake Gold Mines. Work commenced late in the fall of 1934, and by the end of the year a 3-compartment shaft had been sunk to a depth of 150 feet and 80 feet of lateral work had been done on the 150-foot level.

Gold Island

An option was obtained on the Gold Island property at Night Hawk lake, township of Cody, district of Cochrane. Work commenced late in the year and continued until about the end of January, 1935. At the time of cessation of operations a shaft had been sunk 180 feet and a station had been cut at the 170-foot level.

Horseshoe Mines, Limited

Horseshoe Mines, Limited, was incorporated in 1929, with an authorized capital of 4,500,000 shares of $1 par value. The officers and directors were: W. A. Lamport, president; A. Kelly Evans, vice-president; C. M. Chandler, secretary-treasurer; J. H. Lumbers, W. B. Kendall, and G. G. Goodelle, directors. The head office is at 302 Royal Bank Building, Toronto.

The property of this company includes the old Regina mine in the Lake of the Woods area, district of Kenora. It is 45 miles southeast of Kenora.

Operations at the Regina mine were carried on from July, 1933, until early in February, 1934. During July and August, the mine was again dewatered and a small amount of work done, following which operations were again suspended.

Howey Gold Mines, Limited

Howey Gold Mines, Limited, was incorporated in March, 1926. It has an authorized capitalization of 5,000,000 shares of $1 par value, all issued. The officers and directors are: R. T. Birks, president; W. S. Cherry, vice-president, H. C. McCloskey, secretary-treasurer; J. E. Hammell and John A. Northway; directors. Fraser D. Reid is general manager, and Edward Futterer is resident manager. The head office and mine office are both at Red Lake. The executive office is at 717 Federal Building, Toronto.

The company holds approximately 900 acres in the Red Lake area, district of Kenora, Patricia portion. Transportation to the property is by water route from Hudson, on the Canadian National railway, or by airplane. The average number of men employed per month during 1934 was 231.

The following is taken from the general manager's fiscal year ending December 31, 1934:—

SUMMARY OF WORK ACCOMPLISHED

	1934	1933	1932
Drifts, crosscuts, raises, etc.....feet	3,955	1,879	3,562.5
Shafts and winzes.....feet	177	200	430.5
Shaft stations, slashing, etc.....cu. yds.	296	3,860	1,550
Diamond-drilling (underground).....feet	3,629	1,837.6	1,856.6
Diamond-drilling (outside exploration).....feet	851	.....	701
Box-holes.....feet	972	1,883	830.5
Ore broken.....tons	481,492	414,611	339,675
Low-grade material discarded by sorting.....tons	85,648	53,170	44,585
Milled after sorting.....tons	396,109	290,965	284,664
Broken reserves in stopes (Jan. 1, 1935).....tons	301,990	276,526	206,150

EARNINGS STATEMENT

	1934	1933	1932
Total receipts from sales of gold and silver	$1,594,222.51	$1,158,470.03	$1,268,780.07
Total operating cost, including Toronto office expenses	881,869.52	770,010.56	813,368.11
Operating profit	$712,352.99	$388,459.47	$455,411.96

MISCELLANEOUS OPERATING DATA

	1934	1933	1932	Total from start of operations
Tonnage milled and sorted	481,757	344,135	329,249	1,493,247
Tonnage discarded by sorting	85,648	53,170	44,585	199,519
Tonnage milled	396,109	290,965	284,664	1,293,728
Value a ton hoisted	$2.20	$2.73	$3.70	$3.12
Value a ton material discarded by sorting	$0.21	$0.54	$0.42	$0.387
Value a ton of ore milled	$2.64	$3.12	$4.21	$3.54
Loss in tailings a ton milled	$0.214	$0.24	$0.27	$0.257
Loss a ton of ore hoisted (in milling and sorting)	$0.213	$0.286	$0.29	$0.274
Net percentage recovery a ton of ore hoisted	90.3	89.5	92.4	91.2
Total net recovery of gold and silver	$1,594,222.51	$1,158,470.03	$1,268,780.07	$5,396,191.55

N.B.—All values are figured on gold at $20.67 per ounce.

ANALYSIS OF COSTS

	1934 (481,757 tons)		1933 (344,135 tons)		1932 (329,249 tons)	
	Total cost	Cost per ton milled and sorted	Total cost	Cost per ton milled and sorted	Total cost	Cost per ton milled and sorted
Mine operation	$497,155.74	$1.032	$445,033.50	$1.293	$425,094.74	$1.292
Outside exploration	2,389.43	.005	484.39	.002	2,089.95	.006
Crushing and conveying	44,902.88	.093	34,918.07	.102	38,866.59	.118
Ore sorting	23,485.72	.049	15,612.00	.045	12,820.98	.039
Milling	217,909.85	.452	198,877.14	.578	216,049.24	.656
General expense	63,993.85	.133	48,277.67	.140	59,337.36	.180
Total plant cost	$849,837.47	$1.764	$743,202.77	$2.160	$754,258.86	$2.291
Toronto office salaries and general expense	32,028.69	.066	27,578.92	.080	45,313.19	.138
Interest and exchange	3.36	.....	.....	.....	13,796.06	.042
Total operating expenses before depreciation, Dominion and provincial taxes, and pre-operating charges	$881,869.52	$1.830	$770,781.69	$2.240	$813,368.11	$2.471
Dominion and provincial taxes	43,284.59	.090	13,016.83	.038	.....	.....
Depreciation (on 10 per cent. basis)	132,749.76	.276	119,108.64	.346	115,333.90	.350
Pre-operating charges	96,351.40	.200	103,240.50	.300	197,549.40	.600
Total cost	$1,154,255.27	$2.396	$1,006,147.66	$2.924	$1,126,251.41	$3.421

CAPITAL EXPENDITURES

BUILDINGS:		
New change-house	$6,676.54	
New bunk-house	6,065.43	
Addition to hospital	323.03	
Total		$13,065.00
EQUIPMENT:		
X-ray	$2,418.54	
Telephone system	3,488.78	
Tractor	2,182.96	
Rotomill, etc	716.32	
Fire-fighting equipment, etc	569.11	
Miscellaneous	2,796.82	
Total		12,172.53
ADDITIONS IN CONNECTION WITH INCREASED TONNAGE AND DEPTH DEVELOPMENT:		
Aldrich pump on 1,300-foot level	$5,671.81	
Mine electric power—light and signal system	3,273.88	
Mill equipment	638.00	
Total		9,583.69
TOTAL CAPITAL EXPENDITURES		$34,821.22

Ore Reserves

The broken ore reserves in the mine as of December 31, 1934, amounted to 301,990 tons, compared to 276,526 tons the previous year. The unbroken reserves amounted to 1,853,097 tons, compared to 1,751,755 tons the previous year. The value of the broken and unbroken reserves is estimated to be approximately $3.50 per ton, based on the current price of gold.

Exploration

During the year the 500-foot level and the 750-foot level west drifts were extended to points 710 feet and 630 feet, respectively, west of the shaft. This development added a substantia tonnage of slightly lower than average-grade ore to the unbroken reserves.

The 1,000-foot level east drift was driven to a point 1,430 feet east of the shaft. A narrow ore body was encountered, having a length of 110 feet, width of 5 feet, and an average assay value of $8.40 per ton, at current gold prices. It was found that this vein does not extend upward to the 875-foot level. The 1,175-foot level east drift is being driven to explore its possible downward extension.

The main shaft was sunk to the 1,500-foot level and a crosscut started. During the year 1935 the winze also will be sunk to the 1,500-foot level and connected at that elevation to the shaft by an exploration drift, from which drift the dike will be systematically explored.

Further exploration work in the dike beyond the present most easterly workings can be carried on more economically by diamond-drilling from the surface.

Operating Costs

It was estimated in January, 1933, that the recommended increase in tonnage would reduce the cost per ton of ore treated to $1.85. The actual cost for 1934 was $1.83 per ton. This outstanding achievement is a direct result of the skill and efficiency of Mr. Futterer and his staff.

Hudson Patricia Gold Mines, Limited

Hudson Patricia Gold Mines, Limited, has an authorized capitalization of 2,500,000 shares of $1 par value. The company was organized to take over the property of the Metals Development Company, Limited, in the Woman Lake area, district of Kenora, Patricia portion. The holdings consist of 26 patented claims, totalling 1,140 acres, in the townships of Goodall and Dent.

The officers and directors of the company are: W. R. Salter, president; C. H. Ackerman, vice-president; B. A. R. Dignam, secretary-treasurer; M. H. Lebel, P. A. Lavallee, J. L. A. Tetreault, B. R. Hepburn, G. Cockerill, directors. The executive office is at 112 Yonge Street, Toronto.

This property has been operated intermittently since 1929. When Hudson Patricia Gold Mines took it over in April, 1934, the following work had been

done: No. 1 shaft, inclined, had been sunk to the inclined depth of 100 feet; from it 15 feet of crosscutting had been driven and 312 feet of drifting done. No. 2 shaft, vertical, had been sunk 237 feet, and a station cut at the 211-foot level; about 900 feet of lateral work had been done at this level.

From April to the end of November, 1934, Hudson Patricia Gold Mines crosscut 849 feet and drifted 1,061 feet on the 210-foot level; they also drove 169 feet of raise from the 211-foot level to the 100-foot level, and were sinking a winze from the 2nd level, with the 325-foot level as their objective. This winze was down 75 feet on December 11, 1934.

The plant includes an 80 h.p. locomotive-type boiler, a 500-cubic-foot compressor, a 7- by 6-inch reversing steam hoist, a steam generator for the electric-lighting system, a C.I.R. drill-sharpener, and an oil furnace.

The buildings include a fully equipped assay office, blacksmith shop, cookery, bunk-houses for 50 men, 6 dwelling houses, stable, and powder magazine.

J. M. Thompson is manager at the property. The mine address is Narrow Lake, via Sioux Lookout.

J-M Consolidated Mines, Limited

J-M Consolidated Mines, Limited, was incorporated in February, 1932, with a capitalization of 2,500,000 shares of $1 par value. The officers and directors are: J. E. Day, Toronto, president; Charles Taylor, St. Catharines, vice-president; T. J. Day, Toronto, secretary-treasurer; Hon. J. D. Chaplin, St. Catharines, and J. B. Tudhope, Waubaushene, directors. The head office of the company is at 1116 Federal Building, Toronto.

The company acquired the assets of Jackson-Manion Mines, Limited, and Mint-Ore Mines, Limited. The holdings consist of 34 claims, 21 of which are in the main mine group. All are located in the Woman Lake area, Patricia portion of Kenora district.

The mine was idle from August, 1929, to October, 1933. During the previous operation a shaft had been sunk to a depth of 404 feet, and levels had been established at the 125-, 250-, and 375-foot levels. At the end of 1934 the total lateral work was as follows: 890 feet on the 125-foot level, 1,020 feet on the 250-foot level, 50 feet on the 200-foot sublevel, and 760 feet on the 375-foot level. A winze had been sunk 30 feet from the 375-foot level, and 340 feet of raises had been driven.

A cyanide mill capable of handling 30 tons a day was put into operation in May, 1934, and at December 10 had treated 3,066 tons of ore, having a value of $31,200.

The mill equipment includes a 6- by 8-inch jaw-crusher, a 5- by 3-foot ball mill in closed circuit with cone classifier, thickener, Pachuca tank, clarifiers, and filters.

D. M. Thomson is in charge of operations, employing an average of 46 men. The mine address is Jackson Manion.

Kenora Prospectors and Miners, Limited

The capitalization of Kenora Prospectors and Miners, Limited, was increased from 500,000 shares to 1,000,000 shares of $1 par value in 1934. The officers and directors were: Thayer Lindsley, president; I. A. Lindsley, vice-president; Geo. H. Ince, secretary-treasurer; I. M. Machin and Jos. Errington, directors. The executive office is at 25 King Street West, Toronto. The mine office is at Kenora.

The property held by this company includes the old Mikado mine and the Cedar Island mine, both of which are located at Shoal lake, in the Lake of the Woods area, district of Kenora. They are about 45 miles by water from Kenora.

Mikado

Underground work was carried on at the Mikado mine from January 1 to about July 20, 1934. During this period 212 feet of drifting was done on the old 10th level, which is 560 feet vertically from surface. Also a total of 2,760 feet of diamond-drilling was accomplished from underground.

Cedar Island

In May, 1934, work was resumed at the Cedar Island mine, which had been idle since October, 1932. Operations were transferred farther inland to the old Cornucopia shaft, as the workings from the inclined shaft beside the lake were making considerable water. The Cornucopia shaft had been sunk vertically to a depth of 81 feet in the early days, and about 100 feet of lateral work accomplished at that depth. In 1934 this shaft was timbered, a headframe and plant were erected, and sinking was carried on to a depth of 393 feet. A level was established at 284 feet, where 1,066 feet of drifting and 836 feet of crosscutting was accomplished. A total of 1,800 feet of diamond-drilling was done from surface.

The plant used included a 55 h.p. boiler, an 8¼- by 10-inch Ingersoll-Rand divided-drum hoist, and a 600-cubic-foot Ingersoll-Rand Diesel compressor. New buildings erected included a power-house, dry-house, blacksmith shop, and powder-house.

An average of 45 men was employed by this company during the year, of whom 11 were underground. Geo. H. Ince was in charge, with H. Johnson as contractor.

Kenty Gold Mines, Limited

Kenty Gold Mines, Limited, is capitalized at 3,000,000 shares of $1 par value. The officers are: F. L. Trethewey, president; S. W. Black, secretary-treasurer. The executive office is at 8 Wellington Street East, Toronto.

The company suspended all operations at its property in Swayze township, district of Sudbury, in July, 1934, following unfavourable results.

The development work accomplished during 1934, and the total to the suspension of operations, on the various levels, was as follows:—

Level	Drifting		Crosscutting	
	1934	Total	1934	Total
No. 1 Shaft	feet	feet	feet	feet
250-foot	64	434	.....	74
375-foot	382	840	335	518
500-foot	.....	166	.....	202
Total	446	1,440	335	794
No. 2 Shaft				
290-foot	1,533	1,991	701	1,277
525-foot	417	554	189	705
Total	1,950	2,545	890	1,982

No. 1 shaft was sunk to a depth of 510 feet, and No. 2 shaft to 534 feet. Both are vertical 2-compartment shafts; they are about 1,800 feet apart.

The total footage of diamond-drilling done on the property from the commencement of operations was 7,401 feet, of which 6,298 feet was from underground. No changes were made in the plant during 1934.

An average of 37 men was employed, of whom 22 were underground. E. T. Corkill was in charge, with R. M. Williams as assistant.

Kirkland Consolidated Mines, Limited

Kirkland Consolidated Mines, Limited, is capitalized at 7,000,000 shares of $1 par value. There are issued 4,675,706 shares, of which 3,250,000 shares are pooled until July 1, 1935. The officers and directors are: J. W. Rudhard, president; Ferdinand Frohe, vice-president; C. C. Tyx, Tonawanda, N.Y., secretary-treasurer; Geo. F. Pfeiffer, Kevin Killeen, Norman R. Davis, Richard W. Langford, directors. The head office is at 1717 Metropolitan Building, Toronto.

The company owns 1,200 acres: 4 claims in McVittie township, 14 in Gauthier township, and 14 in Grenfell township, district of Timiskaming. A 2-compartment shaft has been sunk to a depth of 265 feet, with levels at 150 and 250 feet. During 1934 the following work was done on the 250-foot level: drifting, 820 feet; crosscutting, 1,280 feet; sinking, 50 feet; diamond-drilling underground, 2,270 feet; diamond-drilling from surface, 1,488 feet. Diamond-drilling on surface from January 1 to February 20, 1935, was 1,398 feet. Underground work was stopped on November 10, 1934.

Ralph Hurd is mine manager, and employed an average force of 25 men. The mine address is Sesekinika.

Kirkland Gold Belt Mines, Limited

Kirkland Gold Belt Mines, Limited, is capitalized at 4,000,000 shares of no par value. The officers and directors are: George W. Morris, president; Jas. E. Day, vice-president; M. C. Smith, treasurer; Roy Weldon, secretary; Dr. W. H. Bennett, H. B. Anderson, and Walter B. Robb, directors. Howard Brassaw is mine superintendent. The mine address is King Kirkland.

The property consists of 292 acres in Lebel township, district of Timiskaming. The average number of men employed during the year was 21.

The development work on the property is as follows:—

	1934	Total to date
	feet	feet
Shaft-sinking	250	768
Crosscutting	265	727
Drifting	1,237	3,529

The mine closed on December 31, 1934. On January 23, 1935, work was again started by Morris Kirkland Gold Mines, Limited, a new company formed to take over the property.

Kirkland Lake Gold Mining Company, Limited

The officers and directors of the Kirkland Lake Gold Mining Company, Limited, are: J. B. Tyrrell, president; R. G. O. Thomson, vice-president;

R. Graham, secretary; V. H. Emery, managing director; A. C. Matthews, J. A. Dalton, J. C. Haight, R. V. Le Sueur, and W. S. Walton, directors. The company owns 465 acres in the township of Teck, district of Timiskaming, and is capitalized at 5,500,000 shares of $1 par value. The head office is at the Bank of Commerce Building, Toronto. The mine address is Kirkland Lake. Wm. Sixt was mine manager until the latter part of the year, when he resigned. An average of 139 men was employed during the year.

The following is taken from the president's report to the shareholders for the year ending December 31, 1934:—

The total income for the year amounted to $717,005.03, of which $702,720.20 was bullion produced. This is $181,310.14 more than was produced in 1933. Of the above income, $297,629.56 was paid in wages, and $193,790.00 for equipment and supplies, almost all of which was purchased from Canadians or Canadian companies. In addition $65,990.00 was paid for hydro-electric power and $10,545.47 in taxes.

The profit derived from operations for the year was $163,512.88, after allowing depreciation but before providing for income tax. In December last an interim dividend of 3 per cent. on the issued stock of the company was paid, which called for an expenditure of $157,173.60.

The following is a summary of the work done in the mine during the year:—

Ore mined and hoisted to mill	tons	64,952
Drifting	feet	5,524
Crosscutting	feet	750
Sinking	feet	408
Raising	feet	983
Station-cutting	cu. ft.	10,200
Slashing	cu. ft.	28,833
Diamond-drilling	feet	5,904

The No. 2 winze was sunk to 5,885 feet, and levels were begun or partly opened at 5,600, 5,725, and 5,850 feet. One hundred and forty-five feet of crosscutting and 1,445 feet of drifting was done here, but with the exception of a ventilation and second exit raise from the 5,600- to the 5,450-foot level, work has been discontinued on these levels while the intensive exploration of the upper levels is in progress.

In co-operation with the management of the Teck-Hughes mine, a connection was made from our 5,200-foot level to their 42nd level, in order to provide an escapement way for the men of one mine into and through the other mine in case of emergency.

The 2,475-foot level, which, at the request of Macassa Mines, Limited, had been driven into their property, was cleared out, so that there is now a free passage westward at this level into their mine, as well as the passage eastward at the 5,200-foot level into the Teck-Hughes mine.

During the year two independent mining engineers, namely Messrs. V. H. Emery and S. N. Graham, were engaged to make a thorough examination of your mine. Their extended report, with plans and sections, was received on the 4th of September, 1934. On the 21st of September, a synopsis of this report, approved by these engineers, was mailed to all registered shareholders, and notices were inserted in the newspapers advising all shareholders, whether registered or not, that the original report was open to inspection at the head office of your company. A number of persons, including representatives of several newspapers, came to the office and examined the report.

As a result of such report a more thorough and intensive programme of lateral exploration and diamond-drilling was undertaken in the mine, including the upper portions, which had not been worked for some years. This lateral exploratory work was in progress at the end of the year and was beginning to show very favourable results, and it is the intention to continue it during the present year.

Since the above report was submitted, a decided improvement has been made in the operation of the mill. Following the recommendations therein contained, the capacity of the primary rock crushers was increased by the installation of larger motors, which enables the ore to be ground finer throughout the circuit, and the result has been to increase the amount of gold precipitated by the cyanide solution. This, with a general tuning-up of the mill, has, without large expenditure or material increase of costs, raised the percentage of gold extracted from the ore in the mill higher than previously attained with the tonnage now being treated.

Mr. Emery was subsequently appointed consulting engineer to supervise and watch the operations undertaken as the result of the report.

Lake Caswell Mines, Limited

Lake Caswell Mines, Limited, was incorporated in April, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: F. J. Sullivan, general manager; M. F. Millward, secretary;

T. A. Burke, G. Cockerill, A. Godfrey, L. J. Layden, and A. E. Dawson, directors. The head office is at 2201 Sterling Tower, Toronto.

The property of this company includes the old Westree or Champion Reef mine in Macmurchy township, in the West Shiningtree area, district of Sudbury. It consists of a group of four claims, on which previous operators put down two shafts, one to 500 feet and the other to 100 feet. They established levels at 240 and 500 feet, where they did 325 and 780 feet of lateral work, respectively. In addition a station was cut at a depth of 92 feet.

This shaft was dewatered in July, 1934, and 70 feet of lateral work was accomplished on the 500-foot level. Underground work was then suspended in favour of surface work for the balance of the year.

The old mining plant was used, which included a 95 h.p. boiler, a 10- by 12-inch hoist, and a 460-cubic-foot Ingersoll-Rand steam compressor.

An average of 19 men was employed under the direction of F. J. Sullivan. The mine address is Westree.

Lake Shore Mines, Limited

Lake Shore Mines, Limited, is capitalized at $2,000,000, in shares of $1 par value. The executive officers and directors are: Harry Oakes, president; W. H. Wright, vice-president; A. L. Blomfield, managing director; Dr. W. P. St. Charles, treasurer; Kirkland Securities, Limited, secretary; Albert Wende and Ernest Martin, directors. The mine and works are at Kirkland Lake, Teck township, district of Timiskaming.

An average of 1,299 men was employed during the year. E. W. Todd is mine superintendent.

The following is taken from the report of the superintendent for the fiscal year ending June 30, 1935:—

During the year, 833,094 dry tons of ore were treated, yielding 460,442 ounces of gold and 105,514 ounces of silver, having a gross value of $16,026,108.57. The total production, after deduction of the federal bullion tax, amounted to $14,578,936.13.

PRODUCTION RECORD

Period	Months	Tons milled	Gross value of bullion[1]	Dividends paid
Mar. 1, 1918, to Nov. 30, 1918	9	14,948	$372,352.35	$100,000
Dec. 1, 1918, to Nov. 30, 1919	9	11,907	302,518.17	100,000
Dec. 1, 1919, to Nov. 30, 1920	12	18,889	525,278.38	80,000
Dec. 1, 1920, to Nov. 30, 1921	12	21,681	523,597.39	120,000
Dec. 1, 1921, to June 30, 1923	19	36,825	850,282.92	160,000
July 1, 1923, to June 30, 1924	12	24,223	590,119.98	160,000
July 1, 1924, to June 30, 1925	12	96,838	1,812,008.05	600,000
July 1, 1925, to June 30, 1926	12	125,676	2,233,475.85	700,000
July 1, 1926, to June 30, 1927	12	214,335	3,105,047.85	1,200,000
July 1, 1927, to June 30, 1928	12	237,962	3,629,317.57	1,600,000
July 1, 1928, to June 30, 1929	12	367,015	5,519,138.86	2,000,000
July 1, 1929, to June 30, 1930	12	467,648	6,609,728.42	2,600,000
July 1, 1930, to June 30, 1931	12	698,624	9,153,546.62	3,600,000
July 1, 1931, to June 30, 1932	12	834,434	13,798,128.33	6,000,000
July 1, 1932, to June 30, 1933	12	797,673	13,277,685.72	6,000,000
July 1, 1933, to June 30, 1934	12	836,991	16,382,274.27	6,000,000
July 1, 1934, to June 30, 1935	12	833,094	16,02o,108.57	8,000,000
Total	.....	5,638,763	$94,710,609.30	$39,020,000

[1]Includes exchange premiums.

DEVELOPMENT FOOTAGE FOR THE YEAR

Level	Drifting	Cross-cutting	Raising	Box-holing	Sub-drifting	Ore and waste passes	Total footage	Diamond-drilling	Station-cutting
	feet	feet	feet	feet	feet	feet		ft. in.	cu. ft.
200-foot	99.5	47.3	.....	.....	4	.....	150.8	420	.....
400-foot	228.7	71.3	113.9	69.2	117.6	.....	600.7	1,093	.....
600-foot	188.8	130.8	179.5	.....	392	.....	891.1	1,378	.....
800-foot	51.2	190	836.8	.....	805.7	.....	1,883.7	611 7	.....
1,000-foot	163.7	87.6	481.8	.....	900.9	.....	1,634	1,147 11	.....
1,200-foot	168.4	129.8	201	.....	395.6	.....	894.8	1,103 2	.....
1,400-foot	88.1	.....	152.5	.....	338.3	.....	578.9	70 6	60
1,600-foot	352.4	361.2	160.2	.....	97.4	.....	971.2	392 8	.....
1,800-foot	578.4	.....	49.2	.....	29.6	.....	657.2	263	.....
2,000-foot	1,015.3	176.7	535.9	.....	146.5	.....	1,874.4	866 6	.....
2,200-foot	444.6	.....	751.5	.....	372.9	.....	1,569	694 3	.....
2,325-foot	738.1	43.6	243	.....	123.6	.....	1,148.3	395 11	408
2,450-foot	697.8	.....	337.5	.....	135.2	.....	1,170.5	682 3	.....
2,575-foot	1,387.9	380.6	396.2	.....	339.8	.....	2,504.5	1,125 1	.....
2,700-foot	686.1	435	195.4	66.4	206	.....	1,588.9	465 4	.....
2,825-foot	272.9	114.5	532.3	.....	24	.....	943.7	1,114	.....
2,950-foot	1,208.8	194.4	102.6	.....	.....	.....	1,505.8	269 11	.....
3,075-foot	373.9	41.4	170	.....	.....	.....	585.3	440 4	.....
3,200-foot	258.2	84.7	.....	.....	.....	.....	342.9	391 1	.....
3,325-foot	.....	.....	.....	.....	.....	.....	.....	.....	.....
3,450-foot	.....	.....	.....	.....	.....	.....	.....	.....	.....
3,575-foot	.....	.....	.....	.....	.....	.....	.....	.....	.....
3,700-foot	.....	.....	.....	.....	.....	.....	.....	.....	.....
3,825-foot	.....	92.1	.....	.....	.....	.....	92.1	706 9	.....
3,950-foot	.....	.....	.....	.....	.....	.....	.....	.....	.....
4,075-foot	.....	.....	.....	.....	.....	.....	.....	.....	.....
4,200-foot	.....	11	.....	.....	.....	154	165	.....	.....
4325-foot	.....	44.4	.....	.....	.....	93.7	138.1	.....	4,800
4,450-foot	284	44.3	.....	.....	.....	33.9	362.2	559 4	3,108
Total	9,286.8	2,680.7	5,439.3	135.6	4,429.1	281.6	22,253.1	14,190 7	8,376

SUMMARY OF ORE HOISTED FOR THE YEAR

Level	Ore from development	Ore from mining
	tons	tons
200-foot	184	2,657
400-foot	1,017	9,821
600-foot	650	48,684
800-foot	1,248	62,744
1,000-foot	687	31,970
1,200-foot	503	20,246
1,400-foot	380	31,034
1,600-foot	324	7,625
1,800-foot	1,154	4,227
2,000-foot	4,540	37,032
2,200-foot	3,007	63,515
2,325-foot	1,583	93,575
2,450-foot	1,798	147,262
2,575-foot	1,354	133,980
2,700-foot	1,862	43,174
2,825-foot	39	35,508
2,950-foot	2,045	17,253
3,075-foot	282	12,692
3,200-foot	54	3,036
3,450-foot	.....	8
4,450-foot	423	.....
Total	23,134	806,043

SUMMARY OF DEVELOPMENT WORK PERFORMED SINCE THE BEGINNING OF OPERATIONS

	Feet
Drifting	121,852
Crosscutting	31,335
Raising	78,934
Subdrifting	16,143
Ore and waste passes	11,647
Shaft-sinking	7,998
Shaft-raising	1,340
Shaft-slashing	761
Winze-sinking	1,151
Diamond-drilling	104,931
	cu. ft.
Box-holing	337,636
Station-cutting	761,681
Sumps	57,068

STATEMENT OF COSTS FOR THE YEAR

	Cost per ton milled
Development	$0.399
Mining	3.515
Milling and refining	1.264
Marketing bullion	.072
General and administrative expense	.249
Operating cost	$5.499
Depreciation	1.053
	$6.552
Provision for taxes (exclusive of bullion tax)	1.248
Total cost	$7.800

Development

During the period, development drifting was limited almost entirely to further exploration in the No. 1 or south vein zone. Total drifting amounted to 9,286.8 feet, of which 3,238 feet were driven in ore averaging 0.77 ounces over an average exposed width of 58 inches.

An ore shoot opened up in No. 1 vein on the 1,800-foot level, near the west side of the property, was extended to the 2,700-foot horizon. The average length of this ore body was 380 feet, and its width, as indicated in preparation for stoping, was 13 feet. Its downward continuation has been determined by diamond-drilling at the 2,825-foot level.

In a section of No. 1 vein situated to the east of No. 1 shaft, further development has proven a continuous ore body extending from the 1,800-foot level to a minimum depth of 3,200 feet. The average length of this occurrence was determined to be 480 feet, and the average width 14 feet.

Other ore shoots, more erratic in character, were discovered in the central section of the No. 1 vein zone. These may be mined profitably at the prevailing market value of gold.

The relative importance of No. 1 vein at the present time is indicated in the table below:—

TONS HOISTED PER MONTH FROM NOS. 1 AND 2 VEINS

Month	No. 1 vein		No. 2 vein		Total
	tons	per cent.	tons	per cent.	tons
July, 1934	27,397	41.47	38,660	58.53	66,057
August, 1934	32,847	45.59	39,209	54.41	72,056
September, 1934	27,516	42.12	37,809	57.88	65,325
October, 1934	36,141	49.48	36,901	50.52	73,042
November, 1934	33,592	48.61	35,507	51.39	69,099
December, 1934	29,816	42.45	40,423	57.55	70,239
January, 1935	30,878	43.37	40,315	56.63	71,193
February, 1935	26,771	41.65	37,505	58.35	64,276
March, 1935	31,795	46.05	37,244	53.95	69,039
April, 1935	29,563	43.24	38,799	56.76	68,362
May, 1935	24,276	34.12	46,869	65.88	71,145
June, 1935	28,050	40.45	41,294	59.55	69,344
Total	358,642	43.25	470,535	56.75	829,177

Development of No. 1 vein has been stressed in order to permit the extraction of ore from this hanging-wall zone, in advance of mining out the footwall ore bodies situated in No. 2 vein.

At the end of the year, there was exposed in drift backs a total of 16,540 lineal feet of ore in which no stoping had been done. The indicated average grade before slashing was 0.67 ounces per ton across 61 inches. Of the total, a length of 10,696 feet was in No. 2 vein and 5,844 feet in No. 1 vein.

The success attending exploration work in the upper and middle levels of the mine, coupled with the present higher value of gold, continues to render unnecessary any immediate further development of lower horizons.

No. 5 Shaft

To expedite the early removal of all ore in the upper and intermediate levels, it was decided to construct a new main hoisting shaft from surface to the 3,950-foot horizon. This No. 5 shaft was started in the footwall of the No. 2 vein zone, a location advantageous from the standpoint of economy of construction and operation, as well as safety from possible subsidence of ground over stoped areas.

Crosscuts were started on certain levels to connect present workings with the new shaft location. From these and other crosscuts, raises will be driven, from which the shaft and station excavations will be completed.

In order to maintain the desired location for No. 5 shaft in the footwall, it was necessary that the upper 70 feet be sunk through the bed of Kirkland lake, now filled with tailings. This work was placed on contract in the hands of the Foundation Company of Canada, a reliable firm capable of successfully completing this particular type of undertaking.

Stoping

All lower new stoping operations, in No. 2 vein, were started on a filled square-set rill method, considered to be most suitable to the ground conditions. A start was made to prepare for mining, under this method, a block of ground extending from the 2,450- to the 3,075-foot levels. New work consisted mainly of slashing drift walls, timbering, and driving fill raises.

Stoping was resumed on the 2,575- and 2,700-foot levels, using the rill method. Slashing of drift walls in No. 1 vein was partially completed to the 2,825-foot level, and a number of new stopes were started. During the year, 473,022 tons of backfill were placed.

The position of the mine, in regard to reserves of ore, broken and in place, was fully maintained.

Milling

Large-scale research work was continued throughout the year, resulting in further increase in extraction. A new precipitation and refining plant was completed, to replace the previously existing installation, which had become inadequate to serve present requirements.

Lakeland Gold, Limited

Lakeland Gold, Limited, was formed to take over the assets and liabilities of Lakeland Gold Mines, Limited. The shares of the old company were exchanged at the rate of four shares of the old company for one of the new. The company owns 1,120 acres at Wolf lake, Maisonville township, district of Timiskaming. The company is capitalized at 2,000,000 shares, of which 1,100,000 are issued. The officers and directors are: F. A. Pollard, president; M. D. Wynman, secretary-treasurer; A. R. Timms, first vice-president; B. Thornber, second vice-president; Robert Johnston, T. Brittain, Thos. Pope, Bruce Mason, directors. Geo. Schmelzle is mine manager. The head office is at 19 Sun Life Building, Hamilton. The mine address is Bourkes.

The following work was done from March 24 to May 15, 1934: crosscutting, 80 feet; drifting, 412 feet; and raising, 89 feet. The mine is being kept pumped out.

Lakeside-Kirkland Gold Mines, Limited

Lakeside-Kirkland Gold Mines, Limited, owns 7 claims in Lebel township, district of Timiskaming. The original company, Queen Lebel Gold Mines, Limited, sold its assets to the Queen Lebel Gold Mining Company, Limited, the shareholders to receive one share of the new company for two of the old. Later, in 1934, the name of the company was changed to Lakeside-Kirkland Gold Mines, Limited, the exchange of shares being made on a basis of one for one.

The capitalization is 3,000,000 shares of $1 par value. A permanent directorate has not yet been appointed. At present E. B. Knapp is managing director; and E. B. Wood, director.

The mine operated from May 2 to November 2, 1934, with an average force of 22 men. During that time 600 feet of drifting and crosscutting and 1,700 feet of diamond-drilling were done on the 300-foot level.

The plant consists of: 2 locomotive-type boilers, of 40 h.p. each; a 400-cubic-foot compressor; and an 8- by 10-inch single-drum steam hoist.

Richard Callin was superintendent. The mine address is Kirkland Lake.

Lebel Oro Mines, Limited

Lebel Oro Mines, Limited, was incorporated in 1920, and the present authorized capitalization is 3,000,000 shares of $1 par value. The officers and directors are: W. J. Green, president; F. E. Pentz, vice-president; P. Fahrenholtz, secretary-treasurer; W. H. Englebright and J. R. Hetherington, directors. The executive office is at 703 Northern Ontario Building, Toronto.

The property of this company includes the old Long Lake mine, located in township 69, district of Sudbury.

Operations at this mine were suspended at the end of February, 1934, following the dewatering and sampling of the old workings. Late in June the construction of a 200-ton mill was started, which was completed at the end of October. Work was then suspended, but is expected to be resumed in the spring of 1935, when it is planned to start milling the tailings from the original operation.

Lee Gold Mines, Limited

Lee Gold Mines, Limited, was incorporated in 1931, with an authorized capital of 3,000,000 shares of $1 par value. The officers and directors were: J. J. Byrne, president; W. B. McPherson, secretary; D. A. Ampleford, treasurer; M. J. Shunsby, M. D. Gray, and E. M. Howells, directors. The head office is at 244 Bay Street, Toronto.

In 1933 the company acquired a group of 17 claims in Greenlaw township, in the Swayze area, district of Sudbury. Surface work was started in April, 1933, followed by 2,000 feet of diamond-drilling. The installation of a mining plant was started in January, 1934.

A 2-compartment vertical shaft was started in March. It was sunk to a depth of 275 feet, and levels were established at 125 and 250 feet. Underground work was suspended in November. A total of 480 feet of drifting, and 624 feet of crosscutting was accomplished on the 125-foot level, and a total of 35 feet of drifting and 400 feet of crosscutting was done on the 250-foot level. The property was closed down at the end of January, 1935.

The plant installed included two 33 h.p. boilers, an 8- by 12-inch AC hoist, and a 52.5-cubic-foot Ingersoll-Rand steam compressor. Buildings erected included a power-house, blacksmith shop, 2-storey office, 2-storey bunk-house, cook-house, stable, and powder-house.

An average of 21 men was employed during 1934. A. Jamieson succeeded R. E. Miller as manager.

Little Long Lac Gold Mines, Limited

Little Long Lac Gold Mines, Limited, was incorporated in January, 1933, with an authorized capitalization of 2,000,000 shares of no par value. The

officers and directors are: Jos. Errington, president; Thayer Lindsley, vice-president; L. A. MacDonald, secretary-treasurer; W. S. Morlock, A. B. Gordon, and D. M. Morin, directors. The executive office is at 25 King Street West, Toronto. The mine address is Geraldton.

The property is in the Little Long Lac area, district of Thunder Bay, two miles south of the Long Lac–Port Arthur branch of the Canadian National Railways.

During 1934 the 3-compartment vertical shaft was sunk an additional 269 feet to a total depth of 719 feet, and levels were established at 445, 570, and 695 feet.

The development work accomplished during the year on the various levels was as follows:—

Level	Drifting	Crosscutting	Raising
	feet	feet	feet
204-foot	156	.....	250
325-foot	740	.....	80
445-foot	756	442	.....
570-foot	380	.....	.....
695-foot	120	.....	.....
Total	2,152	442	320

In September a 48-mile hydro-electric power line was completed from the Northern Empire mine to the property. The original hoist and compressor were replaced by an Ingersoll-Rand double-drum electric hoist and a 1,250-cubic-foot Ingersoll-Rand electric compressor. The boiler plant was retained for heating and standby service.

A 150-ton mill was constructed and put in operation on November 24, 1934. A total of 5,485 tons of ore had been milled by the end of the year, which was obtained from the ore dump and from back-slashing, in preparation for stoping, on the 204-, 325-, and 445-foot levels.

The mill equipment includes a 15- by 24-inch jaw-crusher, a 5-inch Newhouse crusher, a 7- by 5-foot ball mill, a 54-inch Akins classifier, a 5- by 16-foot tube mill, a 36-inch duplex Akins classifier, two 28- by 12-foot Dorr tray thickeners, four 20- by 15-foot Dorr agitators, one 16- by 12-foot Dorr agitator, two 8- by 10-foot Oliver filters, a Merrill-Crowe continuous precipitation unit, six corduroy blanket tables, and amalgamation equipment. Approximately 60 per cent. of the gold is obtained by amalgamation, which is used on the primary classifier overflow and the tube-mill discharge.

Buildings erected during 1934 included a new dry-house, new general office, new 2-storey cook-house, hospital, school, a second 2-storey bunk-house, nine dwelling houses, mill, refinery, and assay office.

An average of 142 men was employed, of whom 27 were underground. A. A. Barton was in charge of operations, with A. Rennick as mill superintendent.

Lucky Cross Leasing Syndicate

The Lucky Cross Leasing Syndicate is capitalized at 700 units of $50 each. The officers are: W. J. Cook, president; Gerald D. O'Meara, secretary-treasurer S. A. Pain, managing director; R. J. Carter and Dr. R. J. Neelands, directors. The secretary's office is at the Bank of Commerce Building, Kirkland Lake.

In 1933 the syndicate obtained a lease on the Lucky Cross property in Teck township, district of Timiskaming. A further report regarding the work on the property is given under Golden Gate Mining Company, Limited, on page 96.

Lucky Kirkland Gold Mines, Limited

Lucky Kirkland Gold Mines, Limited, was incorporated in April, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value, 1,600,905 of which are issued. The officers and directors are: T. B. Armstrong, president; S. L. MacDonald, vice-president and manager; J. J. Gray, secretary-treasurer; G. C. Kirkpatrick, director. The head office is at 159 Bay Street, Toronto. The mine address is Swastika.

Operations were carried on during May and June, 1934, on the property in Eby township, district of Timiskaming, with an average force of 15 men. About 100 feet of drifting was done on the 400-foot level, making a total of 4,000 feet of lateral work to date. The shaft is 415 feet deep.

The mining plant consists of a 60 h.p. boiler, a 6- by 8-inch Jenckes hoist, and a 300-cubic-foot Ingersoll-Rand compressor. There is a camp to accommodate 30 men.

Macassa Mines, Limited

The capitalization of this company is 3,000,000 shares of $1 par value. The officers and directors are: Robert A. Bryce, president; L. Soliague, secretary-treasurer; John D. Perrin, Henry M. Porteous, Thomas Riggs, and Arthur G. Slaght, directors. G. A. Howes is mine manager. The head office is at 85 Richmond Street West, Toronto. The mine office is at Kirkland Lake. About 134 men were employed at the mine during the year.

The company owns 6 claims, adjoining the Kirkland Lake Gold mine on the west, in Teck township, district of Timiskaming. On November 1, 1934, the company paid its initial dividend at the rate of 5 cents per share.

The following is an extract from the report of the mine manager for the twelve months ending March 31, 1935:—

Production

During the year 66,534 tons of ore were treated, from which $1,058,958.29 was recovered, or $15.91 per ton. The daily average milling rate was 182.3 tons at 91.95 per cent. running time. The average extraction was 93.89 per cent.

Construction

To bring the original plant and equipment in line with the rate of production and the amount of underground development work required, several additions were made during the year. The principal expenditures consisted of four cottages, air compressor, large hoist motor, raising headframe, underground equipment, new steel shop and small mill additions, as follows:—

Staff residences (4)	$11,605.10
Hoist and compressor-house equipment	18,152.92
Carpenter and electrical shop	257.03
Raising headframe, ore and waste bin, etc.	7,102.97
Mill and sprinkler system additions	7,465.00
Mine equipment	17,650.55
New steel shop and equipment	3,615.77
Miscellaneous	6,400.45
Total	$72,249.79

Development

While hoisting ore and waste with cages, new exploration and development was limited. To correct this condition, it was decided to change over to skip-hoisting which necessitated cutting underground loading pockets and raising the headframe. These additions were made

during the first five months of the fiscal year, since which time we have had ample hoisting capacity. Since the main shaft has now reached 3,000 feet in depth, this will permit the opening up of new levels at 2,575, 2,675, 2,825, and 3,000 feet. The drift on the 2,475-foot level, west of the shaft, has followed the main break, which has been strong and persistent so far. The face of this drift is now half way between the shaft and the western boundary of the property. Work here has disclosed short sections containing commercial values, but no workable ore shoot in this section has yet been found. The summary of development work is as follows:—

	1934–35	1933–34
	feet	feet
Drifting	5,988	3,483.5
Crosscutting	1,033	349
Raising	1,409	744
Shaft-sinking	481	.....
Station-cutting	91	30
Total	9,002	4,606.5
Diamond-drilling	3,489	2,701.5

Ore Reserves

To date, no level has been fully explored, but new ore shoots have been opened up on the 1,400-, 1,500-, 1,750-, 1,850-, and 2,675-foot levels during the past six months. Some of these shoots are not sufficiently developed to be included in the ore estimate. Taking only positive ore and not making any estimate of a partially developed good tonnage of similar grade nor including indicated lengths of lower grade, the following is an estimate:—

	Tons	Ounces per ton	Value per ton at $35
Unbroken ore	56,900	0.44	$15.40
Broken ore	11,600	.49	17.15
Surface dump	3,490	.43	15.00

With lateral work under way on five levels, and the shaft at sufficient depth to commence work on four more, the coming year will be one of intensive exploration with excellent possibilities of developing ore.

Operating Costs

All work, apart from capital expenditures, has been written off into the operating costs. The development and exploration costs include two major developments, namely, the 2,475-foot west drift and 481 feet of shaft-sinking, which amounts to $0.72 per ton milled.

The operating costs, before provision for depreciation and taxes, are as follows:—

	Cost per ton milled
Development and exploration	$2.44
Mining	2.27
Milling	1.70
Administration and general charges	.98
Total	$7.39

The plant and equipment expenditures are now complete for the present scale of production, so that capital expenditures in the immediate future will be small.

McIntyre-Porcupine Mines, Limited

The authorized capitalization of this company is 800,000 shares of $5 par value. The officers and directors are: J. P. Bickell, president; E. D. Fox, secretary; Balmer Neilly, treasurer. The directors are: J. P. Bickell, W. J. Sheppard, J. B. Tudhope, D. H. McDougall, Strachan Johnston, and Bernard E. Smith. The head office of the company is at 15 King Street West, Toronto. R. J. Ennis is general manager. The mine address is Schumacher.

The company's main property is at Schumacher, in Tisdale township, district of Cochrane. Other holdings of the company are: (1) an option on a property in Hislop township in the new gold area east of Matheson on the T. and N.O. railway, which the company diamond-drilled during the summer and fall of 1934; (2) a property of approximately 400 acres in the Birch Lake area, which is now being worked by lessees, W. D. Cooper and P. A. Barry; (3) a 90 per cent. interest in approximately 390 acres adjoining the Howey mine in the Red Lake area; (4) a 50 per cent. interest with Temiskaming Mines Company, Limited, in the Blue Diamond Coal Company, Brule, Alta.; (5) an option to acquire Canadian Coal Fields, Limited, Hay River, Alta.; (6) an option on the property of O'Leary Malartic Mines, Limited, and other claims owned outright, at Mud Lake, Que.; (7) a 90 per cent. interest in a group of claims in the Beardmore area.

The following information regarding the property at Schumacher is taken from the general manager's report for the fiscal year ending March 31, 1935:—

Production

Ore treated.....tons	862,100	
Value per ton (0.294 ounces at $34.67[1])	$10.23	
Gross value	$8,819,660.27	
Bullion recovered:		
Gold (242,235.876 ounces at $31.34[2])		$7,590,632.35
Silver (64,746.15 ounces at $0.494)		32,038.75
Total value		$7,622,671.10
Recovered per ton (0.281 ounces)	$9.79	
Less bullion levy	.94	
Total value	$8.85	
Bullion marketing costs		29,105.52
Net value of bullion recovered		$7,593,565.58

PRODUCTION SINCE THE BEGINNING OF MILLING OPERATIONS IN 1912

Period	Months	Tons milled	Value per ton	Gross value	Recovery per ton	Total value
1912	12	14,500	$7.00	$101,555.16	$5.25	$76,166.38
1913	12	31,979	7.85	251,314.45	7.05	225,752.25
Jan. 1, '14, to Mar. 31, '15	15	85,654	8.87	760,232.16	8.39	718,331.71
Apr. 1, '15, to Mar. 31, '16	12	105,758	7.71	815,345.49	7.38	779,990.94
Apr. 1, '16, to June 30, '17	15	195,307	10.00	1,954,793.28	9.55	1,864,914.28
July 1, '17, to June 30, '18	12	178,327	10.05	1,793,197.55	9.61	1,714,258.00
July 1, '18, to June 30, '19	12	179,874	9.78	1,759,627.40	9.29	1,671,646.03
July 1, '19, to June 30, '20	12	188,835	11.52	2,175,891.31	11.02	2,080,178.44
July 1, '20, to June 30, '21	12	171,916	11.67	2,005,672.00	11.08	1,904,326.36
July 1, '21, to June 30, '22	12	193,971	10.69	2,074,088.40	9.99	1,937,105.07
July 1, '22, to June 30, '23	12	240,615	9.96	2,397,303.00	9.35	2,249,741.63
July 1, '23, to June 30, '24	12	360,140	9.69	3,488,863.00	9.14	3,291,178.22
July 1, '24, to June 30, '25	12	400,259	9.43	3,774,068.00	8.86	3,546,637.52
July 1, '25, to June 30, '26	12	460,909	8.72	4,020,326.00	8.25	3,804,774.90
July 1, '26, to Mar. 31, '27	9	385,409	8.08	3,113,500.07	7.67	2,957,060.97
Apr. 1, '27, to Mar. 31, '28	12	520,460	8.09	4,207,553.00	7.66	3,987,634.94
Apr. 1, '28, to Mar. 31, '29	12	538,165	8.24	4,433,378.00	7.83	4,212,624.82
Apr. 1, '29, to Mar. 31, '30	12	550,495	8.46	4,657,188.00	8.05	4,433,626.45
Apr. 1, '30, to Mar. 31, '31	12	558,115	8.84	4,934,122.00	8.30	4,633,140.73
Apr. 1, '31, to Mar. 31, '32	12	655,030	8.47	5,548,278.10	8.10	5,305,475.29
Apr. 1, '32, to Mar. 31, '33	12	736,300	8.45	6,224,493.40	8.12	5,981,714.69
Apr. 1, '33, to Mar. 31, '34	12	776,845	10.68	8,296,704.60	10.24	7,957,252.54
Apr. 1, '34, to Mar. 31, '35	12	862,100	10.23	8,819,660.27	8.85	7,622,671.10
Total	.....	8,390,963	$9.25	$77,607,154.64	$8.70	$72,956,203.26

[1]Average open market price.
[2]Market price less bullion levy.

Mining

	Tons
Ore broken in stopes	760,334
Ore from development	112,587
Total	872,921
Ore hoisted	858,179

Development

Development work amounted to 28,240 feet. This includes 15,803 feet of drifts, of which 2,063 feet was on line and 13,740 feet in vein material; of this, 6,980 feet was in ore averaging 0.300 ounces per drift width.

ORE RESERVES, 1934–35

	Tons	Fine ounces gold	Value at $20.67
Estimated	3,219,460	1,046,226	$21,625,486
Broken	211,021	57,600	1,190,320
Total	3,430,481	1,103,826	$22,815,806
Average per ton		0.3217	$6.65

SUMMARY OF DEVELOPMENT AND EXPLORATION, 1934–35

Period	Drifts	Crosscuts	Raises	Winzes	Shafts	Stations	Sumps	Pockets and passes	Total footage	Total excavation	Diamond-drilling
	feet	feet	feet	feet	feet	cu. ft.	cu. ft.	feet	feet	cu. ft.	feet
1	1,369.5	413	165	.....	.....	2,736	.....	.....	1,947.5	2,736	2,554
2	1,225	528	23	.....	.....	16,431	.....	.....	1,776	16,431	3,084
3	811	984	30	.....	.....	2,165	.....	.....	1,825	2,165	3,231
4	1,275	893	.....	.....	.....	.....	.....	.....	2,168	.....	2,961
5	1,155	956	68	.....	.....	.....	.....	.....	2,179	.....	4,124
6	1,026	1,322	46	.....	.....	.....	.....	.....	2,394	.....	4,189
7	1,546	1,342	179	.....	.....	.....	.....	.....	3,067	.....	4,502
8	1,424	1,230	54	.....	.....	.....	.....	.....	2,708	.....	3,533
9	1,330	690	76	.....	.....	.....	.....	.....	2,096	.....	3,674
10	1,415	1,112	.....	.....	.....	.....	.....	.....	2,527	.....	3,851
11	1,427	1,188	189	.....	.....	.....	.....	.....	2,804	.....	4,072
12	1,799	812	137	.....	.....	.....	.....	.....	2,748	.....	4,705
Total	15,802.5	11,470	967	.....	.....	21,332	.....	.....	28,239.5	21,332	44,480
Previous to date	216,854.3	102,255.8	21,592.9	612.7	14,549.4	992,250	55,039	139,699	355,865.1	1,186,988	393,148
Total to date	232,656.8	113,725.8	22,559.9	612.7	14,549.4	1,013,582	55,039	139,699	384,104.6	1,208,320	437,628

Operating Costs

	Total cost	Cost per ton ore milled
MINING:		
Exploration	$79,495.17	$0.0922
Development	441,489.81	.5122
Breaking and stoping	2,367,449.37	2.7461
	$2,888,434.35	$3.3505
Milling	619,581.39	.7187
Administration and general expense	102,880.62	.1193
Total	$3,610,896.36	$4.1885

ANALYSIS OF MINING COSTS PER TON MILLED

	Stoping	Drifting	Cross-cutting	Raising	Shafts and winzes	Stations and sumps	Total cost	Cost per ton
Labour	$1,154,985.22	$137,487.85	$84,047.38	$7,366.67	$181.61	$9,521.57	$1,393,590.30	$1.6165
Explosives	112,936.41	44,593.08	34,181.76	1,776.64	.....	176.14	193,664.03	.2246
Supplies	99,633.86	5,242.48	6,511.44	362.20	672.06	6,254.21	118,676.25	.1377
Power	74,983.03	13,788.38	7,360.87	1,740.79	.....	81.44	97,954.51	.1136
Timbering	234,571.00	.....	.....	.....	7,267.26	273.00	242,111.26	.2808
Shaft repairs	4,781.30	.....	.....	.....	.....	.....	4,781.30	.0055
Backfilling	214,720.79	.....	.....	.....	.....	.....	214,720.79	.2492
Steel-sharpening	36,199.72	12,025.96	7,396.65	779.32	.....	93.79	56,495.44	.0655
Drill repairs	24,639.51	4,711.93	2,497.13	552.06	.....	36.84	32,437.47	.0376
Surveying and engineering	33,385.43	6,261.57	3,300.53	780.50	.....	42.42	43,770.45	.0508
Sampling and assaying	42,934.89	3,255.38	1,713.62	399.27	.....	.....	48,303.16	.0560
Pumping	10,807.43	1,926.85	1,043.40	247.81	29.22	133.25	14,187.96	.0165
Ventilating	6,198.23	1,073.25	542.50	127.69	.....	8.90	7,950.57	.0092
Fire protection	209.64	.....	.....	.....	.....	.....	209.64	.0002
Underground lighting	5,077.78	.....	.....	.....	.....	.....	5,077.78	.0060
Tramming	89,269.28	14,016.69	7,678.50	1,705.36	.....	.....	112,669.83	.1307
Underground crushing	7,262.15	919.30	.....	.....	.....	.....	8,181.45	.0095
Hoisting	214,853.70	24,075.00	.....	.....	470.57	4,426.98	243,826.25	.2828
Total	$2,367,449.37	$269,377.72	$156,273.78	$15,838.31	$8,620.72	$21,048.54	$2,838,608.44	$3.2927
Less undistributed development	.....	.....	.....	.....	.....	.....	29,669.26	.0344
							$2,808,939.18	$3.2583
Exploration	.....	.....	.....	.....	.....	.....	79,495.17	.0922
Total	.....	.....	.....	.....	.....	.....	$2,888,434.35	$3.3505
Unit cost per ton	$2.7461	$0.3125	$0.1813	$0.0184	$0.0100	$0.0244	.....	.....

SUMMARY OF MILLING COSTS

	Labour	Supplies	Shop repairs and maintenance	Power	Total cost	Cost per ton
Crushing and conveying	$36,302.23	$35,511.61	$6,124.33	$20,155.80	$98,093.97	$0.1138
Flotation	44,802.30	123,391.50	10,248.11	70,002.86	248,444.77	.2882
Cyanidation	39,636.12	168,594.36	4,379.39	25,984.98	238,594.85	.2768
Refining	6,622.20	9,059.34	548.26	1,248.74	17,478.54	.0203
Assaying	5,938.20	3,340.02	1,295.28	2,049.33	12,622.83	.0146
Mill alterations	.....	2,791.53	1,554.90	.....	4,346.43	.0050
Total	$133,301.05	$342,688.36	$24,150.27	$119,441.71	$619,581.39	$0.7187

ADDITIONS TO PLANT BUILDINGS AND EQUIPMENT

Miscellaneous surface buildings and equipment	$27,771.01
Additional air compressor equipment	25,648.28
Auxiliary surface man hoist at No. 11 shaft	32,333.86
Mine timber treatment plant	28,909.10
Electric steam generator at main heating plant	7,917.84
Tailings disposal development and equipment	24,866.42
Transportation equipment	25,078.22
Miscellaneous underground equipment	38,732.58
Total additions	$211,257.31

General

In accord with the policy projected or outlined in last year's report, our development work and stoping operations were further extended into what was previously considered marginal ground. While this had the effect of decreasing the grade of ore treated, we increased the mill capacity to an extent sufficient to compensate, and the gross value of our production closely approximates the total of a year ago.

The results obtained in the process of extending old drives on the upper levels were as favourable as they were unexpected. A great deal of work must still be done to prove the actual extent of the ore bodies indicated or found. More extensive work in the upper levels necessitated

some changes in our underground programme and curtailed the amount of development originally planned from the No. 12 shaft.

On this lower horizon crosscuts have been advanced south through the quartz porphyry into the basic schists on the 4,175-, 4,475-, 4,925-, and 5,375-foot levels. On the 4,175-foot level, the No. 22 vein was intersected with results as previously described. On the other levels rock formation and structural conditions were as anticipated, but as yet no ore bodies of economic importance have been intersected. Drifting on the more promising veins crosscut to date is now under way.

McKenzie Red Lake Gold Mines, Limited

McKenzie Red Lake Gold Mines, Limited, is capitalized at 3,000,000 shares of $1 par value, with 2,800,000 shares outstanding. The following are officers of the company: W. G. Armstrong, president; F. D. Reid, vice-president; H. M. Anderson, secretary-treasurer; M. F. Fairlie and G. W. Quinn, directors. The mine office is at Red Lake. The head office is at 509 National Building, Bay Street, Toronto.

The property is located on McKenzie island in Red lake, district of Kenora, Patricia portion, and consists of 11 claims, with an area of approximately 400 acres. This property was formerly known as the Martin-McNeely claims.

The McKenzie Red Lake Gold Mines, Limited, took over the property in April, 1933, and commenced construction of buildings and plant the following month. The plant was put in operation about August 1, 1933. By the end of 1933, the 3-compartment vertical shaft had been completed to a depth of 272 feet, and at the 150-foot level 98 feet of crosscutting and 372 feet of drifting on the vein had been done; at the 250-foot horizon 160 feet of crosscutting and 418 feet of drifting had been done.

Drifting on the 1st level had then showed 320 feet, averaging 0.38 ounces of gold per ton across 5 feet; and on the second level, 304 feet, averaging 0.36 ounces across 5.4 feet. The distance between levels on the dip of the vein is 140 feet. At the end of 1933 the estimated ore in sight was 37,819 tons, containing 13,992 ounces of gold.

In 1934 work was actively carried on throughout the whole year. The following extract is from a progress report made to the shareholders on November 22, 1934:—

Under date of November 12 last, Mr. Shaw, our general manager, estimates ore reserves of 97,900 tons, having an average value of 0.437 ounces per ton ($15 at present gold price). This does not include the ore in the dump, nor any ore from drifting on the 450-foot level.

The mine development work has been continued on the 150-foot and 250-foot levels, and according to Mr. Shaw's report, this work has added to the ore lengths on these levels, so that we now have on the 150-foot level, one block of 400 feet with an average width of 5.4 feet, and another length of 150 feet with a width of 5.2 feet. On the 250-foot level there is continuous ore over a length of 580 feet and 5-foot width, containing ore of mine average, and also a short section 100 feet long and 5.2 feet wide of somewhat lower grade. Drifting in ore on the 250-foot level is proceeding at present.

Following the satisfactory results on these two levels, and in accordance with the recommendations of our engineer, it was decided to proceed with development to greater depth in order to obtain information to guide us regarding mill installation. This work has been accomplished by the sinking of an inclined winze on the vein from the 250-foot level, and the opening up of a 3rd level at a vertical depth of 350 feet. A limited amount of lateral work on the 350-foot level gave several good ore sections, and in doing this work we encountered a new vein branching from the main shear and striking west. This new vein was drifted on for a distance of about 165 feet in ore of mine average grade and width.

The winze was continued and has now reached a depth of 450 feet vertically, where a new level is being opened up. The results encountered in the sinking of the winze were highly satisfactory, and with the exception of a few places where the vein flattened or rolled, there was continuous ore from a point in a raise above the 250-foot level down to the present depth at the 450-foot level, making a total length on the dip of the vein of about 350 feet. The average width of the vein in the winze is 4.7 feet, and the values are higher than the mine average, with the best results encountered below the 350-foot level.

Following the milling tests, to which reference is made in the general manager's supplementary report presented at our annual meeting, your directors made arrangements for the

design and preparation of plans for a cyanide mill, which should give maximum extraction at minimum cost. Hydro-electric power being available, negotiations were entered into with the Hydro-Electric Power Commission of Ontario for a supply of power for operating purposes, and work was commenced on the construction of a power transmission line of about 5½ miles in length. This work is about completed and the power should be turned on at our plant in December. During the summer, preparations were made to replace our steam plant by the installation of electrically driven equipment. New buildings to accommodate increased forces were erected, and in the meantime orders were placed for all materials, machinery, and supplies necessary for mill construction and operation. We were very fortunate in being able to effect delivery at the mine of everything needed before the close of navigation.

The construction of the mill, which is of steel frame with steel tanks and bins, all on concrete foundations, is now well advanced, and the roofing and sheeting of the main building is almost completed. A new steel headframe and mine ore bin are being erected. The initial capacity of the mill is estimated at 125 tons daily, and the design of the building and layout is such that additional units can be added at comparatively low cost to increase the capacity to at least 200 tons. According to the present plans of our manager, the mill should be turned over in February.

The electric power line mentioned in the above quotation was completed at the end of the year, and the 125-ton mill was nearing completion.

W. P. Mackle has been superintendent at the property since the beginning of operations. John W. Shaw is general manager.

McLaren-Porcupine Gold Mines, Limited

McLaren-Porcupine Gold Mines, Limited, has an authorized capitalization of 3,000,000 shares of no par value, of which 2,300,000 have been issued.

The officers and directors are: Dr. W. M. McLaren, president; J. M. McLaren, vice-president and managing director; J. J. Gallagher, treasurer; N. W. Kingsland, Gerald Ruel and Robt. D. McLaren, directors. The head office and mine office are at South Porcupine. Stanley Saxton is manager.

The property consists of seven patented claims comprising about 300 acres in Deloro township, district of Cochrane. The property is one mile south of the Marbuan mine and about five miles from South Porcupine. During 1934 a small number of men were employed prospecting and mining from an open pit. A 3-ton Kennedy Nutt mill was operated for part of the summer on ore from this open pit. A 15-ton mill of the same type was installed late in December. Sixteen men were employed at the mine at the end of the year.

Power is supplied by a portable Sullivan compressor. Two Climax drills are used. The material from the pit is handsorted before being sent to the mill. By crushing to finer size than the Kennedy Nutt mill calls for, the tonnage being handled has been raised to between 20 and 25 tons per day.

MacLeod-Cockshutt Gold Mines, Limited

MacLeod-Cockshutt Gold Mines, Limited, was incorporated in September, 1933. It has a capitalization of 3,000,000 shares of $1 par value. The officers and directors are: F. G. MacLeod, president; W. H. Connell, vice-president and managing director; A. H. Cockeram, secretary-treasurer; A. Cockshutt and G. B. Webster, directors. The head office of the company is at 1001 Federal Building, Toronto. The mine-office address is Geraldton.

The property consists of 22 claims lying south and east of the Little Long Lac mine in the Little Long Lac area, Thunder Bay district. In the summer of 1933 the Connell Mining and Exploration Company held an option on the property and did 8,780 feet of diamond-drilling and a considerable amount of trenching and sank two pits to 15 and 30 feet.

In the spring of 1934, the company installed a mining plant consisting of two 60 h.p. locomotive-type boilers, a 520-cubic-foot compressor, and an 8- by 6-inch hoist with a 24-inch drum. Sinking was started early in the summer.

A 3-compartment shaft was put down and one level opened at the 150-foot level. Work done on the level consisted of: main crosscut north and south, 231 feet; north zone exploration crosscutting and drifting, 662 feet; central zone exploration crosscutting and drifting, 163 feet; and south zone exploration crosscutting and drifting, 726 feet. The results obtained were disappointing and underground operations ceased in December. A diamond-drilling campaign, started about the time of suspension of underground operations, has been planned as a further test of the north zone, which had provided the most favourable results.

Work on the property has been carried out under the management of C. H. E. Stewart. An average of 37 men was employed during the period of operation.

J. Bruce McMartin

On October 10, 1934, J. Bruce McMartin of Montreal, acquired the property of the Dikdik Exploration Company, Limited, situated at Atigogama lake, Rickaby township, district of Thunder Bay. This property consists of a group of 9 claims, and is about 12 miles northwest of Kinghorn station, on the Port Arthur–Long Lac branch of the Canadian National Railways.

Work was commenced on this property in December, 1933, and a narrow high-grade vein was mined by an open cut on claim T.B. 11,071 to a depth of 50 feet over a length of 80 feet. In March a 2-compartment vertical shaft was started from the bottom of the open cut, and continued to a depth of 160 feet below surface. A level was established at 150 feet.

Underground operations were suspended from July until October. In December shaft-sinking was resumed, and the shaft had reached a depth of 233 feet by the end of the year. A total of 218 feet of drifting was accomplished on the 150-foot level during 1934.

Two shipments of sorted ore, totalling about 293 tons, were made to the Flin Flon smelter early in 1934. The recovery from this ore was 1,081 ounces of gold and 600 ounces of silver.

The plant installed included a 310-cubic-foot gasoline compressor, and a 6- by 5-inch Ingersoll-Rand single-drum air hoist. Buildings on the property consisted of a power-house, office, bunk-house, cook-house, stable, and powder-house.

An average of 12 men was employed, of whom 5 were underground. K. W. Fritzsche was in charge of operations. The mine address is Jellicoe.

McMillan Gold Mines, Limited

McMillan Gold Mines, Limited, was incorporated in 1926, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: R. L. Patterson, acting president; G. A. Foot, vice-president; Dr. F. C. Fraser, secretary-treasurer; C. B. Goldsborough, J. M. R. Corbet, W. J. Hussey, C. A. Durkee, G. M. Miller, and R. Martin, directors. The head office is at Sudbury.

The property is about 60 miles southwest of Sudbury, in Mongowin township, district of Sudbury, and is within 2 miles of the Little Current branch of the Canadian Pacific Railway. The mine address is Footbanks.

In the spring of 1934 work was started on the construction of a 125-ton cyanide mill, which was put in operation on August 13, 1934. An electric power line was constructed from Espanola to the property.

Underground operations were carried on throughout the year with the exception of June and July, when electric equipment was installed.

The development work accomplished during 1934, and the total to the end of 1934, on the various levels, was as follows:—

Level	Drifting		Crosscutting		Raising	
	1934	Total	1934	Total	1934	Total
	feet	feet	feet	feet	feet	feet
225-foot	340	365	.....	.....	32	32
325-foot	.....	1,355	.....	504	302	302
425-foot	.....	333	30	95	32	32
525-foot	.....	1,609	.....	639	45	45
625-foot	412	768	108	143	50	50
Total	752	4,430	138	1,381	461	461

Shrinkage stoping was started on the 225- and 325-foot levels.

The new plant installed included a 1,000-cubic-foot electric compressor, and an Ingersoll-Rand double-drum electric hoist. Buildings constructed included a mill, refinery, assay office, dry-house, manager's residence, office, and cook-house. The mill equipment installed included a 12- by 20-inch jaw-crusher, Newhouse crusher, 7- by 5½-foot ball mill, 5- by 26-foot Dorr classifier, two 30- by 12-foot Dorr thickeners, three 16- by 16-foot Dorr agitators, two 8- by 8-foot Oliver filters, and a Merrill-Crowe continuous precipitation unit. Up to the end of the year the mill treated a total of 12,313 tons of ore.

An average of 84 men was employed during the year. L. H. Heidenreich was succeeded by J. G. McGregor as manager. George Dunn was mine superintendent, and W. R. Dennis was mill superintendent.

Manitoba and Eastern Mines, Limited

Manitoba and Eastern Mines, Limited, is capitalized at 5,000,000 shares, of which 3,100,006 were issued, 2,000,000 shares being optioned to Bobjo Mines, Limited, for $202,500.

The property consists of 16 claims in Strathy township, district of Nipissing. The head office is at 25 King Street West, Toronto. The officers of the company are: W. E. Hurd, president; W. G. Chipp, treasurer; T. M. Mungovan, secretary; R. J. Jowsey and L. K. Fletcher, directors. The mine address is Timagami.

The following development work was done during the year: shaft, 323 feet, with levels at 200 and 300 feet; 495 feet of crosscutting; 1,322 feet of drifting; and 2,243 feet of diamond-drilling. The plant consists of a new 700-foot Rand compressor, driven by a 160 h.p. Atlas Polar Diesel engine; a 50 h.p. boiler, locomotive-type, for heating; and a 7 h.p. Diesel D.C. lighting unit. A new double-drum, 6- by 8-inch hoist, air or steam, was installed.

An average of 16 men was employed during 1934.

Marbuan Gold Mines, Limited

Marbuan Gold Mines, Limited, was incorporated in 1933 with a capitalization of 1,000,000 shares of $1 par value, of which 732,898 are issued. The officers and directors are: E. G. Kinkel, president; Jacob Betz, vice-president;

Henry Kobler, treasurer; R. P. Kinkel, assistant treasurer; G. R. Feine, secretary; Gustave R. Loesch, Henry J. Tiedt, and Clarence Leo, directors. The head office is at 902 Lumsden Building, Toronto. The mine address is South Porcupine. Charles L. Hershman is mine manager.

The property, which consists of 5 claims adjoining the Buffalo Ankerite, in Deloro township, district of Cochrane, formerly belonged to March Gold, Limited, and was sold for the benefit of the bondholders when that company went into bankruptcy in 1933.

March Gold had sunk the main shaft to the 425-foot level, sunk a winze from 425 feet to 675 feet, and opened up four levels. In 1926 a 150-ton mill was installed; it was operated until the mine was shut down in 1932, during which time production totalled $1,023,759. Milling was resumed by Marbuan Gold in July, 1934.

The following is taken from the report of the mine manager for the year ending December 31, 1934:—

Production

Dry tons treated	25,715
Mint returns	$113,484.06
Average value per ton ounces	0.135
Recovery per ton milled	$4.41
Ore broken in stopes tons	23,007
Ore broken in development tons	4,170
Ore hoisted tons	26,787
Waste hoisted tons	5,305

Tonnage milled in 1934 was obtained from the Nos. 3, 5, and 6 vein workings on the 170-, 300-, 475-, 800-, and 1,050-foot levels.

Development

	Feet
Drifting	1,478
Crosscuts	371
Raises	517
Winze	380
Total	2,746
	cu. ft.
Stations	24,838
Sumps	3,125
Total	27,963

No. 1 winze was completed in November to the 1,050-foot level. Stations were cut on the 800-, 925-, and 1,050-foot levels, and crosscuts started toward the No. 5 vein on the 800-foot level and the No. 3 structure on the 925- and 1,050-foot levels. The 405 sublevel was driven west for approximately 600 feet. Indicated stope extensions were prospected by a series of raises.

Milling

The mill treated 25,712 tons during the year at a cost of $1.177 per ton.

Percentage of total possible running time	89.5
Tons treated per day	152
Tons treated per 24 hours running time	170
Average mill heads (figured at $20.67)	$2.59
Average mill tails	$0.21

Tonnage milled in 1934 was obtained from abandoned stopes and lateral extensions in the Nos. 3, 5, and 6 veins on the 170-, 300-, and 425-foot levels.

MILL RECORD

Month	Tons milled	Daily average, tons	Heads per ton	Tails per ton	Total value, heads and tails	Bullion	Premium
July	4,356	150	$3.03	$0.203	$13,198.68	$9,418.76	$6,259.31
August	4,889	157	2.41	.205	11,782.49	12,971.75	8,439.24
September	4,492	149	3.01	.220	13,520.92	13,294.24	8,606.00
October	4,331	139	2.64	.230	11,433.84	11,863.23	7,779.31
November	4,625	154	2.22	.190	10,267.50	10,174.70	6,620.45
December	4,707	151	2.30	.190	10,826.10	10,782.22	7,274.85
Total	27,400	150	$2.59	$0.21	$71,029.53	$68,504.90	$44,979.16

N.B.—All values are figured on gold at $20.67.

Ore Reserves

There are no positive ore reserves in the mine at present. Possible ore can be calculated in the Nos. 603 east and 505 east stopes on the basis of past production in these sections and check-sampling results obtained.

Level	Tons	Assay value	Total value
Back of stope to 475-foot (No. 3 vein)	8,093	$7.80	$63,125.40
550- and 475-foot (No. 5 vein)	3,775	4.86	18,346.50
Total	11,867	$6.85	$81,471.90

N.B.—All values are figured on gold at $20.67.

BROKEN ORE

	Tons	Assay value	Total value
No. 5 vein	12,375	$3.75	$46,439.72

N.B.—All values are figured on gold at $20.67.

Operating Costs

Month	Mining	Milling	Development	Total
July	$2.859	$1.274	$1.289	$5.422
August	2.543	1.142	1.647	5.332
September	3.384	1.053	1.577	6.014
October	3.319	1.333	1.808	6.460
November	2.666	1.102	1.571	5.339
December	2.833	1.155	1.539	5.527
Average cost per ton	$2.934	$1.177	$1.572	$5.682

Drifting per foot	$13.32
Raising per foot	11.67
Sinking and stations per foot	78.30

Plant

The mill machinery and general equipment were overhauled and placed in operation. The mine pump was placed on the 1,050-foot level. The hoist was installed on the 475-foot level. Cars, cages, drill machines, and accessory equipment and supplies were purchased.

General

The main haulageway on the 475-foot level was retimbered and widened, and the existing 16-pound rail was replaced by 20-pound rail. Crosscuts were started on the 800-, 925-, and 1,050-foot levels toward the Nos. 5 and 3 structures.

Martin Bird Syndicate

The Martin Bird Syndicate owns 9 claims in Hearst township, district of Timiskaming. The officers and directors are: S. J. Bird, president; G. O'Meara, secretary-treasurer; Dr. R. Armstrong, J. Martin, and D. Lough, directors. John Campbell was mine manager.

During 1934 a shaft was sunk 125 feet, and about 358 feet of lateral work was completed. Operations ceased in November.

Matachewan Consolidated Mines, Limited

Matachewan Consolidated Mines, Limited, owns 21 claims, comprising 840 acres, in Powell and Cairo townships, district of Timiskaming. The authorized capital is 3,000,000 shares of no par value, of which 1,200,000 shares are issued to the Matachewan Canadian Gold, Limited, shareholders. The balance of the stock is optioned to Ventures, Limited, and Sudbury Basin Mines, Limited, to be taken up as money is expended on development. The officers and directors of the company are: Thayer Lindsley, president; H. H. Sutherland, vice-president; H. Whittingham, secretary-treasurer; W. J. Boland and Jos. Errington, directors. Ernest Craig is manager, and Thos. L. Wells is superintendent. The head office is at 25 King Street West, Toronto. The mine address is Elk Lake.

During the year a 100-ton mill was built and put into operation. In November 4,680 tons were milled, from which 679.39 fine ounces of gold and 99.49 ounces of silver were recovered. The following development work was done: raising, 478 feet; drifting, 1,780 feet; crosscutting, 703 feet; box-holing, 318 feet. The ore stoped amounted to 121,620 feet, or 6,081 tons.

An average of 56 men was employed during 1934.

Miller Independence Mines (1924), Limited

Miller Independence Mines (1924), Limited, successor to Miller Independence Mines, Limited, is capitalized at 3,500,000 shares of $1 par value, of which 3,100,000 shares are issued.

The officers and directors are: F. L. Smith, Nantucket, Mass., president and treasurer; George McSherry, vice-president; D. E. Cushing, secretary; W. M. Byers, F. A. Robinson, and Angus Smith, directors. M. W. Hotchkin, consulting engineer, resigned at the end of the year. The head office is at 39 New Bank of Toronto Building, London, Ont. The mine office is at Boston Creek.

In 1932 the company acquired the property of the Allied Gold Mines, Limited, for 1,000,000 shares. The property consists of 560 acres in Pacaud township, district of Timiskaming.

The property was reopened in February, 1934, and shut down again in August. During the period of operation 185 feet of crosscutting and 1,049 feet of drifting were done on the 100-foot level. An inclined winze was sunk to a depth of 221 feet below the 100-foot level. After the underground work was stopped 400 feet of diamond-drilling was done from surface.

An average of 21 men was employed.

Minto Gold Mines, Limited

Minto Gold Mines, Limited, was incorporated in 1930, with an authorized capitalization of 8,000 shares of no par value. The officers and directors were:

John Knox, Jr., president; M. E. Knox, secretary-treasurer; A. Dorfman and J. Ingram, directors.

The property was formerly owned by Cooper Gold Mines, Limited, from whom it was leased and later purchased. It includes the Minto, Jubilee, and Cooper mines, all of which are located in township 29, range 23, in the Michipicoten area, district of Algoma.

Underground operations at the Minto mine were suspended in May, 1934. During the period of operation in 1934 a total of 10,243 tons of ore was mined and milled, of which 3,412 tons was obtained from the 1st level, 1,560 tons from the 2nd level, and 5,271 tons from the 3rd level. No development work was done. Later in the year a total of 1,035 feet of diamond-drilling was done from surface.

Following the suspension of underground operations at the Minto mine, the mining plant was transferred to the Jubilee mine, where underground work was started late in July. Stoping was commenced on the 3rd level, from which 11,946 tons of ore was obtained. This ore was given a preliminary crushing and transported by truck to the 80-ton cyanide mill at the Minto mine, where it was milled.

The plant included a 720-cubic-foot Ingersoll-Rand electric-driven compressor, and an electric hoist.

An average of 42 men was employed throughout the year under the direction of John Knox, Jr. The mine address is Wawa.

Moffatt-Hall Mines, Limited

Moffatt-Hall Mines, Limited, has a capitalization of $5,000,000, in shares of $1 par value. The officers are: L. R. Moffatt, president; and C. F. Tuer, Haileybury, secretary-treasurer. The mine office is at Swastika. The company owns 15 claims in Lebel township, district of Timiskaming.

In February, 1934, the property was leased to Hugh Jardine, who carried on operations until September 21, with an average force of 18 men. During this period a total of 3,178 tons of ore was hoisted and shipped.

On September 21 the Bidgood Kirkland Gold Mines, Limited, took over the lease on the property. From September 21 to the end of the year the latter company hoisted and milled 5,298 tons of ore. The total value of the ore milled during the year was $87,084.08.

The following development work was done by the Bidgood Kirkland Gold Mines, Limited:—

	Feet
Raising	310
Drifting	70
Winze-sinking	16
Diamond-drilling	643

Munro Croesus Mines, Limited

Munro Croesus Mines, Limited, owns 160 acres in Munro township, district of Cochrane, 12 miles east of Matheson. The authorized capital is 40,000 shares of $1 par value. The officers of the company are: Robert Coffey, president; J. E. Grant, Haileybury, vice-president and general manager; L. A. Lillico, secretary-treasurer.

During the latter part of 1934 the mill treated 205 tons, of which 25 tons was taken from the old surface dump. The value recovered was $10,351.76. The property was closed in December, 1934.

Naybob Gold Mines, Limited

Naybob Gold Mines, Limited, was formed in 1932 to take over the property of Hayden Gold Mines, Limited, in Ogden township, district of Cochrane. It is capitalized at 3,500,000 shares of $1 par value. The officers and directors are: R. J. Naylor, Rochester, N.Y., president and manager; Richard N. Clarke, vice-president; H. J. Haddleton, secretary-treasurer; Geo. E. Beggs, John G. Jones, Sherman J. Le Pard, and Jos. Montgomery, directors. The executive office is at 808 Genesee Valley Trust Building, Rochester, N.Y.

During 1934 the mine was kept pumped out until December, when underground work was started on the 300- and 700-foot levels.

Work on the 700-foot level is being confined to No. 703 vein. This is the most southerly vein of a group of three, which strike roughly southeast and dip to the southwest at about 55 degrees. On the 300-foot level a crosscut is being driven south to intersect the same vein.

About 44 men are employed. The mine address is Timmins.

Neville Canadian Gold Mines, Limited

Neville Canadian Gold Mines, Limited, was incorporated in February, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: E. H. Dickenson, president; R. R. Brown, vice-president; W. G. Caulfield, secretary-treasurer; T. M. Mungovan and Paul Fisher, directors. The head office is at 710 Concourse Building, Toronto.

The property acquired by this company consists of a group of 9 claims in Churchill and Macmurchy townships, in the West Shiningtree area, district of Sudbury. It is about 23 miles by road from Westree station on the Canadian National railway, and was formerly known as the Wasapika-Ribble property.

Former operators sank a 2-compartment vertical shaft to a reported depth of 300 feet, with levels at 100, 200, and 300 feet, on which a total of 730 feet of lateral work is believed to have been accomplished.

Work was started on August 4 and suspended on December 15, 1934. A new headframe was erected, and the old buildings on the property, including a power-house, blacksmith shop, assay office, dry-house, bunk-house, cook-house, and office, were repaired. The old steam plant, including two boilers, totalling 81 horse-power, an 8- by 10-inch Jenckes hoist, and a 350-cubic-foot Ingersoll-Rand steam compressor, was overhauled and put in shape for use. The mine had been dewatered to the 100-foot level when operations were suspended.

About 14 men were employed under the direction of G. F. Milne.

North Shores Gold Mines, Limited

North Shores Gold Mines, Limited, was incorporated in November, 1933, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: R. N. Palmer, president; E. E. Watts, vice-president; W. G. Bennett, secretary-treasurer; J. A. Ross and L. P. Wood, directors. The executive office is at 44 Victoria Street, Toronto.

The property held by this company consists of 600 acres located about 3½ miles south of Schreiber, on the main line of the Canadian Pacific railway, district of Thunder Bay.

When this property was taken over it had a 500-foot adit, from which some stoping had been done on a narrow high-grade vein. Underground work was started by this company in April, 1934, and during the balance of the year the

old adit was driven an additional 400 feet. A second adit was started 180 feet below the first, and driven in 400 feet from the portal.

In July, equipment was taken into the property for a 25-ton amalgamation mill and construction started. Milling was started on November 10, and a total of 602 tons of ore was treated during 1934. The ore was obtained from stoping from the 1st level adit. The mill was erected on the shore of Lake Superior at a point about half a mile distant, and 400 feet below, the 1st level adit. The ore was transported to the mill by truck.

The mill equipment included a 19- by 24-inch jaw-crusher, 10- by 14-inch jaw-crusher, 2 Kennedy Nutt mills, ball mill, Akins classifier, Wilfley table, D. S. A. flotation cell, corduroy-blanket tables, and amalgamation plates.

A power plant was erected, and the equipment installed included a 75 k.v.a. generator, driven by a 104 h.p. Diesel engine, and a 1,052-cubic-foot Ingersoll-Rand compressor, driven by a 240 h.p. Diesel engine.

An average of 27 men was employed under the direction of R. N. Palmer. The mine address is Schreiber.

Northern Empire Mines Company, Limited

The Northern Empire Mines Company, Limited, was incorporated in 1932. with an authorized capitalization of 10,000 shares of $10 par value, which was increased in 1933 to 500,000 shares of $1 par value. The officers and directors are: Fred Searls, Jr., president; H. E. Dodge, secretary-treasurer; G. B. Agnew and D. E. Thomas, vice-presidents; Carroll Searls and A. Douglas, directors. The executive office is at 14 Wall Street, New York. The mine address is Empire.

The property of this company is located at Empire, on the Port Arthur–Long Lac branch of the Canadian National Railways, district of Thunder Bay

The development work accomplished during 1934 on the various levels, was as follows:—

Level	Drifting	Crosscutting	Raising
	feet	feet	feet
150-foot			190
300-foot	1,260	63	143
450-foot	1,006	133	79
Total	2,266	196	412

Shaft-sinking was in progress at the end of the year, by which time the 2-compartment shaft had been sunk an additional 107 feet, giving it a total depth of 609 feet, and a station had been cut at the 600-foot level.

The 125-ton mill was completed and put in operation on March 13, 1934. A total of 22,507 tons of ore was treated during 1934, which was obtained from cut-and-fill stoping on the 150-, 300-, and 450-foot levels.

The equipment installed in the mill included a 9- by 12-inch jaw-crusher, 30 gravity stamps, amalgamation plates, an 8- by 18-foot Dorr classifier, a 4- by 7-foot Hardinge ball mill, a Denver Sub-A flotation unit, a 16- by 8-foot Dorr thickener, a 6- by 3-foot Dorr filter. Later in the year cyanide equipment was added, which included an 8- by 8-foot thickener, a 4- by 4-foot ball mill, Akins classifier, three 8-foot Denver agitators, and Merrill-Crowe continuous precipitation equipment.

An average of 83 men was employed, of whom 46 were underground. R. J. Hendricks was in charge of operations; P. E. Corrin was mine captain; and J. M. Cartan succeeded H. D. Hunt as mill superintendent.

O'Connell Gold Mines, Limited

O'Connell Gold Mines, Limited, is capitalized at 3,000,000 shares of no par value, of which 1,200,000 shares are issued. In 1934 the officers and directors were: J. J. Hollinger, president and manager; G. B. O'Connell, vice-president; A. G. Plaxton, secretary-treasurer; R. O. Wheatley, director. The head office is at 100 Adelaide Street West, Toronto.

The company owns 180 acres in Powell township, Matachewan area, district of Timiskaming. In 1934 a plant was installed consisting of a new semi-Diesel oil compressor of 350-cubic-foot capacity, a single-drum hoist, and a 60 h.p. boiler. During June and July a shaft was sunk 50 feet.

An average of 20 men was employed. The mine address is Elk Lake.

Orecana Trusts, Limited

The head office of Orecana Trusts, Limited, is at 1689 Board of Trade Building, Chicago. R. C. Orton is president.

Kozak Property

The company took over the Kozak property, which is located in township 28, range 26, district of Algoma, in 1933. It is less than a mile west of South Goudreau station on the Algoma Central railway.

A 6- by 8-foot vertical shaft was started late in 1933. Underground operations were suspended in the spring of 1934. The shaft was sunk to a depth of 110 feet, and a level established at 100 feet, where a small amount of lateral work was accomplished.

The plant used included a gasoline compressor and an air hoist. R. Tallack was in charge.

Michael-Boyle Property

The company took over the Michael-Boyle property, located in township 27, range 25, district of Algoma, and started operations in March, 1934. There is a 5-mile road from mileage 171½ on the Algoma Central railway to the property.

Previous operators had driven an adit for a distance of 300 feet, from which they did 200 feet of drifting. A shaft had been put down to a depth of 45 feet.

Underground work was started in April and suspended in July, 1934. The adit was driven an additional 33 feet, and 367 feet of drifting was accomplished, using a gasoline compressor. Surface work was done for the rest of the year. An average of 14 men was employed under the direction of J. A. S. Roussac.

Pamour Porcupine Mines, Limited

Pamour Porcupine Mines, Limited, was incorporated in March, 1934. It has a capitalization of 3,500,000 shares. The officers and directors are: G. H. Rainville, president; R. M. Macauley, vice-president; A. Lafontaine, secretary-treasurer; M. Kendall, W. Meen, A. D'Amour, P. Gelines, directors. The head office of the company is at 221 Notre Dame Street West, Montreal.

The holdings of Pamour Porcupine Mines, Limited, are an amalgamation of the properties of La Palme Porcupine Mines Company, Limited, the Three

Nations Mining Company, Limited (which has recently been held by private interests), and Porcupine Grande Gold Mines, Limited. The company is controlled and operated by the Quebec Gold Mining Corporation, which held an option on 2,000,000 shares of the company when it was incorporated. The holdings consist of 20 claims, all in the northeast quarter of Whitney township, district of Cochrane. The claims lie about 7 miles northeast of the Dome mine. The mine address is South Porcupine.

Work was started on the property in May, 1934. Diamond-drilling was commenced in June. During the year 5,966 feet of drilling was done, all from surface, making a total of 12,536 feet of diamond-drilling done on the property to the end of 1934.

Underground work was started in October. Prior to this time the shaft-sinking had amounted to 200 feet, plus the sump, and the following additional underground work had been done:—

	100-foot level	200-foot level
	feet	feet
Crosscutting	713	637
Drifting	1,018	737
Raising	140	100
Winze	.....	33

During 1934 underground work was confined to the 200-foot level, 97 feet of crosscutting being done, and 523 feet of drifting.

At the end of the year there were 34 men employed at the mine. About half this number were employed underground, 7 at diamond-drilling, and the rest on surface. C. D. Stevenson is mine manager.

Parkhill Gold Mines, Limited

Parkhill Gold Mines, Limited, was incorporated in 1929, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors are: Sir Thomas Tait, president; G. F. Elderkin, vice-president; G. F. Racine, secretary-treasurer; G. M. McKee, Chas. Adams, and Dr. C. A. Peters, directors. The executive office is at 1835 Beaver Hall Building, Montreal, Que. The mine office is at Wawa. The property is located in township 29, range 23, in the Michipicoten area, district of Algoma.

During 1934, the 2-compartment 40-degree shaft was sunk an additional 276 feet to a total depth of 1,253 feet on the incline, and levels, the 8th and 9th, were established at 1,000 and 1,200 feet. Development footages accomplished on the various levels during 1934 were as follows:—

Level	Drifting	Crosscutting	Raising
	feet	feet	feet
1st	.....	.....	108
3rd	232	.....	.....
4th	608	106	124
5th	.....	.....	156
6th	43	73	113
7th	1,051	168	245
8th	1,413	207	355
9th	368	104	.....
Total	3,715	658	1,101

A total of 19,455 tons of ore was obtained from the mine during 1934, of which 15,170 tons was from stoping and the balance from development. Stoping was done by open-stoping methods on all levels from the 3rd to the 8th, inclusive, though the major production was from the 7th and 8th levels.

The cyanide mill was operated for 318 days during 1934, and treated a total of 19,431 tons of ore.

An average of 96 men was employed, of whom 62 were underground. R. E. Barrett was in charge.

Paymaster Consolidated Mines, Limited

Paymaster Consolidated Mines, Limited, was incorporated in 1930 and has an authorized capitalization of 9,000,000 shares of $1 par value. The head office is at 204 McKinnon Building, Toronto. The officers and directors are: A. S. Fuller, president; E. H. Walker, vice-president and managing director; E. L. O'Reilly, secretary-treasurer; Chas. E. Cook, H. D. Rothwell, A. W. Hodgetts, C. J. O'Brien, directors.

The principal holdings of this company total about 1,600 acres. The properties are situated in Tisdale township, district of Cochrane, south and west of the Dome mine, the two properties being contiguous. Paymaster Consolidated Mines' holdings include property formerly held or controlled by the following companies: West Dome Mines, Limited; Dome Lake Mining and Milling Company, Limited; Standard Gold Mines, Limited; McLean Gold Mines, Limited; Consolidated West Dome Lake Mines, Limited; Premier Paymaster Mines, Limited; Bison Gold Mines, Limited; West Dome Lake Gold Mines, Limited; United Mineral Lands Company, Limited.

Paymaster Consolidated Mines have numbered the various shafts on their property from west to east. The following is a list with their depths and the approximate amount of development work done from each shaft:—

Shaft	Depth	Lateral workings
	feet	feet
No. 1 (old Paymaster)	80	
No. 2 " "	813	19,202
No. 3 " "	400	
No. 4 (old United Mineral)	253	1,545
No. 5 (old Dome Lake)	1,097	23,537
No. 6 (old West Dome or Heinze)	456	6,946

From the 1,050-foot level of No. 5 shaft, a winze has been sunk, and levels have been established at 1,200 and 1,325 feet.

There are two mills on the property, the old West Dome Lake cyanide mill of 150-tons capacity, not in use, and the former United Mineral Lands mill of 470 to 500 tons capacity, now in use.

Mining operations were started by the Paymaster Consolidated in November, 1933, in the No. 6 shaft area. By July, 1934, the No. 5 shaft workings were pumped out, and work was also started in this area.

In September, 1934, the ore reserves of the company were stated to include: in the No. 6 shaft area above the 400-foot level, indicated and probable, 35,000 tons, averaging $11 per ton; in the No. 5 shaft area, in the old workings above the 1,050-foot level, indicated, about 10,000 tons, averaging $9 per ton; surface

dump, 6,000 tons of low-grade ore. Former production at various times since 1915, from these two shafts, totalled $1,114,821. Past production from the old Paymaster section totalled $384,647.

Milling operations were started by Paymaster Consolidated on September 24, 1934. During the remainder of the year there were treated 13,824 tons of ore, derived from the following sources: from surface dump, 6,786 tons; from No. 5 shaft, 514 tons; from No. 6 shaft, 6,524 tons. From this tonnage production amounted to $77,949.08.

Feed from the surface dump was stopped in December for the winter months. Tonnage was then stepped up from the Nos. 5 and 6 shafts. At the end of December the mill was handling about 140 tons per day, about 20 per cent. of which was coming from No. 5 shaft and 80 per cent. from No. 6 shaft. The ore from these shafts is hauled by trucks to the mill.

During 1934 No. 6 shaft, inclined at 62 degrees, was deepened 125 feet, from 331 feet to 456 feet, and the following additional underground work and diamond-drilling was done:—

	Drifting	Cross-cutting	Raising	Diamond-drilling
	feet	feet	feet	feet
From No. 6 shaft	2,037	368	287	1,271
From No. 5 shaft	.....	28	21	1,055
From surface	.....	.....	.....	602
Total	2,037	396	308	2,928

An average of 72 men per month was employed at the mine during 1934. Of this number 56.3 per cent. were employed underground; 25.9 per cent. on surface; 10.9 per cent. in the mill; and 6.9 per cent. in general construction work.

Chas. Cook is mine manager. The mill superintendent is D. Robinson. The mine superintendent during 1934 was G. R. McLaren, who resigned in January, 1935. His successor has not yet been named. The mine address is South Porcupine.

Pickle Crow Gold Mines, Limited

The property of the Pickle Crow Gold Mines, Limited, is located in the Pickle Lake–Crow River area, in the district of Kenora, Patricia portion. There are 59 claims in the group, comprising approximately 2,300 acres. The property lies about 6 miles east of that of Central Patricia Gold Mines, Limited. The mining camp is situated on claims Pa. 746 and 747. Transportation to the mine in summer is from Hudson or Collins on the Canadian National railway, by air route, or from Hudson by water. Scows starting from Hudson pass through Lac Seul and are taken across into Lake St. Joseph by means of Root river and a marine railway. These scows are then taken across Lake St. Joseph to a point about 20 miles from the mine, from which point supplies are delivered to the mine either by tractor or plane. Winter transportation starts from Savant Lake on the Canadian National railway, a distance of about 115 miles from the mine, and is entirely by tractor train except for supplies taken in by air from Hudson.

The company is capitalized at 3,000,000 shares of $1 par value. It was incorporated January 8, 1934, and purchased property from Northern Aerial

Canada Golds, Limited. The latter company had previously taken over the property from Northern Aerial Minerals Exploration, Limited.

The officers and directors are: J. E. Hammell, president; A. L. Smith, vice-president; Robert Fennell, secretary-treasurer; G. A. Cavin, assistant secretary-treasurer; Mrs. Eola Hammell, director. The mine manager is Alex. G. Hattie. The head office is at 1406 Concourse Building, Toronto. The mine address is Pickle Lake, via Sioux Lookout.

Work was first done on the property in 1928. It was then dormant until 1933, when a steam plant, consisting of two 60 h.p. locomotive-type boilers, was installed. Other equipment included an 800-cubic-foot Canadian Ingersoll-Rand compressor, an 8¼- by 10-inch Canadian Ingersoll-Rand reversible steam hoist, and drill sharpener.

Shaft-sinking was commenced in September, 1933, and the same fall was carried to a vertical depth of 380 feet, with stations cut at the 125-, 250-, and 375-foot levels. The shaft has three compartments. Underground development has been carried on continuously since the shaft was finished. Up to November 30, 1934, the following underground work had been accomplished:—

Level	Drifting	Crosscutting	Raising
	feet	feet	feet
125-foot	614	80	170 [1]
250-foot	1,179	185	
375-foot	1,378	264	35
Total	3,171	529	205

[1]From the 2nd to the 1st level.

Buildings on the property include a power-house, 125-ton mill, steel headframe, blacksmith shop and steel sharpening shop, assay office, mine office, refinery, pump-house, switch-house, change-house, 3 warehouses, bunk-house, cookery, and residences. The average number of men employed at the mine during 1934 was 53.

Porcupine Peninsular Gold Mines, Limited

Porcupine Peninsular Gold Mines, Limited, was incorporated in July, 1921. The following year the holdings of the company, along with those of Porcupine Night Hawk Mines, Limited, Night Hawk Lake Mining Company, Limited, and Callinan-McKay Exploration Company, Limited, were merged into Night Hawk Peninsular Mines, Limited. In 1933, the assets of the Night Hawk Peninsular Mines were transferred to Porcupine Peninsular Mines, Limited.

The officers and directors of Porcupine Peninsular Mines, Limited, are: J. Albert McKay, Pittsburgh, Pa., president; J. H. Black, Toronto, vice-president; J. Ingram, Toronto, secretary-treasurer; J. R. Dodsworth, Jr., Pittsburgh, and G. A. Grover, Toronto, directors.

The company has an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,100,000 were issued in December, 1933. The head office is at 80 King Street West, Toronto. The mine address is Connaught.

The mine is located 10 miles from Connaught on the T. and N.O. railway, in the townships of Cody and Macklem, district of Cochrane.

Late in 1933, Anglo-Huronian, Limited, took an option on an unstated number of treasury shares, the shares to be received in return for work to be done

on the property. Management of the property was taken over by Anglo-Huronian, who commenced a diamond-drilling campaign, which continued to the end of December, 1934. Over 30,000 feet of diamond-drilling was completed. No drifting or crosscutting was done at the property by Anglo-Huronian. In past years the main shaft had been sunk to 440 feet, with levels at 80, 180, 300, and 425 feet. A winze had also been sunk from the 425-foot level, and from it levels opened at 525 and 625 feet.

On the property there is a 200-ton mill, which produced bullion valued at $566,885 from 1924 to 1926. The property was inactive except for pumping operations from 1926 until 1933.

During 1934, Robert E. Dye, manager at the Vipond property of Anglo-Huronian, supervised drilling operations at the Porcupine Peninsular.

Ramore Gold Mining Company, Limited

The property of the Ramore Gold Mining Company, Limited, consists of a block of 20 claims in the township of Playfair, district of Cochrane, about two miles southwest of Ramore. Work on the property has been carried on since July, 1933. The present company was incorporated in September, 1934. The capitalization is 2,000,000 shares of $1 par value, of which 800,000 shares have been issued.

The officers and directors are : C. W. Anderson, president; H. R. Grant, secretary-treasurer; H. N. Van Camp, Dr. S. Evelyn and Alex. C. Smith, directors. W. V. Hocken is mine manager. The head office address is Room 314, C.P.R. Building, Toronto. The mine address is Ramore.

Numerous test pits have been dug, and a shaft has been sunk to a depth of 60 feet.

An average of 10 men was employed.

Red Crest Gold Mines, Limited

Red Crest Gold Mines, Limited, has an authorized capitalization of 3,000,000 shares of no par value. It was incorporated in May, 1934, with a Dominion charter. Officers and directors are: Horace G. Young, president; W. S. Lightball, vice-president; C. G. Macartney, secretary-treasurer. The head office is at 1002 McGill Building, Montreal, Que.

The property, located in Todd township, Red Lake area, district of Kenora, Patricia portion, was formerly known as the Rowan Discovery.

The following paragraph from M. E. Hurst's "Preliminary Report of Developments in the Red Lake Area during 1934," indicates the work being done since the formation of the company:—

> On the Red Crest property, formerly known as the Rowan Discovery, considerable trenching and diamond-drilling have been done along a fracture zone that strikes in a northwesterly direction along a greenstone-granodiorite contact. Several quartz veins having, in places, a combined width of 20 feet, occur within this zone. Exploration to date is said to have indicated an ore shoot 222 feet in length containing 0.65 ounces gold over an average width of 5.1 feet. The auriferous portions of the vein matter appear to be intimately associated with narrow, fine-grained diorite dikes that intersect both greenstone and granodiorite. A mining plant is now being assembled on the property.

Financial difficulties resulted in operations being suspended late in the year, before the proposed shaft was started. J. M. Wilson was manager at the property during 1934. The mine office is at Golden Arm, Red Lake.

Red Lake Gold Shore Mines, Limited

Red Lake Gold Shore Mines, Limited, is capitalized at 5,000,000 shares of no par value. The officers and directors are: Charles E. St. Paul, president; Dr. Robt. W. Breuls, vice-president; Harry A. Newman, secretary-treasurer; Charles W. Gallagher, and Ira E. Hough, directors. The executive office is at 244 Bay Street, Toronto. The mine office is at Red Lake.

The property consists of about 1,100 acres and, as the name implies, is located on the shore of Red lake, Kenora district, Patricia portion. It is adjacent on the west side to the property of Howey Gold Mines, Limited. McIntyre-Porcupine Gold Mines, Limited, holds ground adjacent on the south side. The property was staked in the early Red Lake rush and considerable surface work was done then, but it was not until 1934 that a mining plant was installed, consisting of 2 locomotive-type boilers, 60 horse-power each, one 3-drill steam-driven compressor, a reversible steam hoist, air receiver, and pumping equipment. An office, combined cookery and bunk-house, manager's residence, pump-house, dry-house, hoist-house, boiler-house, blacksmith shop, shaft-house, and a 13,000-gallon water-tank have also been erected.

A shaft has been sunk to 187 feet, and 130 feet of crosscutting to the vein completed. On December 18, 45 feet of drifting on the vein had been accomplished. M. L. Bouzan is manager in charge at the property.

Richelieu Gold Mines, Limited

Richelieu Gold Mines, Limited, was incorporated in May, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: A. B. Stodart, president; G. C. Ames, secretary-treasurer; W. J. McDonough, W. R. Parker, R. Spreckels, and H. R. Drummond-Hay, directors. The head office is at 350 Bay Street, Toronto.

The property acquired by this company consists of a group of 15 claims in the Thunder Bay district, located on the northeast arm of Sturgeon lake, about 10 miles southeast of Savant Lake station on the main line of the Canadian National railway. It is about 4 miles northeast of the St. Anthony mine. The mine address is Savant Lake.

Surface work was started in May, and early in December, 1934, the sinking of a 2-compartment vertical shaft was undertaken. By the end of the year the shaft had reached a depth of 115 feet.

The plant installed included a 70 h.p. boiler, 600-cubic-foot Ingersoll-Rand steam compressor, and an 8- by 6-inch Ingersoll-Rand hoist. Buildings erected included a power-house, hoist-house, blacksmith shop, powder-house, office, bunk-house, and cook-house.

J. G. Harkness was in charge of operations.

Roche Long Lac Gold Mines, Limited

Roche Long Lac Gold Mines, Limited, was incorporated in May, 1934, with an authorized capitalization of 2,500,000 shares of $1 par value. The officers and directors were: John R. Rea, president; P. J. Roche, vice-president; W. H. Beatty, secretary-treasurer; P. J. Graham, director. The executive office is at 200 Sterling Tower, Toronto.

This company acquired 57 claims in the eastern end of the Little Long Lac area, Thunder Bay district, in 1934. In the fall a 2-compartment vertical shaft

was put down to a depth of 115 feet. Underground work was then suspended in favour of diamond-drilling.

The plant used included a 20 h.p. boiler, a small steam hoist, and a 220-cubic-foot gasoline compressor.

The mine address is Hardrock.

St. Anthony Gold Mines, Limited

St. Anthony Gold Mines, Limited, was incorporated in 1921. The authorized capitalization was increased from 3,000,000 to 3,300,000 shares of $1 par value in March, 1934. The officers and directors were: H. P. Bellingham, president; R. F. Taylor, vice-president; T. S. Giles, secretary; R. F. Cairns, treasurer; D. K. E. Fisher and D. M. Bellingham, directors. The head office is at 159 Bay Street, Toronto. The mine address is Savant Lake.

The property of the company is located at Sturgeon lake, 12 miles south of Savant Lake station on the main line of the Canadian National railway, in Thunder Bay district.

The 125-ton cyanide mill was completed and put in operation on May 12, 1934. Power is supplied by the company's hydro-electric plant, which is located about 8 miles from the mine.

Underground work was started in June for the first time since 1929. The development work accomplished up to the time operations were suspended in 1929 was as follows:—

Level	Drifting	Crosscutting
	feet	feet
100-foot	1,060	695
150-foot	950	385
250-foot	745	185
350-foot	1,037	200
500-foot	185	.....
Total	3,977	1,465

This work was done from a vertical 2-compartment shaft from surface to the 150-foot level, a vertical 2-compartment winze from the 150- to the 350-foot level, and another similar winze from the 350- to the 500-foot level. Some stoping had been done on the first four levels, and the ore treated by amalgamation. It is believed that there were about 50,000 tons of tailings left from this work, which could be re-treated at a profit in the new mill.

During 1934 the mine was dewatered to the 350-foot level only. No lateral work was undertaken. The ore in an old shrinkage stope on the 100-foot level was pulled, and some stoping done on the 150- and 250-foot levels.

Up to the end of the year the mill had treated a total of 21,618 tons, of which about 4,800 tons came from underground and the balance from the old tailings and ore dumps.

The steam hoist on surface was converted to electricity, and an electric hoist obtained for No. 1 winze. An 800-cubic-foot electric compressor was installed.

New buildings completed during the year included the hydro-electric plant, dry-house, refinery, assay office, and 2 bunk-houses.

During the year H. A. Darling, L. Weldon, and R. P. Teare were successively in charge of operations. An average of 70 men was employed.

Sakoose Gold Mines, Limited

Sakoose Gold Mines, Limited, was incorporated in June, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: A. H. Acres, president; M. J. Maloney, vice-president; D. McGrory, secretary-treasurer; M. S. Shulman, director. The head office is at 231 St. James Street West, Montreal, Que.

The property acquired by this company includes the old Sakoose mine, which is located about 6 miles south of Dyment, on the main line of the Canadian Pacific railway west of Fort William, district of Kenora.

In July work was started to dewater and sample the old workings, which are located on claim H.W. 416, and completed in October. In September diamond-drilling was started from surface and a total of 3,000 feet accomplished. The old workings were permitted to flood, and a new 2-compartment shaft was started at a point about 500 feet southwest of the old No. 1 shaft. By the end of the year the new shaft had been sunk to a depth of 30 feet and a plant was being installed, which included a 45 h.p. boiler, a 480-cubic-foot Sullivan steam compressor, and a 9- by 12-inch Jenckes hoist. Buildings erected during the year consisted of a power-house, blacksmith shop, office, bunk-house, cook-house, manager's residence, and powder-house. D. H. Traynor was in charge of operations, succeeding W. C. Hood. The mine address is Dyment.

Saundary Syndicate

The Saundary Syndicate suspended work at the old Headlight mine, located 2 miles west of Mine Centre, district of Rainy River, at the beginning of February, 1934. About 30 tons of ore was mined on the 50-foot level, of which 13 tons was milled.

Three men were employed under the direction of A. E. Saunders.

Selected Canadian Golds, Limited

Selected Canadian Golds, Limited, was incorporated in March, 1932, with an authorized capitalization of 10,000 preferred shares of $100 par value, and 15,000 common shares of no par value. The officers and directors were: D. M. Hogarth, president; G. G. Blackstock, secretary-treasurer; Halstead Lindsley, R. Livermore, W. T. McEachern, Quincy Shaw, and C. D. MacAlpine, directors. The head office is at the Bank of Commerce Building, Toronto.

In the summer of 1934 the company obtained an option on the old Sultana mine, located about 7 miles southeast of Kenora, in the Lake of the Woods area, district of Kenora. Work was started on October 1 to dewater and sample the old workings, following which diamond-drilling was started from underground.

Between 1891 and 1906 previous operators sank an 80-degree, 8- by 15-foot shaft to a vertical depth of 560 feet, and established eight levels, on which they did a total of 1,535 feet of lateral work. Stoping was done on all levels except the 8th. A 30-stamp mill was operated, and a production of between $700,000 and $1,000,000 obtained during the period of operation.

Between October 1, 1934, and the end of the year the company accomplished 1,809 feet of diamond-drilling. A total of 90 feet of lateral work was done on the 4th level, and 147 feet on the 7th level, for drill locations.

The plant used included two of the old 100 h.p. boilers, the old 700-cubic-foot steam compressor, and a new 9- by 11-inch Ingersoll-Rand steam hoist.

About 20 men were employed under the direction of Cameron McDonald.

Sinclair Mines Syndicate

The Sinclair Mines Syndicate holds a group of 16 mining claims in township 23, range 10, district of Algoma. It is about 8 miles east of Searchmont station on the Algoma Central railway.

During the early part of 1934 a 2-compartment vertical shaft was sunk to a depth of 50 feet, and 50 feet of drifting done at that level. The plant used included a 220-cubic-foot Ingersoll-Rand gasoline compressor and a gasoline hoist. Buildings consisted of a bunk-house, cook-house, blacksmith shop, and powder-house.

Dr. Alexander Sinclair, Sault Ste. Marie, was manager of the syndicate.

S. B. Smith

In 1933 S. B. Smith acquired the Van Sickle property, claim S.S.M. 301, located in township 29, range 23, in the Michipicoten area, district of Algoma. It adjoins the Parkhill property on the east side.

Operations were commenced in April, 1934, and a 2-compartment, 45-degree shaft was started in May. By the end of the year the shaft was at a depth of 140 feet on the incline, and a level had been established at 119 feet. A total of 430 feet of drifting and 119 feet of raising was accomplished on this level.

A 15-ton mill was constructed during the year. The equipment included a Telsmith crusher, Kennedy-Nutt mill, Wilfley table, and amalgamation plates. It was operated only a few hours at a time in October for the equivalent of about four days continuous operation.

The mining plant installed included a 175-cubic-foot electric compressor and a small electric hoist. Electric power was obtained from the High Falls plant of the Great Lakes Power Company. Buildings erected included a power-house, blacksmith shop, bunk-house, cook-house, manager's residence, and powder-house.

An average of 22 men was employed under the direction of J. C. Canfield. The mine address is Wawa.

South Vermillion Gold Mines, Limited

South Vermillion Gold Mines, Limited, was incorporated in April, 1934, with a capitalization of 1,500,000 shares of $1 par value. The officers and directors were: A. Pacitto, president; A. E. Broadley, vice-president; M. F. Burrows, secretary-treasurer; F. J. McFarlane and G. McLaughlin, directors. The head office is at 21 King Street East, Toronto.

The property held by this company consists of a group of three claims located on Bad Vermilion lake, about 3 miles southwest of Mine Centre, Rainy River district.

Work was commenced on April 16, and shortly afterwards a 7- by 12-foot vertical shaft was started. During the rest of the year a headframe, power-house, blacksmith shop, powder magazine, and office were constructed. A 50 h.p. boiler and a 125-cubic-foot steam compressor were installed but not used. By the end of the year the shaft had reached a depth of 40 feet, and sinking was still in progress with hand-steel and windlass.

About 10 men were employed under the direction of A. Pacitto. The mine address is Mine Centre.

Stanley Gold Mines, Limited

Stanley Gold Mines, Limited, was incorporated in 1933, with an authorized capitalization of 300,000 shares of $1 par value. Stanley E. Siscoe was president. The head office is at 231 St. James Street West, Montreal, Que.

The property is located in township 29, range 23, in the Michipicoten area, district of Algoma. It is about 5 miles by road from Wawa station on the Algoma Central railway.

Operations were continued throughout 1934. In January a mining plant was installed, and the electric power line was completed. Shaft-sinking was started in February. The 7- by 12-foot shaft, which had been sunk to a depth of 30 feet by hand-steel in 1933, was put down to a depth of 300 feet. Levels were established at 123 and 256 feet. The shaft has an inclination of 33 degrees to the 1st level, and one of 47 degrees from there to the bottom.

To the end of 1934 a total of 1,425 feet of drifting and 168 feet of crosscutting, had been accomplished. Operations ceased the end of December.

The plant included 2 electric compressors having a total capacity of 750 cubic feet, a 10- by 12-inch steam or air hoist, and a 48 h.p. boiler. Buildings erected during the year included an assay office and manager's residence.

An average of 23 men was employed, of whom 8 were underground. O. H. Adams was in charge of operations.

Stellar Gold Mines, Limited

Stellar Gold Mines, Limited, was incorporated in Manitoba in July, 1934, with an authorized capitalization of 3,000,000 shares of no par value. The officers and directors were: C. H. Miles, president; W. H. Laverty, vice-president; S. E. Fairs, secretary; and W. J. Hoover, director. The executive office is in Winnipeg.

A group of claims was acquired near Mine Centre in Rainy River district, and in September a 3-compartment shaft was started. Operations were suspended in October after sinking 68 feet.

The plant used consisted of a 15 h.p. vertical boiler, a 5- by 7-foot steam hoist, and a 310-cubic-foot GD gasoline compressor.

Straw Lake Beach Gold Mines Syndicate, Limited

Straw Lake Beach Gold Mines Syndicate, Limited, was formed in August, 1934, with an authorized capital of 115,000 shares of no par value. The officers and directors were: W. E. Segsworth, president; E. J. Kerswill, secretary-treasurer; R. J. Jowsey, J. D. Conover, L. L. Steindler, and J. A. Gairdner, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Emo.

This syndicate acquired a group of 9 claims at Straw lake, district of Kenora, which is 35 miles north of Fort Frances by air. It is 70 miles by winter road from Emo, which is 20 miles west of Fort Frances on the Canadian National railway.

Following surface work, a 2-compartment vertical shaft was started late in October, 1934, and sunk to a depth of 105 feet. A level was established at 100 feet, on which 187 feet of drifting was accomplished by the end of the year.

The plant installed included a 310-cubic-foot Ingersoll-Rand gasoline compressor and a gasoline hoist. Buildings erected consisted of a power-house, blacksmith shop, office, bunk-house, cook-house, and stable.

Frank Carnegie was in charge of operations.

Swayze-Huycke Gold Mines, Limited

Swayze-Huycke Gold Mines, Limited, was incorporated in 1933 with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: W. L. Doyle, president; F. G. Huycke, vice-president; A. B. Drake, secretary-treasurer; L. Guertin, W. C. Ryckman, and C. H. Martin, directors. The head office is at 372 Bay Street, Toronto.

The property of this company includes a group of 6 claims located in Cunningham township, in the Swayze area, district of Sudbury. It is 17 miles by road from Sultan on the main line of the Canadian Pacific railway.

A mining plant was installed in March, 1934, and shaft-sinking started. Operations were suspended in May, recommenced in July, and again suspended in September. The 2-compartment vertical shaft was sunk to a depth of 150 feet and a level established at 125 feet. When operations were suspended in September about 31 feet of drifting and 100 feet of crosscutting had been accomplished on this level.

The plant used included a 310-cubic-foot CP compressor, driven by a 50 h.p. Diesel engine, and an 8- by 10-inch air hoist. Buildings constructed included a power-house, blacksmith shop, powder-house, office, cook-house, and two bunk-houses.

An average of about 8 men was employed under the direction of W. McClintock.

Sylvanite Gold Mines, Limited

Sylvanite Gold Mines, Limited, has an authorized capital of 3,300,000 shares of $1 par value. The officers and directors of the company are: Edward L. Koons, president; William L. Marcy, vice-president; W. S. Walton, secretary; Clark L. Ingham, treasurer; Welles V. Moot, managing director; C. E. Rodgers, general manager; Alfred H. Sharpe and Harry Yates, directors. The head office is at Kirkland Lake, and the executive office is at 300 Erie County Bank Building, Buffalo, N.Y.

The property is situated in the township of Teck, district of Timiskaming. An average of 263 men was employed during the year.

The following is taken from the general manager's report for the fiscal year ending March 31, 1935:—

Production

TONS MILLED AND YEARLY PRODUCTION FOR FISCAL YEARS ENDING MARCH 31

Year	Tons	Production	Average recovery, Troy ounces per ton
1930	75,408	$690,400.14	0.44
1931	83,034	837,013.97	.49
1932	94,276	948,926.13[1]	.49
1933	96,140	912,377.15[1]	.40
1934	98,311	1,558,912.87[1]	.52
1935	124,956	1,584,817.39[2]	.41

[1]Included exchange on bullion.

[2]Including exchange on bullion, after bullion tax is deducted. Average price received for year ending March 31, 1935, was $31.32 per ounce.

Mining

Year	Ore broken			Waste broken			Total ore and waste broken
	In stopes	From development	Total	Hoisted to surface	Used for backfill	Total	
1932.....	80,678	27,417	108,095	6,658	16,369	22,937	131,032
1933.....	66,130	37,467	103,597	21,774	5,347	27,121	130,718
1934.....	54,423	31,971	86,394	25,457	5,838	31,295	117,689
1935.....	93,883	37,161	131,044	11,812	10,623	22,435	153,479

Some 3,328 feet of work was done through ore, in drift and subdrift work.

Ore Reserves.—Broken reserves at the end of the year amounted to 82,990 tons. This was almost exactly equal to the amount shown at the beginning of the period.

Operating Costs

	Total cost	Cost per ton ore milled
1931:		
Development and exploration	$212,792.08	$2.563
Mining	267,376.14	3.220
Milling	106,575.54	1.283
General charges	34,187.94	.412
Administrative charges	21,213.75	.255
Total	$642,145.45	$7.733
1932:		
Development and exploration	$184,936.28	$1.962
Mining	285,365.41	3.026
Milling	112,630.68	1.194
General charges	49,478.61	.525
Administrative charges	24,594.16	.261
Total	$657,005.14	$6.968
1933:		
Development and exploration	$227,278.95	$2.364
Mining	249,907.58	2.599
Milling	105,168.81	1.094
General charges	48,907.65	.509
Administrative charges	23,437.97	.244
Total	$654,700.96	$6.810
1934:		
Development and exploration	$235,067.63	$2.391
Mining	217,517.25	2.213
Milling	111,849.51	1.138
General charges	48,073.77	.489
Administrative charges	34,774.84	.353
Total	$647,283.00	$6.584
1935:		
Development and exploration	$242,173.47	$1.938
Mining	263,644.48	2.109
Milling	151,620.64	1.213
General charges	44,840.04	.359
Administrative charges	39,000.00	.312
Total	$741,278.63	$5.931

By study of the above yearly figures it will be noted that the average operating cost, 1931 to 1935, inclusive, was $7.023, or $1.092 above 1935, with a reduction of 0.653 cents per ton in 1935 as against 1934.

Development and Exploration

Class of work	Year ending March 31, 1933	Year ending March 31, 1934	Year ending March 31, 1935	Total from beginning of operations to March 31, 1935
	feet	feet	feet	feet
Drifting	6,681	4,399.5	8,985	48,390.5
Crosscutting	4,201	2,347	2,688	24,825.5
Raising	3,029	2,464.5	1,905.5	13,738.5
Sublevel drifting	1,436	1,473.5	1,268.5	9,290.5
Box-hole raising	1,179	429	352	6,644.5
Winzing	.....	97.5	.....	97.5
Shaft-sinking	.....	612	.....	5,654
Total	16,526	11,823	15,199	108,641
Per cent. of crosscutting to total of crosscutting and drifting	38.7	34.8	23.2	34
	cu. ft.	cu. ft.	cu. ft.	cu. ft.
Shaft stations and sump excavations	5,610	19,140	840	205,858
	feet	feet	feet	feet
Diamond-drilling	11,945	6,713	15,952	77,026

No. 2 Shaft.—The greatest volume of exploration and development work done during the year was in the area north of the shaft, although a considerable amount was completed in the medium- to low-grade sections of the south vein system.

Mining operations were conducted on 15 of the 28 levels established at this shaft. The scope extended from 250 to 3,600 feet. The greatest concentration of effort was, however, immediately below, on, and extending to several levels above the 875- and 2,500-foot horizons. From these chief bases an extensive horizontal area was profitably explored. This work continued to confirm what past history has indicated, namely, that ore occurrences in your mine are widespread and are not confined to main veins or definite zones.

Stoping and development to an increasing degree was done along contacts of sediment with porphyry, or altogether in sedimentary formation near the porphyry. General results here were such as to indicate that these ore bodies can be regarded as important producers when the area is more fully developed. Veins occurring in porphyry are, nevertheless, still the chief source of production.

No. 4 Shaft.—From this section 29.1 per cent. of total mill feed for the year was obtained. A fair tonnage of known ore remains, and further exploration of the more favourable ground is planned. This includes upper-level areas of Sylvanite's original claim, L. 2,227, and the recently purchased Rose Fraction, or claim L. 11,398.

Mill Addition

The mill increase to 350 tons per day, mentioned in the last annual report, was put in effect August, 1934. Since that time capacity has been further increased to about 400 tons, with continued satisfactory operation. Milling equipment was installed with a view particularly to fine grinding, and treatment of the lower-grade ore, made profitable by the increased price of gold.

Additional Buildings and Equipment

Exclusive of the mill enlargement, this includes the purchase of certain experimental units in the mill, a fireproof addition to the refinery, a building addition to the assay office, and the installation of a dust-collecting system. An addition was also made to the miners' change-house.

Summary

Tonnage milled for the year represented an increase of 26,645, or 27.1 per cent. over that treated in 1934, while tons of broken reserves were not decreased.

Production, after deduction of bullion tax, was slightly in excess of 1934; operating costs were reduced 65.3 cents per ton milled; milling costs were 7.5 cents higher. This last is chiefly

due to the fact that an abnormal amount of mill alteration and experimental work was charged to operation.

As mentioned above, mill capacity was increased chiefly to handle ore of lower grade than that treated during past years. In consequence it is planned to develop to a greater extent than previously the low- to medium-grade ore now indicated, the tonnage of which appears to be highly important in lengthening the life of your mine.

Diamond-drill and other exploration carried on during the year in large volume in both igneous and sedimentary formation, indicated extensive and promising areas. Development of these will be continued. It is further confidently expected that the mining of such ore, coupled with a continued and comprehensive programme of exploration in large and favourable sections as yet but slightly prospected, will lead to other important sources of ore.

Talisman Gold Mines, Limited

Talisman Gold Mines, Limited, is capitalized at $1,000,000, in shares of $1 par value. The property consists of 242 acres in Guibord township, district of Cochrane, situated about 13 miles east of Matheson, and is part of the property formerly known as the Gardner Guibord. The officers and directors are: James E. Grant, Haileybury, president; Hugh McIntyre, vice-president; J. W. Beilby, secretary-treasurer; R. J. Lillico, B. H. L. Symmes, and R. G. Meech, directors. The head office is at 364 Bay Street, Toronto.

During 1934 the following development work was done in the old shaft, which was sunk some years ago to 100 feet, with stations at 60 feet and 100 feet: crosscutting, 694 feet; raising, 30 feet; drifting, 374 feet. An average of 19 men was employed.

The plant consisted of two 60 h.p. return tube boilers, a 500-cubic-foot steam compressor, and a 6- by 8-inch steam hoist. The mine was closed down in the early fall of 1934.

Tashota Goldfields, Limited

Tashota Goldfields, Limited, was incorporated in November, 1932. It has an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors are: H. H. Vaughan, Montreal, president; Thomas Arnold, Montreal, vice-president; P. W. Ogden, Montreal, secretary-treasurer; W. A. Eden, R. J. Stokes, J. C. Rogers, J. A. Lindsay, and J. A. Griffith, directors. The head office is at Tashota.

The property is located 16 miles south of Tashota on the transcontinental line of the C.N.R., in the Onaman Lake area, district of Thunder Bay. This property was formerly owned by the Tashota Gold Mines, Limited.

The property has been worked intermittently since 1928, when shaft-sinking was first started. When operations were begun again in April, 1934, a total of 1,700 feet of lateral work had been done on the 100- and 200-foot levels, and the shaft was down 230 feet. Since then the shaft has been sunk to 366 feet, and a 3rd level is now being developed at the 325-foot horizon. Total later work done underground to December 11, 1934, has been reported to be 2,483 feet, divided as follows: on the 100-foot level, station and crosscutting 80 feet, drifting 430 feet; on the 200-foot level, station and crosscutting 326 feet, drifting 1,647 feet. J. D. Cumming is superintendent in charge of operations.

Teck-Hughes Gold Mines, Limited

Teck-Hughes Gold Mines, Limited, has an authorized capital of 5,000,000 shares of $1 par value, of which 4,807,144 shares are issued. The officers and directors are: Albert W. Johnston, chairman of the board; D. L. H. Forbes, president and general manager; George C. Miller, vice-president; Conrad E. Wettlaufer, secretary; K. P. Emmons, treasurer; P. Nugent Tapley, assistant-treasurer; J. W. Stephenson, assistant-secretary; John F. Lash, William W.

Reilley, John F. Thompson, and H. C. McCloskey, directors. R. J. Henry is general superintendent. The head office is at Kirkland Lake, and the executive office is at 25 King Street West, Toronto. An average of 738 men was employed during 1934 at the mine in Teck township, district of Timiskaming.

The following is an extract from the president's report for the 12 months ending August 31, 1934:—

During the fiscal year ended August 31 last, the tonnage of ore treated was practically the same as during the two previous years. The price of gold and its realizable value per ounce to your company (after deducting the new bullion tax levied by the Dominion Government) fluctuated between the limits of $30.50 per ounce at the beginning of the fiscal year to a peak of $34.80 per ounce during the early part of March, and was approximately $30.80 at the end of the period. The average for the bullion sold during the fiscal year was $32.394 per ounce. The average cost of producing gold increased from $11.04 to $15.04 per ounce.

The estimate of gold in "positive ore" decreased from 375,495 ounces at August 31, 1933, to 323,088 ounces at August 31, 1934, although the total footage of drifting increased during the period from 9,974.5 lineal feet to 11,163.5 lineal feet. The tonnage of ore produced from development decreased from 29,151 tons in the previous year to 21,749 tons.

At September 1 last, the mine ore tonnage to be milled during the current fiscal year was placed upon a reduced basis of approximately 1,050 tons per day, instead of approximately 1,300 tons per day during the previous year. Re-treatment of tailings which were sorted out and saved several years ago has been commenced and will partly offset this reduction of mine ore tonnage.

Mine workings within the ore zone were deepened from 5,074 feet to 5,735 feet, a vertical distance of 661 feet, which figure compares with 463 feet during the previous fiscal year. Taken as a whole and compared with the new level development results of other recent years, the new levels that were opened up during the year below the 40th show a diminution in both average grade and total tonnage per level, although results on the 45th level seem to indicate a return to better ore conditions. It now seems probable that the limit of depth for profitable mining will be reached sometime within the next three years. New ore in addition to that from deep levels is being developed in the older portions of the mine, where mining had ceased to be profitable under former conditions.

While decreasing earnings from gold production may be expected, present indications are that the Teck-Hughes mine can be profitably operated for several years to come. There is also the possibility of more favourable ore discoveries than were disclosed during the last year.

Liquid assets, consisting of cash, Dominion of Canada bonds, and gold bullion, amounted to $3,572,734.52 at August 31, which compares with $3,898,468.76 at the end of the previous fiscal year. The decrease in liquid assets is more than accounted for by the investment of over $800,000 in the capital stock and bonds of Lamaque Gold Mines, Limited. Your company owns 70.8 per cent. of the capital stock of Lamaque Gold Mines, Limited, and all of its issued first mortgage bonds. The financing of the Lamaque enterprise is now being done entirely through the purchase of its bonds by your company. Mining and construction work to develop and equip the Lamaque mine for a capacity of 450 tons per day is planned for completion before the end of next October, while 225 tons per day of this capacity is expected to be available by the end of next June.

The following is taken from the general superintendent's report for the fiscal year ending August 31, 1934:—

During this period 474,700 tons of ore were treated. The recovery of bullion and precipitate was the equivalent of 181,453.51 troy ounces of fine gold, which realized $5,877,973.88. After the addition of other income the gross revenue was $5,983,525.03, or $12.60 per ton of ore milled.

Including the sum of $253,005.96 charged for depreciation on buildings and fixed plant, the total operating cost was $2,730,010.72, or $5.75 per ton. After making provision of $224,016.30 for taxes, and adding $19,104.50, a profit derived from the sale of bonds, the surplus was $3,048,602.51. Following is an analysis of operating costs:—

	Total cost	Cost per ton of ore treated	Cost per ounce of gold produced
Development and exploration	$442,813.22	$0.93	$2.44
Mining	1,322,603.21	2.79	7.29
Milling	457,355.19	.96	2.52
General expense	229,881.44	.49	1.27
Examination of new properties	24,351.70	.05	.13
Depreciation	253,005.96	.53	1.39
Total	$2,730,010.72	$5.75	$15.04

At the end of the fiscal year the deepest working was the No. 3 winze, at a vertical depth of 5,735 feet. Lateral development on the block of levels from 35 to 40 was practically complete by the end of January, 1934, and the total length of ore found amounted to 2,596 feet, with an estimated average grade of 10.01 dwt. per ton. The block from 40 to 45 was partially developed on September 1, and the total length of ore found up to that time was 1,505 feet, with an estimated average grade of 8.91 dwt. per ton.

Classified under the usual headings the year's development was as follows:—

	Feet
Drifting	11,167.5
Crosscutting	3,529
Raising	5,862.5
Winzing	1,391.2
Total development	21,950.2

Diamond-drill exploration amounted to 12,179.8 feet. Ore produced from development amounted to 21,749 tons.

The technical estimate of "positive ore" reserve at September 1 is as follows:—

	Tons	Gold content in troy ounces	Average grade in pennyweights per ton
Broken ore	302,520	114,599	7.58
Blocked ore	460,843	208,489	9.05
Total	763,363	323,088	8.46

Teddy Bear Valley Mines, Limited

Teddy Bear Valley Mines, Limited, has a capitalization of $10,000,000, in shares of $1 par value, 5,000,000 of which are outstanding. The company was formed to take over the properties held by the Teddy Bear Valley Syndicate and Abitibi Mines, Limited.

The property consists of 1,500 acres in Holloway and Harker townships, district of Cochrane. Finances for development are furnished by the Teddy Bear Valley Syndicate. The syndicate has an office at 503 Royal Bank Building, Toronto. C. Ellwood Hoffmann is managing director.

During 1934 a shaft was sunk 300 feet and stations were cut at the 150- and 275-foot levels. On the 150-foot level, 400 feet of crosscutting and 200 feet of drifting were done, and a station was cut on the 275-foot level.

The equipment consists of a 100 h.p. locomotive-type boiler, a 10- by 12-inch steam hoist, and a 16- by 24-inch straight-line compressor of about 400-cubic-foot capacity.

An average of 20 men was employed. Edward H. Orser is consulting engineer at the property, and H. Smeaton is superintendent. The mine address is Lightning River.

Toburn Gold Mines, Limited

Toburn Gold Mines, Limited, has a capitalization of 2,000,000 shares of $1 par value. The officers and directors are: H. A. Guess, president; R. F. Goodwin, vice-president; G. A. Brockington, secretary; Charles Earl, assistant secretary; J. C. Emison, treasurer; E. C. Corson, assistant treasurer; W. J. Boland and James Moore, directors; F. G. Hamrick, comptroller and auditor. The New York office is at 120 Broadway, and the Toronto office at 217 Bay Street, in care of W. J. Boland.

The mine is in Teck township, district of Timiskaming. During 1934 an average of 127 men was employed. M. W. Hotchkin, Kirkland Lake, is superintendent.

The following is an extract from the president's report to the shareholders for the fiscal year ending December 31, 1934:—

Surface exploration consisted of some trenching on Nos. 6 and 7 veins, the area believed to contain the north break. Sufficient encouragement was met to justify underground work in 1935.

Underground exploration activities at Toburn for 1934 consisted of 1,030 feet of diamond-drilling. Almost all the drill-holes were short, north or south horizontal holes put out in an effort to locate parallel vein structures.

Total development work done during the year 1934 amounted to 6,289 feet, all of which was above the 1,018-foot level. This development consisted of 3,030 feet of drifting, 1,067 feet of sublevel drifting, 1,043 feet of crosscutting, 608 feet of raising, 481 feet of box-holing, and 60 feet of slashing. Of this total, approximately 1,980 feet was done on ore, breaking 5,775 tons, which was sent to the mill. Approximately 91 per cent. of the development work was confined to the 542-, 667-, 792-, 893-, and 1,018-foot levels. Work done on the 1,029-foot sublevel is included in the total for the 1,018-foot level.

The more noteworthy results of the 1934 development were:—

1. Locating the 911-drift ore shoot on the 893-foot level, which is believed to be a branch of the 1,024-drift vein, which, in turn, is most likely the upward extension of the 1,215- and the 1,325-drift veins. This identifies two inclined vein structures dipping approximately 53° S. W. of the dike fault, one above the other, i.e. the 672-904 vein structure and the 911-1,325 vein structure.
2. Locating ore on the nearly vertical No. 11 vein structure at the A 100-foot level, 542-foot level, and 667-foot level, both east and west of the dike fault, intermediate between the A 100- and 542-foot levels.
3. Locating ore on the No. 7 vein structure above the A 200-foot level, which has good poss bilities for extensions both downward and eastward.

Production figures for 1934 compared with those of the year 1933 are:—

Year	Tons milled	Average ounces gold per ton	Ounces fine gold produced	Percentage mill recovery
1933.....	36,913	0.659	23,020	94.7
1934.....	36,230	.583	20,401	96.6

The estimated ore reserves broken and unbroken at December 31, 1933, were 50,200 tons, averaging 0.66 ounces gold per ton, and at December 31, 1934, were 60,550 tons, averaging 0.63 ounces gold per ton.

This means that 46,580 tons of new ore, averaging 0.56 ounces gold per ton, were found and opened up by the exploration and development of 1934.

Earnings for the year 1934, after deducting administration and taxes, but before deduction of $182,101.04 depreciation and depletion, were $315,811.27.

Tom Johnson-Nipigon Mines, Limited

Tom Johnson–Nipigon Mines, Limited, was incorporated in 1931. The name of the company was changed from Kirkland Divide Gold Mines, Limited, to its present name in 1934. It has a capitalization of 2,000,000 shares of $1 par value. The officers and directors are: P. H. Crawshaw, president; J. R. Scott, vice-president; M. O. Inglis, secretary-treasurer; Thos. Johnson and H. S. Shannon, directors. The head office is 1005 Bank of Hamilton Building, Toronto. The mine office is at Empire.

The company owns 6 claims in the Kowkash area and 11 claims adjoining the property of Northern Empire Mines on the west, in the Beardmore area, Thunder Bay district. The company also holds 300,000 shares in Nipsona Mines, Limited, a subsidiary of Tom Johnson–Nipigon Mines, which company was formed in 1934 to obtain control of 4 claims adjacent to those of the parent company. Some surface trenching and diamond-drilling has been done on the Kowkash property.

On the Beardmore claims surface work is reported to have shown one of the Northern Empire veins extending 234 feet northwest of the boundary, where it

averages 8 to 10 inches in width. At this point it is cut by a dike. West of the dike it has been traced another 125 feet, where its width ranges from 6 to 8 inches. Good values are said to have been obtained from this vein.

Sidney Muskin is the engineer in charge at the Beardmore property.

Vermilion Lake Gold Mines, Limited

Vermilion Lake Gold Mines, Limited, incorporated in 1932, has an authorized capitalization of 15,000 shares of no par value. The officers and directors are: Dr. H. K. Mitchell, president; H. Dix Rogers, vice-president; J. C. Stewart, secretary-treasurer; John E. Clark and J. Bennett, directors. The head office is at 1005 Lumsden Building, Toronto. The mine address is Northpines.

The property consists of about 480 acres at Big Vermilion Lake, 7 miles from Hudson, on the Canadian National railway, district of Kenora, Patricia portion.

A considerable amount of surface work, trenching, and test-pitting has been done on the property. In September, 1934, control of operations was acquired by the Reward Mining Company, Limited, of British Columbia, on the basis of the Reward Mining Company receiving 8 per cent. of the net earnings. The company planned to diamond-drill the property during the first months of 1935.

Wawa Goldfields, Limited

Wawa Goldfields, Limited, was incorporated in 1933. The authorized capitalization was increased from 1,500,000 to 2,500,000 shares of $1 par value in November, 1934. The officers and directors were: A. P. Earle, president; H. H. Racine, vice-president; P. C. Dings, G. S. Payne, and L. Beauregard, directors. The head office is at 616 Canada Cement Building, Montreal.

The property includes a group of 4 claims in township 29, range 23, in the Michipicoten area, district of Algoma. The mine address is Wawa.

During 1934 a total of 90 feet of drifting, and 209 feet of crosscutting was done on the 50-foot level. This work was done during May, June, and July. Some surface work was then done until November, when operations were suspended. A 375-cubic-foot Diesel compressor was used.

An average of 14 men was employed from May until November. A. C. Melkman was in charge of operations.

Wells Longlac Mines, Limited

Wells Longlac Mines, Limited, was incorporated in 1934 with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: A. J. Felton, president; A. W. Burt, vice-president; F. E. Forrester, secretary-treasurer; E. C. McCracken and Chas. Palmer, directors. The head office is at 347 Bay Street, Toronto.

During 1934 this company took an option on the Stagee property, which adjoins the old Foley mine, in the Mine Centre area, district of Rainy River. Underground exploration was started in November, and by the end of the year a 2-compartment shaft had been sunk to a depth of 108 feet, and 20 feet of drifting had been accomplished on the 100-foot level.

The plant used consisted of a 20 h.p. boiler, a 5- by 7-inch steam hoist, and a 310-cubic-foot gasoline compressor. A. S. Dawson is mine manager. The mine address is Mine Centre.

The company owns a group of 15 claims in the Magnet Lake section of the Little Long Lac area, on which surface work and diamond-drilling was performed during the year.

Wendigo Gold Mines, Limited

Wendigo Gold Mines, Limited, was incorporated in October, 1933, with an authorized capitalization of 2,000,000 shares of $1 par value. The officers and directors were: H. D. Tudor, president; H. G. Young, vice-president; H. R. Tudhope, secretary-treasurer; A. J. Bolton and W. G. Cameron, directors. The head office is at 701 Dominion Bank Building, Toronto.

The property of this company is located at Witch bay, on the Lake of the Woods, district of Kenora, and is 22 miles southeast of Kenora.

The plant installed included a 100 h.p. boiler, a 375-cubic-foot Ingersoll-Rand steam compressor, two 525-cubic-foot Ingersoll-Rand steam compressors, and an 8¼- by 10-inch Ingersoll-Rand hoist. Buildings erected during the year included an office, blacksmith shop, dry-house, and assay office.

During 1934, the 2-compartment 80-degree shaft was sunk 399 feet to a total depth of 516 feet. Levels were established at 200, 350, and 500 feet.

A total of 1,000 feet of diamond-drilling was done from underground during the year.

The lateral work accomplished during 1934, and the total done to the end of 1934, on the various levels, was as follows:—

Level	Drifting		Crosscutting	
	1934	Total	1934	Total
	feet	feet	feet	feet
50-foot	.....	114	.....	.....
60-foot	.....	65	.....	.....
100-foot	225	290	.....	.....
200-foot	815	815	160	160
350-foot	225	225	55	55
500-foot	590	590	50	50
Total	1,885	2,099	265	265

The work on the 60-foot level was done from the old No. 2 shaft, which has a depth of 100 feet and connects with the main shaft workings at that horizon.

An average of 44 men was employed, of whom 12 were underground. C. L. Spencer was in charge of operations. The mine address is Kenora.

West Red Lake Gold Mines, Limited

West Red Lake Gold Mines, Limited, is capitalized at 3,000,000 shares of $1 par value. The officers and directors were: G. B. Hughes, president; A. J. Doane, vice-president; W. E. Robinson, secretary-treasurer; J. E. Streight, A. Cockeram, and M. R. Howey, directors. The executive office is at 609 Continental Life Building, Toronto.

The property consists of 27 claims in four groups located in the townships of Todd and Ball in the Pipestone Bay section of the Red Lake area, Kenora district, Patricia portion.

The main group consists of 9 claims, totalling approximately 375 acres. The mining plant is on claim No. 10,057, approximately 21 miles west of the Howey gold mine.

The mining plant and camps were erected in May and June, 1934. Buildings include a boiler-house, 45 by 35 feet; blacksmith shop, 16 by 22 feet; dry-house, 16 by 20 feet; warehouse, 12 by 14 feet; and powder magazine, 18 by 20 feet. The plant equipment includes two 60 h.p. locomotive-type boilers, a 7- by 10-inch double-acting reversible hoist, a 400-cubic-foot vertical-type compressor, and a No. 2 Gardner Denver steel sharpener.

In July a 2-compartment shaft, 11 by 6½ feet outside measurement, was started. This shaft was sunk to a depth of 205 feet, a level was established at the 200-foot horizon, and 95 feet of crosscutting and 298 feet of drifting was done. Work was discontinued at the property during the latter part of October, 1934. A. H. Honsberger was manager in charge of operations.

Witch Bay Gold Mines, Limited

Witch Bay Gold Mines, Limited, was incorporated in July, 1934, with an authorized capitalization of 50,000 shares of $1 par value. The officers and directors were: Henry Martin, president; H. G. Young, vice-president and managing director; H. R. Tudhope, secretary-treasurer; H. D. Tudor and A. J. Bolton, directors. The head office is at 357 Bay Street, Toronto.

The property of this company consists of two groups of claims adjoining the Wendigo mine on the east and west at Witch bay, on the Lake of the Woods, District of Kenora.

Work was started in August and suspended in December, 1934. During that period an old 30-foot shaft on the east group was cleaned out and sunk an additional 15 feet. Some surface trenching was also done.

The plant installed included a 60 h.p. boiler, a 4- by 6-inch hoist, and a gasoline compressor. F. M. Passow was in charge of operations. The mine-office address is Kenora.

Wright-Hargreaves Mines, Limited

Wright-Hargreaves Mines, Limited, has an authorized capital of 5,500,000 shares of no par value. The officers and directors of the company are: Oliver Cabana, Jr., president; W. H. Wright, vice-president; Gerard F. Miller, treasurer; E. L. Miller, secretary and managing director; James Y. Murdoch and Oliver G. Donaldson, directors. The head office is at Fort Erie. The mine address is Kirkland Lake.

M. W. Summerhayes is general manager, and 440 men were employed during the year at the mine in Teck township, district of Timiskaming.

The following is taken from the general manager's report for the fiscal year ending August 31, 1934:—

During this period 330,741 tons of ore were treated, containing 207,655 ounces fine gold and 40,915 ounces of fine silver. There was realized from the marketing of this bullion, $6,797,578.81.

The average grade of the ore going to the mill, at $20.67 per ounce, was 0.66 ounces, or $13.68 per ton, with a recovery of 0.63 ounces, or $13.07 per ton, an extraction of 95.51 per cent.

ANALYSIS OF OPERATING COSTS

	Total	Cost per ton milled
Development, exploration, and pumping	$357,223.79	$1.080
Stoping	748,532.05	2.263
Transporting ore (hoisting, etc.)	275,119.27	.832
Milling charges	459,090.54	1.388
Marketing bullion	32,060.15	.097
General surface charges	37,453.38	.113
Stock transfer and registrar charges	13,685.70	.041
Insurance, silicosis, workmen's compensation, property taxes, miscellaneous	83,026.89	.251
General and undistributed charges (storehouse, hospital, maintain misc. mine buildings, mine management and administration, interest and exchange, legal expenses, miscellaneous)	125,792.04	.380
Depreciation buildings and equipment	274,762.70	.831
	$2,406,746.51	$7.276
Provision for taxes (exclusive of bullion tax)	275,000.00	.831
Provision for depletion of mining properties	182,111.00	.551
Amount written off, shaft No. 4	170,299.62	.515
Total	$3,034,157.13	$9.173

SUMMARY OF DEVELOPMENT AND EXPLORATION
August 31, 1934

	Drifting	Shaft-sinking	Cross-cutting	Raising	Total footage	Diamond-drilling	Excavation
	feet	feet	feet	feet		feet	cu. ft.
August 31, 1933	119,464	10,681	42,492	7,987	180,624	87,805	364,938
Fiscal year	17,162	.....	5,618	1,191	23,971	16,586	33,230
August 31, 1934	136,626	10,681	48,110	9,178	204,595	104,391	398,168

PRODUCTION RECORD, 1921–1934
(Based on gold at $20.67 per ounce)

Year	Tons milled	Value per ton	Gross value	Recovery per ton	Bullion produced	Dividends
1921 (8 mos.)	36,081	$13.96	$503,302	$13.00	$468,665	.....
1922	66,181	12.49	827,447	11.52	762,752	$412,500
1923	79,242	10.48	830,992	9.52	754,978	206,250
1924	84,487	14.16	1,194,217	12.89	1,088,725	206,250
1925	147,939	14.49	2,148,554	12.93	1,913,401	550,000
1926	153,392	15.66	2,400,795	14.02	2,150,844	893,750
1927	209,164	11.77	2,455,460	10.51	2,151,916	1,237,500
1928	256,331	8.36	2,144,002	7.20	1,845,923	825,000
1929	188,238	10.29	1,938,552	9.25	1,741,872	.....
1930	220,430	12.20	2,687,828	11.03	2,431,896	275,000
1931	266,352	11.73	3,124,533	10.93	2,912,308	825,000
1932	295,525	12.85	3,796,295	12.00	3,546,903	1,100,000
1933 (8 mos.)[1]	193,441	13.56	2,623,456	12.63	2,443,760	550,000[2]
1934	330,741	13.68	4,525,150	13.07	4,321,945	2,750,000
Total	2,527,544	$12.34	$31,200,583	$11.29	$28,535,888	$9,831,250

[1]In 1933, the fiscal year closing changed from December 31 to August 31.
[2]April and July dividends only.

MILLING STATISTICS

September 1, 1933, to August 31, 1934

Ore milled	tons	330,741
Average value per ton		$13.68
Gross value	$4,525,149.92	
Loss in tailings	203,205.31	
Net value recovered		$4,321,944.61
Average tons milled per day		906.14
Per cent. of possible running time		97.11
Tons 100 per cent. running time		933
Solution precipitated	tons	1,173,048
Solution precipitated per ton of ore	tons	3.55
Value per ton in tailings		$0.614
Per cent. extraction		95.51
Cyanide consumed per ton of ore (K.C.N.)	lbs.	0.497
Zinc consumed per ton of ore	ounces	1.544
Zinc consumed per ton of solution	ounces	0.436
Lime consumed per ton of ore	lbs.	2.814
Steel consumed per ton of ore, ball mills	lbs.	2.52
Steel consumed per ton of ore, tube mills	lbs.	2.80
Cost of flotation reagents consumed per ton of ore		$0.033
Average value of pregnant solution		$3.68
Average h.p. consumed per day		2,451
Average h.p. consumed per ton milled		2.70
Power cost per h.p. consumed		$58.96

N.B.—All values at $20.67 per ounce.

ORE RESERVES ESTIMATE

	Tons	Ounces	Grade	Value[1]
On hand August 31, 1933	998,061	0.67	$13.75	$13,726,809
Developed in fiscal year	517,884	.60	12.44	6,441,538
	1,515,945	0.64	$13.30	$20,168,347
Milled in fiscal year	330,741	.66	13.68	4,525,150
Ore reserves, August 31, 1934	1,185,204	0.64	$13.20	$15,643,197

[1]Calculated at $20.67 per ounce.

ADDITIONS TO PLANT, BUILDINGS, AND EQUIPMENT

September 1, 1933, to August 31, 1934

Mill structure and equipment	$216,946.99
Shops and equipment	12,872.55
Power-house and electrical equipment	6,947.42
Assay office, building and equipment	14,630.88
General surface and buildings	9,902.68
No. 4 shaft and hoist-house	8,038.80
Sprinkler system	30,665.45
New tailings line	12,364.90
Underground equipment	12,940.46
Total	$325,310.13

Development

There were 517,884 tons of new ore developed, having an average grade of 0.60 ounces, or $12.44 per ton at $20.67 per ounce. A considerable quantity of this consists of low-grade ore actually developed in other years but which, due to the increased price for gold, can now be included in the reserves. After deducting 330,741 tons milled, there were 187,143 tons added to our reserves. Some 17,162 feet of drifting was done, of which 8,052 feet, or 47 per cent. was on ore.

A diamond-drill hole has intersected the north vein at the 4,500-foot horizon, showing the usual excellent structures and mineralization.

It is planned during the present fiscal year to prepare for a new interior shaft for developing the mine below the present bottom. This will consist of the necessary hoisting station and ore and waste passes to connect with No. 3 shaft and the upper portion of the shaft above the 3,900-foot level.

Milling

During the early months of the period under review, the mill alterations were completed and the full benefits of the various changes on the per cent. of extraction obtained. The pilot mill indicated a possible extraction of 96.2 per cent. This percentage was obtained in May last and has been bettered each succeeding month since that time.

General

A complete sprinkler system has been installed in the mill and shops, covering the most important fire hazards. This should reduce to a minimum the chances for a fire.

The finer grinding in the mill has introduced more base metals into our bullion, making a regulus carrying high gold values as a by-product. This is hard and expensive to reduce satisfactorily, and the bullion shipped is not easy to check with the mint. We have, in the last few weeks, worked out what appears to be a new refining process which will eliminate this trouble. If the further experiments in a larger way prove satisfactory, we propose to make the necessary changes in our refinery equipment to put this process into use.

Young-Davidson Mines, Limited

The officers and directors of Young-Davidson Mines, Limited, are: Gideon Grant, president; C. G. Knott, vice-president; F. M. McKay, secretary-treasurer; Jacob A. Davidson, A. Calvin Ross, Colin M. McLean, directors. The capitalization is $3,000,000, in shares of $1 par value.

The company owns a property in Powell township, district of Timiskaming, which is being operated under agreement by the Hollinger Consolidated Gold Mines, Limited. An account of the work done on the property appears on page 102 of this report. The mine address is Elk Lake.

Young-Shannon Gold Mines, Limited

Young-Shannon Gold Mines, Limited, was incorporated in 1932, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors were: C. T. Young, president; S. J. Defoe, secretary; W. C. Huff, treasurer; and A. J. Bolton, director. The head office is at 1 Toronto Street, Toronto.

The property of this company includes a group of 9 mining claims in Chester township, district of Sudbury. There is a 22-mile road from Makwa station on the Canadian National railway.

In June a 2-compartment vertical shaft was started on a small island in Clam lake. By the end of the year the shaft had been sunk to a depth of 100 feet, and 50 feet of drifting and 50 feet of crosscutting accomplished at that level. A total of 3,000 feet of diamond-drilling was done during the year.

The plant installed included a 45 h.p. boiler, an 8- by 12-inch steam hoist, and a 220-cubic-foot GD gasoline compressor. Buildings erected included a power-house, blacksmith shop, bunk-house, and powder-house.

An average of 12 men was employed throughout the year. C. T. Young was in charge of operations, with A. Taylor as mine captain. The mine address is Gogama.

GRAPHITE

Black Donald Graphite Company, Limited

The officers of the Black Donald Graphite Company, Limited, are: R. F. Bunting, president and manager; W. B. Bunting, vice-president; R. A. Telfer, secretary-treasurer.

The mine in Brougham township, Renfrew county, operated 90 days during 1934, and the refinery 144 days. About 2,000 tons of ore was hoisted and milled.

The company reports that owing to improvement in market conditions stocks of refined graphite on hand have been somewhat reduced.

An average of 28 men was employed during the period of operation. The mine address is Calabogie.

GYPSUM

Canadian Gypsum Company, Limited

The Canadian Gypsum Company, Limited, has a capitalization of $300,000, divided into 3,000 shares of $100 par value. The officers and directors of the company are: S. L. Avery, president; R. G. Bear, secretary-treasurer; O. M. Knode, C. F. Henning, Otis Wack, and J. E. MacLeish, directors. The head office is at 1221 Bay Street, Toronto. The head office officials are: B. S. Barns, agent and comptroller, and F. B. Gibbs, manager. Otis Wack, Windsor, N.S., is director of operations.

The company operates a gypsum mine and plant near Hagersville, in Oneida township, Haldimand county. All commercial gypsum products are produced at the plant, which includes a mill, wall board and block manufacturing buildings. During 1934 some 17,046 tons of rock were hoisted. An average of 30 men was employed. W. E. Allen, Hagersville, is superintendent.

The company also operates a quarry and lime plant at Guelph; a large gypsum quarry at Windsor, N.S.; a gypsum mill at Hillsborough, N.B.; a gypsum calcining mill at Iona, Cape Breton; and a winter gypsum storage depot at Deep Brook, N.S.

Associated with the company is the Gypsum Packet Company, Limited, operating four 7,000-ton freight and passenger steamers between Nova Scotia and United States ports.

Gypsum, Lime and Alabastine, Canada, Limited

Gypsum, Lime and Alabastine, Canada, Limited, has a capitalization of 2,000,000 shares of no par value. The officers are: R. E. Haire, president and manager; S. H. J. Reid, secretary-treasurer; W. E. Armstrong, Henry Cockshutt H. J. Haire, Jas. R. Inksater, G. H. Kranenberg, J. E. McConnell, R. S. McCurdy, N. L. Nathanson, W. C. Pitfield, and John F. Cameron, directors. The head office is at Paris, Ont.

The mine and mill at Caledonia, Seneca township, Haldimand county, was operated throughout the year. L. V. Robinson was superintendent, employing an average of 110 men.

There were hoisted 21,744 tons of rock. Of this, some 1,432 tons were sold and the rest was manufactured into landplaster, stucco, Paristone, Gyproc, dry Insulex, gypsum lath, and other building products.

In addition to the Caledonia mine, the company operates gypsum plants at Montreal, Winnipeg, Vancouver, and Calgary.

Lime plants are situated at Beachville, Elora, Hespeler, Milton, Limehouse, and Puslinch, Ont., and at St. Mark and Joliette, Que.

Quarries are operated at Mabou, N.S.; Gypsumville, Man.; and Salmon River, B.C. The alabastine plant is at Paris, Ont.

MOLYBDENITE

Phoenix Molybdenite Corporation, Limited

The Phoenix Molybdenite Corporation, Limited, has a capitalization of $1,000,000, in shares of $1 par value. The officers and directors are: F. L. Stinson, president and manager; E. A. Dempster, vice-president; W. G. Chipp, secretary-treasurer; John Thompson and George Joynt, directors. The head office is at 316 Excelsior Life Building, Toronto. The mine address is R.R. 2, Ashdad.

The mine in Bagot township, Renfrew county, was operated from April to October, 1934.

A blacksmith shop, transformer station, and mill were erected. The mill went into operation on August 15, and during the remaining period of operation treated about 200 tons of ore from surface, with a recovery of 3,300 pounds of concentrates.

At the end of September there were 31 men employed at the property.

NICKEL AND COPPER

Cuniptau Mines, Limited

Cuniptau Mines, Limited, has an authorized capital of 3,000,000 shares of $1 par value. The property consists of 62 claims in Strathy township, district of Nipissing, two miles north of Timagami. The officers of the company are: B. W. Watkins, president; E. P. Muntz, vice-president; W. G. Watkins, secretary-treasurer. J. W. Morrison is consulting engineer, and S. S. W. Cole, mine manager. The head office is at 465 Bay Street, Toronto. The mine address is Goward.

To the end of January, 1935, the following work had been done. A 2-compartment shaft was sunk to a depth of 240 feet, with levels at 100 and 225 feet. Drifting and crosscutting amounted to 1,372 feet, and 55 feet of raising was done. A 50-ton blast furnace is being put into operation with the intention of treating the green ore.

An average of 40 men was employed.

Falconbridge Nickel Mines, Limited

The officers and directors of Falconbridge Nickel Mines, Limited, are: Thayer Lindsley, president; Halstead Lindsley and J. G. Hardy, vice-presidents; N. F. Parkinson, secretary-treasurer; W. S. Morlock, director. The authorized capital is 5,000,000 shares of no par value. The head office is at 25 King Street West, Toronto.

The company operates a nickel-copper property in Sudbury district. Ernest Craig is general superintendent; J. R. Gill, smelter superintendent; Angus MacDonnell, underground superintendent; and R. C. Mott, concentrator superintendent. During 1934 an average of 436 men was employed, of whom 124 were underground. The mine address is Falconbridge.

The following is taken from the report of the general superintendent for the year ending December 31, 1934:—

Such interruptions as were experienced to continued operation of mine and reduction plants were entirely due to necessary periodic repairs to blast furnace and settler.

Mine Development

Development footages attained during the year and combined over all levels, distribute as tabulated below:—

Drifting and crosscutting	feet	4,054
Raising	feet	1,122
Stope entrances	feet	130
Box-holes		7
Diamond test drilling	feet	2,597
Diamond-drilling (surface)	feet	405
Station-cutting	cu. ft.	6,700
Shaft-sinking	feet	546

All development work during the year was carried out within the area in which ore reserves were computed in 1933, with the exception of the east drive on the 500-foot level.

Of the total 4,054 feet of drifting and crosscutting, 2,577 feet was driven east on the 500-foot level. This work served to open up the eastern ore bodies and to provide a connection with No. 5 shaft. Intensive faulting, encountered in some sections, reduced the ore possibilities at this horizon. One body, however, extending for 500 feet and disclosing fair widths, was opened up, while the last 1,100 feet of the drive was in ore of widths varying between 10 and 40 feet but of a grade considerably reduced by the presence of large amounts of quartz. The limits of this body have not yet been reached.

On the 750-foot level an advance of 610 feet west disclosed 575 feet of good ore. The east drive was continued for 233 feet with ore to 120 feet, at which point the main fault was encountered.

No. 5 Shaft.—Preparation for sinking a 5-compartment shaft at a location some 2,400 feet east from the present working shaft was made early in the summer. This shaft is 13 feet 4 inches by 19 feet 6 inches, outside timber, and will be continued to a depth of 1,500 feet.

The depth of overburden having been established at 100 feet by means of an electrical survey and checked by one bore-hole, excavation of the shaft was commenced in June. Sinking through the overburden was accomplished by excavating inside a steel plate shield, the excavation being followed by timber sets spaced at 3-foot centres and closely lagged. After reaching bed rock, in order to seal off the water and quicksand encountered there and also to reinforce the shaft through the sand, a concrete lining was poured inside the timber and continued to surface. Permanent steel sets were started in September, and a total depth of 546 feet from surface had been reached by the end of the year. A station was cut at the 500-foot level, where connection was made with the east drift.

Ore Reserves

Ore reserves, computed as at December 31, 1934, are tabulated hereunder:—

	Tons
Ore reserves as at December 31, 1933	2,817,884
Plus new ore added 1934	460,000
Total	3,277,884
Less: drawn during 1934	317,646
Total ore reserves (averaging 2.04 per cent. nickel and 0.90 per cent. copper), December 31, 1934	2,960,238

Mining

The results of mining activities during the year are set out in the following table:—

Broken Ore in Stopes	Tons
Balance December 31, 1933	408,780
Broken during 1934	386,051
Total	794,831
Less: hoisted from stopes during 1934	285,089
Broken ore reserves December 31, 1934	509,742
Ore Hoisted	
From stopes, 1934	285,089
From development, 1934	14,085
From concentrating dump, 1934	18,472
Total ore to crushing plant, 1934	317,646

Crushing, Sorting, and Transportation

From 317,646 tons of ore delivered to the crushing plant, 44,116 tons, or 13.9 per cent., of waste was eliminated by sorting and discarded. The balance, amounting to 273,530 tons, was transported over the aerial tramway to the treatment plant bins.

The entire reduction plant was in operation 337.46 days during the year. Periodic repair campaigns, necessary in the one-unit plant, account for the whole of lost operating time. Results of operation tabulate as below:—

	Short tons
Total ore treated	272,923
Matte produced	9,271.4
Nickel in matte produced	5,202.6
Copper in matte produced	2,450.8
Metals per ton of ore:	Pounds
Nickel	41
Copper	19.90
Metallurgical losses per ton of ore:	
Nickel	2.88
Copper	1.64

Construction

With the exception of temporary installations of equipment to facilitate the sinking of No. 5 shaft, practically no additions or alterations to the plant were undertaken during the year.

Housing facilities were further increased during the year, and an up-to-date sewage disposal system was installed. Sewerage and water systems were also extended to provide adequate service and fire protection throughout plant and townsite.

The following is an extract from the report of the consulting metallurgist for the year ending December 31, 1934:—

Mill and Smelter

The mill and smelter operated throughout the year with only the normal interruptions for repairs. The excellent overall metallurgical recovery was slightly improved.

Refinery

The refinery, which is located in Norway, operated very steadily throughout the year, although with a little less than normal capacity during the first few months due to adjustment of new equipment. A certain amount of additions and alterations took place, more to improve and stabilize operating conditions than to increase capacity, although this at the end of the year was very ample for 6,000 short tons annually and some months exceeded this rate.

Custom matte was received regularly, from February, at the increased rate of 1,000 long tons nickel annually. The plant for separation of precious metals was finished during the year and is gradually coming into routine. Research work and experiments are going on to further improve the recovery and high quality of the metals, and some small further progress has been made.

For the year 1934, the amount of metals in matte received from the smelter, the refinery production, the metals in process, and the metals in matte on hand at the end of the year is set out in the following table:—

	Nickel	Copper
	lbs.	lbs.
Metals in Falconbridge matte received, less refining losses	9,924,129	4,626,535
Produced in marketable form during the year	9,508,939	4,633,235
Metals in process of refining at end of year	1,953,277	402,976
Metals in matte on hand at end of year	1,355,139	604,058

International Nickel Company of Canada, Limited

The officers of the International Nickel Company of Canada, Limited, are: Charles Hayden, chairman of the board; Robert C. Stanley, president; John F. Thompson, vice-president; Paul D. Merica and John C. Nicholls, assistants to the president; James L. Ashley, secretary-treasurer.

The directors whose term expires in 1935 are: James L. Ashley, John F. Dulles, Reg. Halladay, Charles Hayden, J. W. McConnell, R. S. McLaughlin, Britton Osler, J. A. Richardson, Robt. C. Stanley, Andrew V. Stout, John F. Thompson, and Rt. Hon. Lord Weir of Eastwood.

The directors whose term expires in 1936 are: John P. Bickell, Hon. H. Cockshutt, Wm. N. Cromwell, D. Owen Evans, Sir Harry McGowan, R. H. McMaster, Wm. W. Mein, Rt. Hon. Lord Melchett, Paul D. Merica, Sir Robert L. Mond, Thomas Morrison, Seward Prosser, and Grant B. Shipley.

The executive office is at 67 Wall Street, New York City, and the general offices of the mining and smelting division are at Copper Cliff, Ont.

This company and subsidiary companies operate hydro-electric power plants at High Falls, Big Eddy, Wabageshik, and Nairn Falls, Ont.; nickel-copper mines in Sudbury district, Ont.; smelters at Copper Cliff and Coniston, Ont.; refineries at Port Colborne, Ont., Acton, England, and Clydach, Wales; rolling mills at Birmingham, England, Huntington, W. Va., and Glasgow, Scotland; a colliery at Pontardawe, Wales; and a foundry at Bayonne, N.J.

The authorized capital of this company consists of $27,679,900 of preferred shares of $100 and $5 par value, and 15,000,000 shares of common stock of no par value.

The following information is extracted from the annual report of the company covering the year ending December 31, 1934:—

General

The improvement in your company's business mentioned in the annual report for 1933 continued through 1934, with the result that the report submitted herewith is the most satisfactory since that for 1929, which was the peak year in the history of the nickel industry.

Sales of nickel, copper, rolling-mill products, and precious metals, details of which appear in the Sales section, substantially increased. Quoted prices for nickel, with the exception of a lower sterling price, remained unchanged. However, though still low, the average price received for copper was 5 per cent. in excess of that obtained in 1933.

Operations throughout the year, conducted on an increased scale and at a uniform rate, afforded your management opportunity to cut costs of production to the lowest figures obtaining since your plants were reconstructed and the Frood mine fully developed. The expanded operations called for additions to pay-rolls and decreased unemployment in the various localities in which your operations are conducted.

The financial statements are submitted for convenience in United States dollars. As in the previous year sales outside of Canada and the United States were based on sterling. It will be noted that a net profit of $18,487,478.80 was realized after all charges, including provision of $5,321,131.52 for depreciation, mine depletion, and other reserves. After paying $1,933,898.75 of preferred dividends there remained $16,553,580.05, equal to $1.13 per share on the common stock. The year closed with your company in a strong cash position.

There follows a résumé of your company's diversified activities during the year ended December 31, 1934.

Sales

Your company's sales of nickel in all forms, including nickel in alloys, amounted to 91,459,554 pounds, compared with 74,356,969 pounds in 1933, an increase of 23 per cent.

Sales of nickel in products of the Port Colborne, Canada, and Clydach, Wales, refineries amounted to 73,964,621 pounds, compared with 61,353,495 pounds in 1933, an increase of 21 per cent. Sales of nickel in products of the Copper Cliff smelter amounted to 1,357,008 pounds. Sales of nickel in products of the rolling mills at Birmingham, England, Glasgow, Scotland, and Huntington, W.Va., and of the foundry at Bayonne, N.J., totalled 16,137,925 pounds, compared with 13,003,474 pounds, an increase of 24 per cent.

The estimated world's consumption of nickel in all forms was 122,000,000 pounds, compared with 96,000,000 pounds in 1933 and 57,000,000 pounds in 1932.

Sales of Monel metal, a product made direct from Creighton ore, totalled 10,763,821 pounds, compared with 9,101,219 pounds in 1933, an increase of 18 per cent.; sales of pure rolled nickel were 7,469,914 pounds, compared with 6,287,991 pounds in 1933, an increase of 19 per cent.

Copper sales, inclusive of copper in sulphate produced in Wales, increased from 113,682,312 pounds to 194,870,682 pounds, or 71 per cent.

Gold sales were 74,375 ounces, compared with 21,355 ounces in 1933; silver sales were 1,006,808 ounces, compared with 876,303 ounces; and sales of the platinum metals were 124,424 ounces, compared with 77,198 ounces. Sales of selenium were 73,516 pounds, and sales of tellurium 1,110 pounds.

Mines

Throughout 1934 ore was mined continuously from the Frood and Creighton mines, the total tonnage shipped amounting to 2,690,814 tons, of which the Frood mine contributed 1,868,186 tons and the Creighton mine 822,628 tons.

At the Frood mine exploratory work was restricted to the lower levels, and ordinary development work was regulated to conform with ore requirements. During 1934 the advance of shafts, drifts and crosscuts, raises, winzes, and box-holes amounted to 19,937 feet, thus bringing the total development work in this mine to 31.7 miles. Twenty new stopes and 5 pillar stopes were brought into production. There are now available for production in the Frood mine 83 stopes and 13 pillar stopes. The average output of a stope is 140 tons daily and that of a pillar 60 tons daily. Costs of development work and mining were satisfactory, and the mine is in splendid condition to supply smelter requirements.

The advance made at the Creighton mine in 1934, inclusive of shafts, drifts and crosscuts, raises, winzes, and box-holes totalled 8,694 feet. In order to mine efficiently the large reserves of proven ore in the lower levels a new shaft is being sunk. Work is progressing on the shaft-sinking and on the erection of the necessary surface plant, and it is estimated that this project will be completed early in 1937.

Smelters

The concentrator was operated at a uniform rate throughout the year and treated 1,843,146 tons of ore, the greatest tonnage thus far handled. As the result of certain rearrangement of equipment and with the completion of some minor installations the available capacity in the grinding and flotation sections is 8,000 tons per day. This capacity can be readily increased to 11,000 tons per day should demand call for increased quantities of nickel. Experimental work is being continued actively with reference to mechanical details of operations and chemical features of flotation.

The Copper Cliff smelter produced 92,174 tons of bessemer matte and 97,611 tons of blister copper. Three reverberatory furnaces were in operation throughout the year. The installation of additional converters, mentioned last year, has been completed, which not only adds to plant capacity but from a metallurgical standpoint balances adequately the copper and nickel smelting operations. From the standpoint of efficiency the performance of the reverberatory furnaces and converters was good, and greater daily tonnages were smelted than at any time heretofore.

For the Orford separation process one blast furnace was used throughout the year and a second for seven months. A marked reduction in the amount of coke and nitre cake used per ton of bessemer matte smelted resulted in a reduction of costs.

At the Coniston smelter three blast furnaces were in operation up to April 1, and four thereafter. During the year 840,980 tons of ore were smelted and 59,732 tons of bessemer matte produced. This smelter in common with your other plants in the Sudbury district is in splendid physical condition and is operating satisfactorily from the standpoint of tonnage and cost of production.

Hydro-Electric Plants

All of your four hydro-electric plants were in use throughout the year. Through systematic maintenance of storage dams, water capacity has been materially increased. The concrete dam at Nairn Falls was partially reconstructed and the station generally overhauled. All power-plant equipment is maintained in excellent condition and the stations are furnishing a large quantity of electric power with little or no interruption in this important service.

Refineries

Port Colborne Refinery.—Six electrolytic circuits were in continuous operation during the year and a seventh was in use from April to August, inclusive. The total output of nickel, inclusive of nickel in oxide, was 70,974,850 pounds. Particular attention has been paid to plant research, which has resulted in numerous efficiencies in process operations. The resulting savings, together with improvements in handling materials, have enabled your management to show satisfactory costs. There has been little change in labour conditions at this refinery. Increased output and a steady rate of operations have resulted in the maintenance of a fairly constant number of employees.

Ontario Refining Company, Limited.—As a result of increased nickel production there was a corresponding increase in the tonnage of blister copper received from the Copper Cliff smelter, which rose from approximately 6,500 tons per month at the beginning of the year to 9,000 tons per month during the last quarter. Refined copper production amounted to 95,558 tons, compared with 58,098 tons in 1933. Shipments from the refinery were 97,292 tons in 1934, compared with 53,678 tons in 1933.

Selenium and tellurium are now regularly produced as by-products in addition to by-product gold, silver, and platinum metals. A plant for refining tellurium was constructed during the year and was started in October, 1934. Plant research throughout the refinery has resulted

not only in operating economies but has further improved the quality of your ORC brand of refined copper.

Your company's stock interest in the Ontario Refining Company, Limited, was increased from 67.79 per cent. to 90 per cent. during the year and may be further increased, as referred to in the annual report for 1931, upon termination of the copper purchase contract therein mentioned. In the event that all of the remaining outstanding stock is purchased in 1935 a cash expenditure of approximately $1,100,000 is indicated.

Ore Reserves

Proven ore reserves on December 31, 1934, were 204,399,463 tons. In the ordinary course of mining operations 2,720,779 tons were added to reserves.

Outlook

A programme of mine development and plant construction and rehabilitation, begun in 1926 and concluded in 1929, entailed expenditures in excess of $50,000,000. Coincident with the completion of this extensive work the current world trade collapse started and has lasted with varying severity since that time.

It is, however, gratifying to report that your company's business apparently turned the corner of depression during the spring of 1932 and since then has improved gradually to such an extent that the net profits in 1934 are, with one exception, the greatest in your company's history. Furthermore, it should be noted that 1934 was the first period in which your modernized plants were operated at a rate of capacity sufficient to demonstrate the economies which the large capital expenditures have made possible.

The year closed with all of your properties in first-class condition and with your sales and technical departments thoroughly organized and staffed to manage efficiently a growing business. Hence, barring major disturbances, 1935 should continue to show improvement in quality of output, lower costs of production, and from present indications increasing sales of your company's diversified products.

Employees

The total number of employees at the year-end was 9,154, distributed as follows: Canada 5,474, Great Britain 2,507, United States 1,122, other countries 51. Employees on December 31, 1933, numbered 8,297. The increase, amounting to 10 per cent., is due to the increased scale of operations.

It is gratifying to report that there was a further decline in the accident rate in the mining division, the number of compensation accidents per 1,000 shifts worked in 1934 being 0.206, compared with 0.259 in 1933.

During 1934 an average of 1,663 men was employed at Copper Cliff, 426 at Coniston, 1,529 at Frood, and 752 at Creighton. Of these, an average of 1,208 men was employed underground at Frood, and 514 at Creighton.

Donald MacAskill is general manager; R. D. Parker, general superintendent; H. J. Mutz, superintendent of mines; S. J. Kidder, superintendent of the Creighton mine; F. J. Eager, superintendent of the Frood mine.

RADIUM

Canada Radium Mines, Limited

Canada Radium Mines, Limited, has a capitalization of 2,500,000 shares of $1 par value, of which 1,400,000 shares have been issued. The property consists of 750 acres in Cardiff township, Haliburton county. The officers and directors are: K. W. Wright, president; Geo. F. McCandless, vice-president; A. M. Barry, secretary-treasurer; Frank Austin, managing director; E. W. Austin, superintendent; Geo. A. Arthur and John G. Cole, directors. H. L. McClelland is consulting engineer. The head office is at 244 Bay Street, Toronto. The mine address is Cheddar.

The shaft has been sunk to a depth of 375 feet, with levels at 125, 250, and 365 feet. Approximately 700 feet of lateral work has been completed.

About 15 men are employed at the mine.

SILVER AND COBALT

Cain and Taylor

The Beaver mine in Coleman township, district of Timiskaming, was operated from January 2 to June 9, 1934, by the owners, C. E. Cain and W. D. Taylor.

From 35 tons of ore hoisted and shipped, there were recovered 58,620 fine ounces of silver, having a value of $24,598. An average of 12 men was employed.

Cobalt Properties, Limited

Cobalt Properties, Limited, is capitalized at $25,000, in shares of $1 par value. The officers are: Ambrose Murphy, president; Arthur Brocklebank, managing director; T. Wainwright, vice-president; H. E. Tomney, secretary-treasurer; Agnes Reid, director. The head office is at Cobalt.

The company owns the following properties in the township of Coleman, district of Timiskaming: Coniagas, Mining Corporation, Right of Way, McKinley-Darragh-Savage, and Cobalt Townsite.

During 1934, shipments of 102 tons of ore, containing 221,345 ounces of silver, were made. About 50 men were employed during the year.

George Martin

George Martin of Cobalt operated the Crown Reserve mine in Coleman township, district of Timiskaming, under lease during part of 1934, employing 8 men.

Shipments of 7,568 pounds of silver-cobalt ore and 1,124 ounces of bullion were made.

Mining Corporation of Canada, Limited

The properties of the Mining Corporation of Canada, Limited, in Coleman township, district of Timiskaming, were leased from January 1 to September 12. The operation by the lessees yielded 49,789 ounces of silver, valued at $24,615.

The mines were sold to Cobalt Properties, Limited, in September.

Nipissing Mining Company, Limited

Nipissing Mines Company, Limited, has a capital of 1,200,000 shares of $5 par value. The directors of the company are: E. P. Earle, president and treasurer; Alexander Fasken, vice-president and secretary; Richard T. Greene, Dr. F. R. Bennetto, C. W. Nichols, Halstead Lindsley, and Hugh Park, directors. The head office is at the Excelsior Life Building, Toronto, and the New York office is at 165 Broadway.

The operating company is the Nipissing Mining Company, Limited, with a capital of 2,500 shares of $100 par value. The officers and directors of the company are: Alexander Fasken, president and secretary; E. P. Earle, vice-president and treasurer; Richard T. Greene, C. W. Nichols, Dr. F. R. Bennetto, Halstead Lindsley, and Hugh Park, directors. Hugh Park is general manager.

The mine in Coleman township, district of Timiskaming, was reopened in July, 1934, and operated until the end of the year, with an average force of 21 men.

The following is an extract from the report of the general manager for the fiscal year ending December 31, 1934:—

Operations at the Cobalt property were more extensive than in 1933. There was marked improvement in the price of silver and in the market demand for ores and residues containing cobalt and other minerals. This condition permitted the reopening of one of the shafts, to extract several hundred tons of cobalt ore. Shipments of residue amounted to 600 tons, as contrasted with no sales in 1933.

The clean-up of the fire area at the low-grade mill produced 575 tons of medium-grade silver ore, which was shipped direct to smelters. It is probable that some further tonnage from this source will be procured. Leasers working in various sections of the property obtained fair results, in which the company shared to a substantial extent.

The following shipments were made during the year:—

	Tons	Ounces silver
Bullion	21.56	628,608.30
Clean-up	573.37	103,267.32
Leasers' ore	131.19	161,971.27
Residue	605.81	43,335.63
Cobalt ore	360.40	.....
Total	1,692.33	937,182.52

The approximate value of shipments was $425,000.

There was a gratifying material increase in the price of silver, the year starting at 44⅞ cents and ending at 54¾ cents, the average for 1934 being 47.973 cents, an increase of 13¼ cents, or 38 per cent. over 1933. There have been further increases since 1934, present quotations being around 75 cents. The following table shows the fluctuations in the price of silver during the 5 preceding years:—

	Average	High	Low	Spread
	cents	cents	cents	cents
1934	47.973	55.75	41.75	14
1933	34.727	45	24.5	20.5
1932	27.892	31	24.25	6.75
1931	28.701	37.25	25.75	11.5
1930	38.154	46.875	30.75	16.13

It is doubtful whether any considerable amount of silver remains in the old workings which would be profitable for the company to extract at present or even higher prices. If silver continues at about the present level there may be some inducement to carry on further exploration work in the search for new veins, though such exploration work could not be expected to be as profitable as the portions already explored and from which the major part of past production was derived.

M. J. O'Brien, Limited

Cross Lake Mine

The Cross Lake mine in Coleman township, district of Timiskaming, is owned and operated by M. J. O'Brien, Limited. J. G. Dickenson is general manager, and W. A. O'Flynn is manager. About 103 men are employed. The mine address is Cobalt.

The following development work was done in 1934: drifting and crosscutting, 4,257 feet; raising, 637 feet; sinking, 11 feet.

The following table shows the ore hoisted and milled in 1934:—

	Tons
Total tons broken	43,316
Ore hoisted	22,794
Waste hoisted	14,790
Ore milled	30,755
Custom ore milled	301

The silver recovered amounted to 1,088,993 ounces, of which 26,086 ounces was from custom ore. There were shipped:—

Cobalt	lbs.	54,873
Copper	lbs.	24,745
Lead	lbs.	7,789
Gold	ounces	4.531

Miller Lake O'Brien Mine

The Miller Lake O'Brien mine, Nicol township, district of Timiskaming, is owned and operated by M. J. O'Brien, Limited. J. G. Dickenson is general manager and H. G. Kennedy is manager. The mine address is O'Brien. The average number of men employed was 83.

The 1934 report is as follows:—

	Feet
Drifting	2,734
Crosscutting	386
Raising	126
Sinking	41
	Tons
Ore stoped	10,246
Ore and waste broken	21,484
Ore hoisted	21,680
Waste hoisted	6,514

Peterson Cobalt Mines, Limited

The property of Peterson Cobalt Mines, Limited, in Coleman township, district of Timiskaming, was not operated in 1933, but a short lease was given to Frank Barnet. Ore picked from the dump yielded $165.52 in silver.

C. W. Price

The Foster mine in Coleman township, district of Timiskaming, was operated under lease by C. W. Price, who employed 2 men. Shipments of ore and concentrates yielded 6,037 ounces of silver, having a value of $3,088.59.

Sandoe and Moyle

The Temiskaming mine in Coleman township, district of Timiskaming, was leased to Richard Sandoe and H. Moyle.

Some 9 tons of ore shipped to the Temiskaming Testing Laboratories for treatment yielded 25,488 ounces of silver.

Smith Cobalt Mines, Limited

The property of Smith Cobalt Mines, Limited, is in Coleman township, district of Timiskaming, east of Cross lake. A shaft had been sunk by the Mining Corporation to a depth of 410 feet, and 1,100 feet of lateral work had been done.

The new company started dewatering the workings in May, 1934, and to the end of the year the following work was done: drifting, 60 feet; raising, 25 feet; and winze-sinking, 66 feet. Operations ceased on December 31, 1934. An average of 13 men was employed.

The officers are: W. H. Smith, president; A. A. Amos, vice-president; Col. E. F. Armstrong, vice-president; A. Kelso Roberts, secretary-treasurer. The company is capitalized at 4,000,000 shares of $1 par value, of which 2,100,000 are issued. The executive office is at 320 Bay Street, Toronto.

A. Wood

The Dominion Reduction property in Coleman township, district of Timiskaming, was leased to A. Wood, Cobalt, in 1934.

Ore shipped to Deloro, Noranda, and the O'Brien mill at Cobalt, yielded 11,490 ounces of silver.

TALC

Canada Talc Company, Limited

The mine and mill of the Canada Talc Company, Limited, in Hastings county, were operated throughout the year. The officers and directors of the company are: W. S. Morden, president; Roy Taylor, secretary; E. S. James, director.

The ore was mined from the 3rd and 8th levels. A total of 7,237 tons was hoisted, and 7,337 tons were milled. On the 4th level, 450 feet of drifting was done to open up new veins.

Roy Taylor, Madoc, is manager, employing an average of 17 men in the mine and 11 in the mill.

Geo. H. Gillespie Company, Limited

The officers and directors of the Geo. H. Gillespie Company, Limited, are: Geo. H. Gillespie, president; M. H. Ludwig, secretary-treasurer; Alexander Longwell, director.

The Henderson mine in Huntingdon township, Hastings county, was operated throughout the year. Some 6,667 tons of ore were hoisted and treated at the Gillespie mill.

Geo. H. Gillespie, Madoc, is manager. Eight men were employed at the mine and 10 at the mill.

METALLURGICAL WORKS

Algoma Steel Corporation, Limited

During 1934 only one blast furnace of this corporation, located at Sault Ste. Marie, was operated. No. 4 furnace was in blast from January 1 to June 15, and from October 16 to November 23. It produced a total of 68,904 tons of iron.

Jas. H. Bell was blast furnace superintendent.

Canadian Furnace Company, Limited

The Canadian Furnace Company, Limited, at Port Colborne, operated the furnace from July to December, 1934.

The production for the year was as follows:—

	Gross tons
Pig iron	38,980
Spiegeleisen	6,541
Total	45,521

The officers of the company are: Frank B. Baird, Buffalo, N.Y., president; Richard C. Yates, Port Colborne, vice-president and manager; Frederick C. Slee, Buffalo, N.Y., secretary. W. J. Higgins, Port Colborne, is superintendent.

Canadian Industries, Limited

During 1934, the sulphuric acid plant, located at Copper Cliff, was in continuous operation.

There are three 50-ton-per-day units, which manufacture acid from the converter gases produced at the smelter of the International Nickel Company. All three units were in operation throughout the year. The nitre cake plant, which has an estimated capacity of 72,000 tons per annum, was operated at about 60 per cent. of capacity. In this plant sodium sulphate is treated with sulphuric acid to produce nitre cake, which is used in the Orford process of separating nickel from copper.

An average of 52 men was employed. G. G. Vincent was succeeded by E. Jordan as works manager.

Deloro Smelting and Refining Company, Limited

The plant at Deloro operated throughout the year. The silver output for the year amounted to approximately 2,728,300 ounces.

The officers of the company are: M. J. O'Brien, chairman of the board; J. A. O'Brien, president; S. F. Kirkpatrick, vice-president and managing director; F. A. Bapty, secretary-treasurer. S. B. Wright is general manager, and R. A. Elliott is superintendent.

International Nickel Company of Canada, Limited

The refinery at Port Colborne was operated continuously throughout the year. An account of the operations appears on page 160 of this report.

Ontario Refining Company, Limited

The copper refinery of this company, situated at Copper Cliff, was operated continuously during 1934. Operations were gradually increased from about 55 per cent. of the rated capacity of the plant, as at the end of 1933, to about 85 per cent. at the end of 1934.

A wide variety of electrolytic copper shapes was produced, with an increasing volume of end-poured cakes, bars, and billets, made by the patented process of which this company is the only licensee in Canada. By-product departments were expanded, and a tellurium recovery plant was completed and put in operation in October. Gold, silver, platinum metals, selenium, and tellurium are now regularly produced as by-products.

The refinery operated chiefly on blister copper from the Copper Cliff smelter of the International Nickel Company, although gold ores and gold-bearing slags and mattes were also treated.

The distribution of products extended to most European countries, with the largest volume going to the United Kingdom. No copper has been shipped to the United States since a 4-cent-per-pound tariff was placed on foreign copper in June, 1932.

An average of 462 men was employed, in comparison with 236 men during 1933. F. Benard was plant manager.

Steel Company of Canada, Limited

The Steel Company of Canada, Limited, operated "A" furnace for 44 days, with a production of 12,679 gross tons of pig iron, and "B" furnace for 278 days, with a production of 151,072 gross tons.

The average number of men employed was 85. R. A. Gillies is blast furnace superintendent.

The officers of the company are: Charles S. Wilcox, chairman of the board; R. H. McMaster, president; H. M. Jaquays and H. T. Diplock, vice-presidents; H. H. Champ, vice-president and treasurer; H. S. Alexander, secretary; S. E. Le Brocq, comptroller.

MINING ACCIDENTS IN 1934

Chief Inspector of Mines, D. G. Sinclair, Toronto; Inspectors, R. H. Cleland, Timmins; D. F. Cooper, Sudbury; E. C. Keeley, Kirkland Lake; A. R. Webster, Toronto

Accidents during 1934

During the year 1934 at the mines, metallurgical works, quarries, and clay, sand, and gravel pits regulated by *The Mining Act*, there were 1,945 accidents to employees reported to the Department of Mines up to January 16, 1935. Thirty-three fatalities arising out of 32 separate accidents were reported.

These returns represent an increase of 407 in the total number of accidents, and an increase of 8 in the number of fatalities recorded.

The report shows a fatality rate of 1.61 per thousand men employed, which is 1.14 per thousand lower than the average for the past twenty-five years.

There were 93 non-fatal accidents per thousand men employed, which is a decrease of 2 per thousand from the rate of 1933.

The percentage of non-fatal accidents followed by infection decreased from 7.3 in 1933 to 7.1 in 1934.

Fatal Accidents

A comparison of fatal accidents for the past five years is given in the following table:—

Distribution	1930	1931	1932	1933	1934
Mines, underground	30	21	17	20	22
Mines, surface	3	8	0	1	2
Metallurgical works	11	1	1	1	5
Quarries	4	2	1	0	1
Clay, sand, and gravel pits	6	4	4	2	2
Total	54	36	23	24	32

By months the fatal accidents occurred as follows:—

Month	No. accidents	No. men killed
January	3	4
February	4	4
March	1	1
April	0	0
May	3	3
June	2	2
July	3	3
August	2	2
September	3	3
October	2	2
November	7	7
December	2	2
Total	32	33

Classifying the fatalities according to industries gives the following:—

Gold mines	18
Nickel mines	7
Silver mines	0
Talc mines	0
Metallurgical works	5
Quarries	1
Sand, gravel, and clay pits	2
Total	33

ANALYSIS OF FATALITIES AT MINES, 1930–1934

Cause	1930	1931	1932	1933	1934
	per cent.	per cent.	per cent.	per cent.	per cent.
Fall of ground	45.6	31	21	23	24
Run of ore or rock	8.6	3.5	5.3	9	8
Shaft accidents	8.6	17.2	15.8	9	8
Explosives	8.6	6.9	31.6	9	20
Miscellaneous, underground	20	13.8	26.3	45	32
Surface	8.6	27.6	.....	5	8

TABLE OF FATAL ACCIDENTS IN MINES, METALLURGICAL WORKS, QUARRIES, AND GRAVEL, SAND, AND CLAY PITS, 1910–1934

Year	Persons killed at metallurgical works and mines	Persons employed at metallurgical works and producing mines	Persons employed at non-producing mines (estimated)	Total persons employed	Fatal accidents per 1,000 employed
1910	48	10,862	2,000	12,862	3.73
1911	49	12,543	2,000	14,543	3.37
1912	43	13,108	2,000	15,108	2.84
1913	64	14,293	2,000	16,293	3.93
1914	58	14,361	1,500	15,861	3.6
1915	22	13,114	1,500	14,614	1.51
1916	51	14,624	2,000	16,624	3.07
1917	36	16,791	1,000	17,791	2.02
1918	32	14,726	500	15,226	2.1
1919	39	11,926	1,000	12,926	3
1920	29	10,486	1,000	11,486	2.61
1921	24	8,436	1,000	9,436	2.54
1922	30	9,500	1,500	11,000	2.72
1923	30	10,500	1,500	12,000	2.5
1924	40	11,000	1,500	12,500	3.2
1925	42	11,500	1,500	13,000	3.23
1926	32	11,500	1,500	13,000	2.46
1927	33	13,311	2,000	15,311	2.1
1928	85	15,787	2,000	17,787	4.76
1929	55	17,145	1,849	18,994	2.89
1930	56	18,217	317	18,534	3.02
1931	37	17,820	447	18,267	2.03
1932	25	14,378	431	14,809	1.69
1933	25	15,080	804	15,884	1.57
1934	33	19,302	1,254	20,556	1.61

The comparative fatality rate per thousand men employed at mines, metallurgical works, quarries, and clay, sand, and gravel pits is as follows:—

	Men employed	No. killed	Rate per thousand
Mines	14,755	25	1.69
Metallurgical works	3,892	5	1.28
Quarries	1,096	1	.91
Clay, sand, and gravel pits	813	2	2.46
Total	20,556	33	1.61

The occupation and nationality of the men killed at mines, metallurgical works, and clay, sand, and gravel pits are set out in the following table:—

Occupation	Austrian	British	Finn	Hungarian	Italian	Jugo-Slav	Lithuanian	Norwegian	Pole	Total
Block-holer						1				1
Cage-tender		1								1
Chute-blaster					1					1
Driller	1	1	1			1				4
Drill helper		2	1			2				5
Engine operator		1								1
Labourer		4	1				1	1		7
Pipefitter		1								1
Rigger's helper		1								1
Scaler		1	1							2
Shaft inspector			1							1
Shift boss		1								1
Shop helper		1								1
Switchman		1								1
Trammer		2		2					1	5
Total	1	17	5	2	1	4	1	1	1	33

The ages of the men killed are as follows:—

17–20	21–25	26–30	31–35	36–40	41–45	46–50	Over 50	Total
3	6	4	13	3	2	1	1	33

Non-fatal Accidents

The causes of non-fatal accidents at mines are shown in the following table:—

Cause	Surface	Underground	Total
Fall of persons	102	143	245
Falling objects	53	147	200
Tramming	4	121	125
Hand tools	75	50	125
Flying objects, sledging, etc.	18	99	117
Rock or ore at chute		115	115
Fall of rock or ore, scaling, drilling, etc.		109	109
Fall of rock or ore at face		108	108
Crushed between two objects	26	64	90
Handling rock or ore		72	72
Nails or splinters	21	37	58
Strain while lifting	14	40	54
Running into or striking objects	7	45	52
Drilling machines		44	44
Machinery	37	7	44
Explosives	3	27	30
Fall down shaft, winze, or stope		25	25
Burns	16	4	20
Cage, skip, or bucket		17	17
Air or rock blast		11	11
Poisoning from cyanide	7		7
Electricity	4		4
Explosion from carbide	1		1
Gas	1		1
Unclassified	11		11
Total	400	1,285	1,685

The causes of non-fatal accidents at metallurgical works were:—

Falling objects	23	Hand tools	3
Fall of persons	19	Strain while lifting	3
Burned by slag, matte, or scrap	18	Gas	3
Crushed between two objects	10	Nails of splinters	3
Cranes, ladles, hooks	7	Burns by acid	2
Burns	5	Running into or striking objects	2
Machinery	4		
Flying objects, sledging, etc.	3	Total	108
Transportation	3		

The causes of non-fatal accidents at quarries were:—

Handling material	22	Explosives	4
Flying objects, sledging, etc.	12	Fall of rock	3
Fall of persons	11	Running into or striking objects	2
Falling objects	9	Strain while lifting	2
Hand tools	8	Nails or splinters	1
Machinery	7	Unclassified	1
Transportation	6		
Derricks, cranes, etc.	6	Total	98
Crushed between two objects	4		

The causes of non-fatal accidents at clay, sand, and gravel pits were:—

Fall of persons	4	Transportation	2
Falling objects	3	Strain while lifting	1
Fall of material	3	Unclassified	2
Crushed between two objects	3		
Machinery	2	Total	22
Hand tools	2		

Infection

Records show that infection followed in 136 cases out of a total of 1,913 accidents:—

Location	No. of accidents	Accidents followed by infection	Per cent. infection
Mines, underground	1,285	92	7.1
Mines, surface	400	36	9
Metallurgical works	108	3	2.8
Quarries	98	5	5.1
Clay, sand, and gravel pits	22	.....	.....
Total	1,913	136	7.1

Accidents from Explosives

Cause	Non-fatal		Fatal		Total	
	No. of accidents	Men injured	No. of accidents	Men killed	No. of accidents	Men killed or injured
Returned too soon to blast	.....	.....	2	3	2	3
Delayed too long blasting	3	5	2	2	5	7
Unexplained blast	.....	.....	1	1	1	1
Drilled into explosive	4	9	.....	.....	4	9
Concussion from blast	1	1	.....	.....	1	1
Cap exploded while crimping	1	1	.....	.....	1	1
Walked into blast	4	5	.....	.....	4	5
Premature blast	3	4	.....	.....	3	4
Explosion while tamping	1	2	.....	.....	1	2
Struck by rock from blast	6	6	.....	.....	6	6
Total	23	33	5	6	28	39

Electric Accidents

The following table shows the fatal accidents due to the use of electricity at mines, metallurgical works, and quarries during the last ten years:—

1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	Total
3	.....	2	1	.....	6	.....	.....	.....	.....	12

The following table shows the total number of non-fatal electric accidents during the last ten years:—

1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	Total
6	5	10	4	14	10	7	3	4	4	67

Mine Fires

Goodfish Mining Company, Limited

A gas explosion and fire occurred underground in the No. 3 shaft workings of the Goodfish Mining Company, Limited, about 3.40 P.M., on August 27.

No work had been done at this shaft from 1923 until the summer of 1934, and the workings had remained filled with water during that time. The principal work done at this location had consisted of sinking an inclined shaft on the vein, dipping from 65 to 90 degrees, to the 200-foot level, where some drifting had been done to the east and west and two crosscuts run to the north. From a crosscut directly north of the shaft a vertical winze had been sunk to the 350-foot level, and a small amount of drifting and crosscutting had been done at this horizon.

During 1934 work was again undertaken, with a view to exploring this property further. At the time of the accident the water had been pumped down to the 200-foot level and a small amount of driving had been done there. An attempt was being made to dewater the vertical winze below the 200-foot level, and an air lift had been rigged for this purpose. The air jet in this lift had apparently become blocked, and the three men underground were attempting to overcome this difficulty when the outbreak of gas was encountered. One man, Hugh Armstrong, was standing on the first landing below the 200-foot level in the winze, and his two fellow workmen were at the collar of the winze when the rush of gas occurred. All the men were carrying carbide lamps, and immediate ignition of the gas took place. The men were all thrown about and lost their hats and lamps in the explosion, but were able to reach the foot of the main shaft and climb to surface. Armstrong was the most extensively injured, his face and hands being quite severely burned.

The fire evidently burned itself out quickly, and no ignition of the winze timbers occurred. Work was held up at the property until the following day, when an examination of the workings was made by a crew equipped with gas masks, safety lamps, and canaries. During this inspection all air lines in the mine were opened, and on the return of the exploration party to surface the compressor was started and the workings were thoroughly blown out. On the resumption of operations on the morning of August 29 a further rush of gas was encountered, but as no open lights were in use, no further ignition of the gas occurred.

Hollinger Consolidated Gold Mines, Limited

An overheated, wood-lined brake shoe on a haulage locomotive operating on the 1,850-foot level at the Hollinger mine, on the morning of February 7, was the cause of the calling out of the rescue equipment and rescue teams.

By the time the teams and equipment were assembled at No. 11 shaft the source of the trouble had been located and it was found unnecessary to bring them into operation.

Smoke from the heated brake shoe spread over the level for about 600 feet.

Spontaneous Combustion in Carbide Refuse

A fire occurred in the shaft-house of the Paymaster Consolidated Mines, Limited, on the afternoon of February 10, due, apparently, to the spontaneous combustion of acetylene generated in the spent carbide container into which the miners had been accustomed to dump the refuse from their lamps on coming to surface. A great deal of difficulty was experienced in extinguishing the flames, as neither pyrene, water, nor sand seemed to have any effect, and it was only after calling out the fire brigade from South Porcupine that success was attained through the use of "foamite."

In seeking an explanation of the cause of the fire the Shawinigan Chemicals, Limited, manufacturers of carbide, were consulted and replied as follows:—

The fire at the Paymaster mine is the first of this nature which has come to our notice, although from experience at the carbide works, we can readily understand the cause.

The formation of acetylene by slacking carbide with water liberates a great deal of heat. When carbide lumps are used the reaction is comparatively slow and the heat escapes, but when water comes in contact with very fine particles of carbide, the reaction is almost instantaneous, and if there is a quantity of slacked lime or carbide present, this serves to hold the heat and a temperature well above the ignition point of acetylene is easily reached. The safe handling of siftings from commercial sizes constitutes one of the difficulties of carbide manufacture, and fires are prevented by keeping the siftings or fines at a safe distance from water.

The process of screening partially used carbide naturally permits small particles of carbide to pass with the lime, and from your description of the circumstances, we are sure that the water dripping on this carbide eventually produced enough heat to ignite the acetylene.

The operation of screening damp, partially used carbide will also produce some acetylene, but as this will not ignite unless present in air to a greater extent than 3 per cent., it is generally safe unless water is actually present. We believe, then, that if the screenings are kept dry there is no danger of spontaneous combustion. The amount of phosphorus compounds in carbide is not sufficient to cause any trouble.

From the above it will be seen that it is possible for a very nasty situation to arise in the ordinary treatment of such waste material about a mine, and it is recommended that procedure along the following lines be followed to avert a recurrence of such a situation:—

UNDERGROUND

1. Miners should scatter waste carbide in the rock pile when recharging their lamps; it will slowly slack there and cause no dangerous condition.

2. Waste carbide should not be dumped into old powder boxes, etc., at eating places or stations unless these are especially provided for the purpose and are located in dry places away from other inflammable materials and are regularly taken to surface for disposal.

3. Waste carbide should not be transported in any shaft or on any train or truck unless covered by some waterproof material.

4. Waste carbide should not be transported in any shaft with open-flame lamps.

Surface

Waste carbide brought to the surface in miners' lamps should be dumped into a suitable, hooded metal container, preferably located away from the shaft-head, and this container should be emptied at frequent, regular intervals.

Prosecutions

A charge was laid against John Campbell, manager of the Martin Bird Syndicate, for operating contrary to Subsection 27, Section 163, of *The Mining Act*, in that a gasoline pump was operated in a shaft at that property.

A plea of "guilty" was entered before Magistrate Atkinson at Kirkland Lake on June 14, and a fine of $100 and costs was imposed.

A charge was laid against the Swayze Huycke Gold Mines, Limited, for operating contrary to Subsection 110, Section 163, of *The Mining Act* in that sinking operations were conducted at that property with a hoist equipped with a foot brake.

A plea of "guilty" was entered by the company, and the case was disposed of without court proceedings. A fine of $100 was imposed.

Summary of Rope Tests, 1934

The following is a summary of the tests made in the Wire Rope Testing Laboratories of the Department of Mines during 1934:—

Tests for Ontario mines under Act	326
Special informative tests for mines	6
Tests for wire-rope manufacturers	15
Tests for other manufacturers	6
Tests for mines outside Ontario	7
Other tests	7
Total	367

CLASSES FOR PROSPECTORS, 1934-35

By E. M. Burwash

General Summary

Prospectors' classes were held as usual during the winter 1934–35, except that the number of places visited for this purpose was reduced to 10, as compared with a maximum of 15 in recent years. To effect this, several places of some importance in former years had to be omitted, especially Fort Frances, Sioux Lookout, Sudbury, and Porcupine. The attendance secured was uniformly good, especially at two places which had not been recently visited. Marmora, visited for the first time, supplied a class of 70, and Kapuskasing, last visited seven years ago, had a class of 163. At Port Arthur and Fort William also, the revival of interest and activity in mining matters, due to the recent discoveries and excitement in the Little Long Lac and Sturgeon River areas, resulted in a registration of 78 at Port Arthur and 152 at Fort William. Other places that have been visited regularly for the last few years show a decline in attendance, which may be attributed to two causes: (1) Most of the men locally resident have already had the course, in many cases more than once; and (2) more men are at work in the woods than of recent years. This statement applies to Sault Ste. Marie, Kenora, Haileybury, Kirkland Lake, and Toronto. At Ottawa, on the other hand, where classes have been regularly held for the preceding seven years, a steady increase in attendance was continued this year, with an enrollment of 56, compared with 44 last year.

Analysis of Class Attendance

The following table gives detailed information as to the work of the classes for prospectors in the various localities in which they were held.

TABLE OF ATTENDANCE, 1934–1935

Place	Dates	Mineralogy[1]		Geology[2]		Total student periods
		Registration	Average attendance	Total attendance	Average attendance	
	1934					
Ottawa	Nov. 22–30	56	42	213	42.6	549
Marmora	Dec. 3–11	70	39.63	306	61.2	623
Sault Ste. Marie	Dec. 13–21	53	31.375	96	19.2	347
	1935					
Toronto	Jan. 3–11	355	247	1,085	217	3,061
Port Arthur	Jan. 14–22	78	59.5	193	38.6	659
Fort William	Jan. 24–Feb. 1	152	111.75	319	68.8	1,213
Kenora	Feb. 4–12	28	11.5	47	11.75	139
Haileybury	Feb. 14–22	54	32.125	96	19.2	353
Kirkland Lake	Feb. 25–Mar. 5	75	40.375	233	58.125	556
Kapuskasing	Mar. 7–15	163	115.75	[3]	.....	926
Total	.....	1,984	60.35	2,289	.....	7,816

[1]Eight afternoons.
[2]Five evenings.
[3]Omitted.

INDEX, PART I

NOTE.—All places referred to are in Ontario, unless otherwise designated.

A PAGE

Abitibi Mines, Ltd. 147
Abrasive Co. of Canada, Ltd. 27
Accidents, mining, rept. on 168-174
Ace Exploration and Holding Co. Ltd. 44
Acetate of lime, lime for 39
Acetylene. *See* Carbide refuse.
Acid plants 58, 60, 166
Ackerman, C. H. 105
Acme Gold Mines, Ltd., dividends 15, 16
Acreage tax, revenue 48
Acres, A. H. 139
Actinolite.
  Mine, manager and address 59
  Statistics 2, 3
Actinolite, Ont., actinolite 59
Acton, England.
  Platinum metals refinery 159
Adams, Chas. 132
Adams, L. W. 55, 95
Adams, O. H. 141
Adams, Robt. F. 63
Addington co. *See* Centreville.
A. E. Jupp Construction Co. 66
Africa. *See* Transvaal.
Afton gold m.
  Operations 85
  Optioned to Consolidated Mg. and Smelting Co. 55, 85
Afton tp.
  Gold Mg. *See* Afton gold m.
Agnew, George B. 130
Agnew, W. N. 86
Agriculture, lime consumption 39
Aikens, W. J. 82
Aird, H. R. 99
Akehurst, J. F. R. 55, 88, 94
Albastine plant, Paris 155
Aladdin Cobalt Co., Ltd., dividends 22
Alcanada Mining Corpn., Ltd. 43
Alexander, H. S. 167
Alexander, J. A. 50
Algold Mines, Ltd.
  Capital; officers; operations 67, 68
  Incorporated 43
  Mill, capacity 8
  Mine manager and address 54
Algoma district.
  See also Deroche tp.; Sault Ste. Marie.
  Gold mg. *See* Gold Lands Synd.; Goudreau g. area; Michael-Boyle g. m.; Michipicoten g. area; Sinclair Mines Synd.
  Mining lands, sales and leases 48
Algoma Steel Corpn., Ltd.
  Manager and address 58
  Incorporated 43, 44
  Operations 27, 28, 165
  Silica brick quarry 61

PAGE

Algoma Summit Gold Mines, Ltd.
  Capital; officers; operations 68
  Incorporated 44
  Mill, capacity 8
  Mine manager and address 54
  Production 11
Alkali, lime for 39
Allan, J. C. 78
Allen, Innis P. 89
Allen, J. B. 98
Allen, W. E. 60, 155
Allied Gold Mines, Ltd. 127
Alsbach, Clarence 54, 68
Alsbach Gold Mining Co., Ltd.
  Capital; officers; operations 68
  Manager and address 54
Amalgamated Gold Fields Corpn., Ltd.
  See also Blue Quartz g. m.
  Capital; officers 68, 69
  Production 10, 13
Amalgamated Mills and Mines, Ltd. 43
American Cyanamid Co. 62, 63
Ames, G. C. 71
Amherstburg, salt 62
Amity Gold Mines, Ltd. 44
Ammonia; ammonium sulphate 29
Amos, A. A. 164
Ampleford, D. A. 114
Ampleford, L. 65
Ancaster, limestone quarry 64
Ancaster tp. *See* Hamilton.
Anderdon tp.
  Lime quarry; limestone 63
Anderson, A. J. 54
Anderson, C. F. 64
Anderson, C. W. 136
Anderson, H. B. 108
Anderson, H. M. 121
Anderson, J. F. 55, 99
Anderson and Son, J. G. 60, 61
Anglo-Huronian, Ltd.
  See also Vipond g. m.
  Capital; officers; operations 69, 70
  Dividends 15, 16
  Option on Porcupine Peninsular g. m. 135
  Profit tax 51
Ankerite gold m.
  See also Buffalo Ankerite g. m.
  Production (1926-30) 12
Appeals to Mining Court 49
Appleby, Thos. A. 65
Ardeen Gold Mines, Ltd.
  See also Moss g. m.
  Capital; officers; operations 70, 71
Argonaut gold m., production 10, 14
A. R. L. Gold Mines, Ltd. 44
Armstrong, E. F. 164
Armstrong, Hugh 172

PAGE

Armstrong, R. 127
Armstrong, T. B. 116
Armstrong, W. E. 155
Armstrong, W. G. 121
Arnold, Thos. 145
Arsenic.
  Industry .30, 59
  production and value 2, 3
  from silver ores 21
Arthur, Geo. A. 161
Artificial gas. *See* Gas, coal.
Artificial stone 38
Asbestos. *See* Actinolite.
Ashley, James L. .158, 159
Ashley gold m.
  See also Ashley Gold Mg. Corpn.
  Manager and address 54
  Mill, capacity 8
  Operations 71
  Production .10, 14
Ashley Gold Mining Corpn., Ltd.
  See also Ashley g. m.
  Capital; officers 71
  Operated by Mining Corpn. of Can. 54
Ashmore tp.
  Gold mg. *See* Hard Rock Gold Mines.
Assay fees 48
Assay office.
  See Provincial Assay Office.
Associated Mine Managers, Ltd. 43
Atigo Gold Mining Co., Ltd. 43
Atigogama lake.
  Gold mg. *See* Dikdik g.m.
Atlas Securities Co., Ltd. 44
Atnel Mines, Ltd. 43
Austin, E. W. 161
Austin, Frank .58, 161
Austin Rouyn Gold Mines, Ltd. 44
Australia, gold production (1930-34) 18
Avery, S. L. 155
Avocalon Mining Syndicate, Ltd. 44

B

Babcock, Howard O. 95
Bache, Jules 89
Bad Vermilion lake.
  Gold mg. *See* South Vermillion Gold Mines.
Bag bay, Shoal l.
  Gold mg. *See* Cedar Island, Mikado g. mines.
Bagot tp., molybdenite 156
Bailes, F. J. 72
Bains, B. S. 63
Baird, D. S. .55, 99
Baird, Frank B. 165
Baldeck, Alphonse J. 74
Ball tp.
  Gold mg. *See* Cole Gold Mines; West Red Lake Gold Mines.
Ballantyne Long Lac Mines, Ltd. 44
Banbury, Robert S. 77
Bancroft, mica 61
Bankfield Gold Mines, Ltd.
  Capital; officers; operations 72
  Incorporated 44
  Mine manager and address 54
Banner Gold Mines, Ltd. 43
Bannockburn tp.
  Gold mg. *See* Ashley g. m.

PAGE

Bapty, F. A. 166
Barite.
  Industry and statistics 3, 31
  Mines and managers listed 59
Barnes, Co., Ltd., Wm. R. 66
Barnet, Frank 164
Barns, B. S. 155
Barr, Walter J. 60
Barrett, R. E. .56, 133
Barry, A. M. 161
Barry, P. A., and Cooper, W. D.
  Lessees, McIntyre Birch L. g. claims 86, 118
Barry-Hollinger gold m.
  Manager and address 54
  Mill, capacity 8
  Operations 72
  Production .10, 14, 72
Barry-Hollinger Gold Mines, Ltd.
  See also Barry-Hollinger g. m.
  Capital; officers 72
Barton, A. A. .56, 115
Barytes Products, Ltd. 59
Base metals.
  See also Copper; Lead; Nickel; Zinc.
  Values increased 1
Bastard tp. *See* Delta.
Bathurst, T. W. 72
Bathurst tp.
  Feldspar 60
  Granite quarry 65
Bathurst Feldspar Mines, Ltd. 60
Bathurst Gold Mines, Ltd. 54
  Capital; officers; operations .72, 73
  Incorporated 43
  Production 11
Bathurst Mines, Ltd. 72
Bayham tp., natural gas 33
Bayonne, N. J., foundry 159
Beachville.
  Lime quarry and plant .62, 63, 155
  Stone quarry 63
Bear, R. G. 155
Beardmore area.
  See also Beardmore g. m.; Tom Johnson–Nipigon Mines.
  McIntyre g. claims 118
Beardmore gold m.
  Manager and address 56
  Mill, capacity 8
  Operations. *See* Northern Empire Mines.
Beatty, Sir E. W. 85
Beatty, W. H. 137
Beatty tp.
  Gold mg. *See* Blue Quartz g. m.
Beauregard, L. 149
Beaver silver m. 19
  Manager and address 58
  Operations 162
Beaver Consolidated Mines, Ltd.
  Dividends 22
Beckett, W. J. .76, 96
Beggs, George E. 129
Beilby, J. W. 145
Bell, Harry 62
Bell, James H. .56, 165
Bell, Wilson 100
Belleville.
  Assay office 52
  Cement plant .37, 62
Bellew, H. C. 59

PAGE
Bellingham, D. M. 138
Bellingham, H. P. 138
Belmont tp., trap rock 65
Belmore Syndicate, Ltd. 43
Belorrain Mines, Ltd. 43
Belyea, Gordon 97
Benard, F. 59, 166
Benedict, P. C. 55, 94
Bennett, J. 149
Bennett, W. G. 129
Bennett, Dr. W. H. 108
Bennetto, Dr. F. R. 162
Bentinck tp. *See* Durham.
Benzol, from coking industry 29
Bertie tp. *See* Ridgeway.
Bessey and Co., Ltd., N. R. 44
Betz, Jacob 124
Bexley tp. *See* Coboconk.
Bickell, J. P. 117, 159
Bidgood gold m.
See also Bidgood Kirkland Gold Mines.
Manager and address 54
Mill, capacity 8
Production 10, 14
Bidgood Kirkland Gold Mines, Ltd.
See also Bidgood g. m.; Moffatt-Hall g. m.
Capital; officers; operations 73
Work by, on Moffatt-Hall g. m. 128
Biederman, Albert G. 63
Big Divide Gold Mines, Ltd. 44
Big Eddy, water power 156
Big Vermilion lake.
Gold mg. *See* Vermilion Lake Gold Mines.
Bigstone Bay Gold Mines, Ltd. 44
Billie, Charles V. 65
Billie, F. R. 65
Bilmac Gold Mines, Ltd. 43
Birch Bay Gold Mines, Ltd. 44
Birch Lake area.
McIntyre-Porcupine claims 86, 118
Bird, S. J. 56, 127
Birks, R. T. 103
Birmingham, England 156
Bishop, A. L. 83
Bismuth.
Production and value 2, 3, 5
from silver ores 21
Bison Gold Mines, Ltd. 133
Black, J. H. 69, 135
Black, S. W. 107
Black Donald Graphite Co., Ltd.
Manager and address 60
Operations 154, 155
Sales, value of 32
Blackstock, Geo. G. 82, 139
Blanshard tp. *See* St. Marys.
Blast furnaces 28, 58, 165
Blaylock, S. J. 85
Blocks, building 38
Blomfield, A. M. 110
Blue-prints, number sold 49
Blue Diamond Coal Co. 118
Blue Eagle Gold Syndicate, Ltd. 43
Blue Quartz gold m.
See also Amalgamated Gold Fields Corpn.
Manager and address 54
Mill, capacity 8
Operations 68, 69
PAGE
Blue Quartz gold m.—*Continued*
Production 10, 13
Bob Tough Gold Mines, Ltd.
Capital; officers; operations 73
Mine manager and address 54
Bobjo Mines, Ltd. 124
Bob's Lake mica m. 61
Boland, W. J. 127, 145
Bolduc, J. P. 50
Bolender Bros. 63
Bolton, A. J. 150, 151, 154
Bonter, J. W. 63
Bonter Marble and Calcium Co. 63
Bonuses. *See* Dividends and Bonuses.
Boring permits, revenue 48
Boston Creek area. *See* Pacaud tp.
Bothwell oil field 34
Bouchard Clericy Gold Mines, Ltd. 44
Boundary Lake Mining Co., Ltd. 43
Bourbeau Lake Chibougamau Mines, Ltd. 44
Bourget Springs 61
Bourgie, J. B. 63
Bourlamaque tp., Que. 91
Bousquet Gold Mines, Ltd.
Anglo-Huronian option 69
Capital; operations 74
Mine manager and address 54
Officers 69, 74
Bouzan, M. L. 57, 137
Boyd, T. R. 61
Boyles Brothers Drilling (Eastern), Ltd. 44
Bramor Mining (Ontario), Ltd. 44
Brant, F. A. 54, 68
Brant co.
See Brantford; Onondaga tp.; Paris.
Brantford, sand and gravel 66
Brass used in cement industry 38
Brassaw, Howard 56, 108
Brennan and Kenty Bros. Prospecting Co., Ltd. 44
Brennan David gold claims 55
See also Hislop g. m.
Breuls, Robert W. 137
Brick (common, face, and fancy).
Industry and statistics 2, 3, 41
Brick, cement, production 38
Brick, sand-lime. *See* Sand-lime brick.
Brick, sewer, statistics 2, 3, 41
Brick, silica. *See* Silica brick.
Brigham, A. F. 57, 100
Brine. *See* Salt.
British America Nickel Corpn. 24
British Canadian Mines, Ltd. 55, 94
See also Foley Syndicate.
British Columbia.
See Salmon River; Vancouver.
British Guiana Goldfields, Ltd. 44
British United Natural Gas, Ltd. 43
Britt, feldspar 60
Brittain, T. 113
Broadley, A. E. 140
Brockington, G. A. 147
Brocklebank, Arthur 58, 162
Brooke, Lionel 54, 74
Brooke tp., petroleum 34
Brougham tp.
See Black Donald Graphite Co.
Brown, R. R. 129
Brown, Wm. 63
Bruce, Hon. R. R. 85

PAGE

Bruce co. *See* Kincardine.
Bruce-Matachewan Gold Syndicate, Ltd. 43
Bruell Gold Syndicate, Ltd. 43
Brunner Mond, Canada, Ltd.
Lime quarry 63
Limestone quarry 63
Salt for chemical plant 34, 62
Bryce, Robert A. 116
Bryden, Douglas 54, 72
Buchanan, E. M. 82
Bucke tp. *See* Haileybury.
Budd, E. G. 73
Buffalo Ankerite gold m.
See also Ankerite g.m.; Buffalo-Ankerite Gold Mines.
Manager and address 54
Mill, capacity 8, 74
Operations 74-76
Production 10, 12, 74
Buffalo Ankerite Gold Mines, Ltd.
See also Buffalo Ankerite g. m.
Capital; officers 74
Dividends 15, 16
Marbuan mill operated by 12
Profit tax 51
Buffalo Mines, Ltd., dividends 22, 23
Building blocks, production 38
Building industry.
Improvement in 37, 40
Wages index 36
Building materials. *See* Structural materials.
Building permits, statistics 36
Building stone.
See also Stone.
Statistics 40
Building tile.
See Structural tile.
Building Products, Ltd. 65
Building Services, Ltd. 59
Bullion, receipts of crude, by Ottawa Mint from Ontario mines (1930-1934) 17
Bullion, silver, for U.S. Treasury 19
Bunting, R. F. 60, 154
Bunting, W. B. 154
Burd, Carl 65
Bureau of Mines, Ontario 4
Burial vaults, cement 38
Burk, Lorne 78
Burke, T. A. 110
Bur-Ley Long Lac Gold Mines, Ltd. 44
Burmas, Ltd. 44
Burnett, Frederick 89
Burns, Tommy. *See* Tommy Burns g. m.
Burrows, M. F. 140
Burt, A. W. 149
Burwash, E. M.
Report by, on Classes for Prospectors 175
Burwash tp., feldspar 60
Burwash Yellowknife Mines, Ltd. 44
Business construction contracts 36
Business transactions, mining recorders' 49
Butler, granite quarry 65
Butt, H. A. 98
Byers, W. M. 127
Byrne, J. C. 98
Byrne, J. J. 98, 114
Byrne, N. W. 73

C PAGE

Cabana, Oliver, Jr. 151
Cable-testing fees 48
Cable tests. *See* Rope tests.
Cain, C. E. 58, 162
Cairns, R. F. 138
Cairo tp.
See Matachewan Consolidated g. m.
Calabogie.
See Black Donald Graphite Co.
Calcium carbide, lime for 29
See also Carbide refuse.
Calcium molybdate, production 27, 28
Calder, John M. 97
Calder-Bousquet Gold Mines, Ltd. 44
Caldwell pyrite mine 60
Caledonia.
See Gypsum, Lime and Alabastine, Canada.
Caledonia tp., mineral water 61
Calgary, Alta., gypsum plant 155
California, U.S.A.
Gold production (1930-34) 18
Callin, Richard 56, 114
Callinan-McKay Exploration Co. 135
Calvin, C. C. 89
Camden tp. *See* Centreville.
Cameron, John F. 155
Cameron, W. G. 150
Cameron, W. M. 63
Cameron isld., Shoal l. 92
Campbell, John 127, 174
Campbell, L. A. 85
Campbell Sandstone Quarries, Ltd. 65
Canada.
Building permits, value of 36
Gold production 18
Canada and Dominion Sugar Co. 63
Canada Cement Co.
Limestone quarry 63
Plants listed 37, 62
Canada Crushed Stone Co. 63
Canada Lime Co. 63
Canada Nighthawk Mines, Ltd. 31, 59
Canada Talc Co.
Mine manager and address 62
Officers; operations 165
Canadel gold claim 84
Canadian Radium Mines, Ltd.
Manager and address 58
Operations 161
Canadian Reserve (Larder Lake) mill. 8
Canadian Associated Goldfields.
Production 14
Canadian Atlas Steels, Ltd. 27
Canadian Carborundum Co. 27, 28
Canadian Coalfields, Ltd. 118
Canadian Commodity Exchange 19
Canadian Copper Co., dividends 26
Canadian Dredging Co. 66
Canadian Electro Castings, Ltd. 27
Canadian Furnace Co.
Manager and address 58
Officers; operations 27, 28, 165
Canadian Gold and Metals Mining Co., Ltd. 44
Canadian Gold Refining Co., Ltd. 43
Canadian Gypsum Co., Ltd.
Lime quarry 63
Mine manager and address 60
Officers; capital; operations 155
Production 32

PAGE

Canadian Industries, Ltd.
Salt operators....34, 35, 62
Sulphuric acid plant....58, 60, 166
Canadian Kirkland Mines, Ltd.
Capital; officers; operations....76, 77
Mine manager and address.... 54
Canadian Leviathan Exploration Co., Ltd.... 44
Canadian Mint, Royal.... 17
Canadian Pyrites, Ltd.... 60
Canadian Reserve Mines, Ltd.
Mill, capacity.... 8
Canadian Slate Mines, Ltd.... 43
Canador Mining, Ltd.... 44
Canamerican Corpn., Ltd.... 44
Canfield, J. C....57, 140
Canusa gold m.
See also Canusa Gold Mines.
Mill, capacity.... 8
Operations.... 77
Production.... 13
Canusa Gold Mines, Ltd.
See also Canusa g. m.
Capital; officers.... 77
Mine manager and address.... 54
Canusa Mining and Exploration Co., Ltd.... 77
Capital.
Invested in gold mining.... 15
in nickel-copper mining.... 25
in silver mining....22, 23
Of mining companies incorporated in Ontario....42-47
Carbide refuse, combustion of.
Notes; rules for prevention....173, 174
Cardiff tp., radium.... 161
Cardiff Waters, Ltd.... 43
Cardinal Gold Mines, Ltd.... 44
Care, A. J. P.... 59
Carew, F. J.... 76
Carleton co.
See also Gloucester, Nepean tps.; Ottawa.
Sandstone.... 65
Carlsbad, Ltd.... 61
Carlsbad Springs.... 61
Carnegie, Frank....57, 141
Cartan, J. M.... 131
Carter, R. J.... 115
Casey tp.
Silver shipments (1908-1922).... 20
Casey Cobalt Silver Mg. Co., Ltd.
Dividends.... 22
Casey Summit gold m.
Mill, capacity.... 8
Mine address.... 54
Operations....77, 78
Production.... 11
Casey Summit Gold Mines, Ltd.
See also Casey Summit g. m.
Capital; officers.... 77
Casselman, limestone quarry.... 64
Castle-Tretheway Mines, Ltd.
Dividends....22, 23
Casual fees, revenue.... 48
Casummit Lake area.
Gold mg. *See* Casey Summit g. m.; McIntyre Birch Lake g. m.
Caulfield, W. G.... 129
Caustic soda, for coking industry.... 29
Cavin, G. A.... 135

PAGE

Cedar Island gold m.
Manager and address.... 55
Operations.... 107
Cement products.
Industry and statistics....2, 3, 37, 38
Centennial Gold Mines, Ltd.
Capital; officers; operations.... 78
Mine address.... 54
Central Canada Mines, Ltd.
Capital; officers; operations....78, 79
Mine address.... 54
Production.... 11
Central Malartic Mines, Ltd.... 44
Central Patricia Gold Mines, Ltd.
Capital; officers; operations.... 79-81
Mill, tonnage, present and proposed. 8
Mine manager and address.... 54
Production....11, 79
Central Porcupine Mines, Ltd.
Capital; officers; operations....81, 82
Mine manager and address.... 54
Central Porphyry Contacts, Ltd.... 45
Centralac Mining Co., Ltd.... 44
Centreville, limestone.... 64
Ceramic industry, report on. *See* Montgomery, R. J.
Certificates of record and performance of work.... 49
Chalmers, Miss M.... 63
Chalmers Lime Works.... 63
Champ, H. H.... 167
Champion Reef gold m.
See Westree g. m.
Chandler, C. M.... 103
Chaplin, Hon. J. D.... 106
Chappie-Mammoth Gold Mines, Ltd.... 45
Charette and Son, S.... 60
Chatham, lime.... 63
Chatham tp.
See Wallaceburg.
Chemical fees.... 48
Chemical industries, lime consumption. 39
Chemical laboratories.
See Provincial Assay Office.
Chemical plants.
See Acid plants.
Cherry, W. S.... 103
Chester tp.
See Young-Shannon Gold Mines.
Chieftain Gold Mines, Ltd.... 45
Childs, H. H.... 95
Chipp, W. G....124, 156
Christie, Chas. R.... 63
Chromite.
See also Chromium Mg. and Smelting Corpn.
Industry.... 29
Production....2, 3, 5
Chromium.
Industry and statistics. *See* Chromite.
Mine. *See* Chromium Mg. and Smelting Corpn.
Chromium Alloy Co., Ltd.... 67
Chromium Mining and Smelting Corpn., Ltd.
Capital; officers; operations....29, 67
Incorporated.... 43
Mine manager and address.... 54
Churchill tp.
See Churchill Mg. and Milling Co.; Neville Canadian Gold Mines.

PAGE

Churchill Mining and Milling Co., Ltd.
Capital; officers; operations 82
Mill, proposed, capacity 8
Mine address 54
Cinder bricks and blocks 38
Cinder consumption, cement works 38
Cintorico Gold Mines, Ltd. 45
Cities of Ontario, building permits 36
City of Cobalt silver m. 23
City of Cobalt Mining Co., Ltd.
Dividends 23
Claims, mining, statistics 48-51
Clam lake.
See Young-Shannon Gold Mines.
Clarence tp. *See* Bourget Springs.
Clark, John E. 149
Clark Gold Mines, Ltd. 42
Clarke, Richard N. 129
Classes for prospectors, report by E. M. Burwash 175
Clay products.
Industry and statistics 40, 41
production 2-4
increase 1
Cleland, R. H. 168
Clifton g. m., production (1922-1924) .. 13
Cline. *See* Huddlestone and Cline.
Clydach, Wales.
Nickel refinery 156
Coal, for coking industry 29
Coal gas, statistics 29
Cobalt (mineral).
Demand for, increased 19, 163
Industry and statistics 2, 3, 5, 19-23
Mines 19, 58
reports 162-165
Cobalt, Ont.
See also Temiskaming Testing Laboratories.
Silver.
see also Cobalt silver area.
mines and managers listed 58
Cobalt silver area.
Cobalt mg. 19
see also Cobalt (mineral).
Mines. *See* Coleman tp.
Revival in mining 20
Silver shipments 19, 20
Cobalt Central Mines Co., Ltd.
Dividends 22
Cobalt Comet Mines, Ltd.
Dividends 22
Cobalt Lake silver m. 23
Cobalt Lake Mining Co., Ltd.
Dividends 23
Cobalt Properties, Ltd.
Capital; officers; operations 162
Mine manager and address 58
Profit tax 51
Cobalt Silver Queen, Ltd.
Dividends 22
Cobalt Townsite silver m. 23
See also Cobalt Properties, Ltd.
Cobalt Townsite Mg. Co., Ltd.
Dividends 23
Cobnor Silver Mines, Ltd. 42
Coboconk, lime 63
Cochenour-Willans gold m.
Employees 101
Operations 103
Optioned to Hollinger Consol 55, 103

PAGE

Cochrane district.
See also Beatty, Cody, Coulson, Garrison, Guibord, Harker, Hislop, Holloway, Macklem, Munro, Playfair tps.; Porcupine g. area.
Mining lands, revenue 48
Cockeram, Alan H. 79, 122, 150
Cockerill, G. 105, 110
Cockshutt, A. 122
Cockshutt, Hon. H. 159
Cockshutt, Henry 155
Cody tp.
Gold mg. *See* Gold Island g. m.; Porcupine Peninsular Gold Mines.
Coffey, Robert 128
Coghill, J. M. 50
Cohen, Louis 79
Coke industry 27-29
Coldwater Crushed Stone, Ltd. 63
Cole, A. A. 51
Cole, Cicily 83
Cole, John G. 161
Cole, J. Y., Jr. 54, 83
Cole, S. S. W. 58, 156
Cole Gold Mines, Ltd.
Capital; officers; operations 83
Mine manager and address 54
Coleman mining division.
Recorder's report 49, 50
Coleman tp.
Cobalt mg. *See* Cobalt (mineral).
Silver mg. *See* Beaver s. m.; Cobalt Properties; Cross Lake, Crown Reserve, Dominion Reduction, Foster s. mines; Mining Corpn.; Nipissing s. m.; Peterson Cobalt Mines; Smith Cobalt Mines; Temiskaming s. m.
Colliery, Welsh, owned by International Nickel Co. 159
Collingwood, limestone quarry 64
Collins, chromium near 67
Combustion. *See* Spontaneous combustion.
Companies Act, The 42
Company, mining, incorporations 42-47
Concordia Gold Mining Co., Ltd.
Capital; officers; operations 83
Incorporated 43
Mine manager and address 54
Cone, Russell 55, 94
Coniagas silver m.
See Cobalt Properties, Ltd.
Coniagas Mines, Ltd., dividends 22
Coniaurum gold m.
See also Coniaurum Mines; Goldale shaft
Mill, capacity 8
Mine manager and address 54
Operations 84-86
Production 10, 12
Coniaurum Mines, Ltd.
See also Coniaurum g. m.
Capital; officers 83
Dividends 15, 16
Profit tax 51
Coniston.
Acid plant 60
Smelter (nickel-copper) 59, 159
labour employed 161
Connell, F. M. 79

PAGE
Connell, W. H.....79, 122
Connell Mining and Exploration Co.... 122
Connolly talc m..... 62
Conover, J. D..... 141
Consolidated Chibougamau Goldfields, Ltd..... 42
Consolidated Mg. and Smelting Co. of Canada, Ltd.
Capital; officers; operations.....85, 86
Mines optioned..... 55
Consolidated Sand and Gravel, Ltd.... 66
Consolidated West Dome Lake Mines, Ltd..... 133
Construction contracts, statistics..... 36
Cook, C. E.....57, 133, 134
Cook, W. J..... 115
Cooper, D. F.....67, 168
Cooper, George..... 97
Cooper, W. D., and Barry, P. A.
McIntyre Birch L. g. claims, lessees..55, 86
Cooper gold m..... 128
See also Minto Gold Mines.
Cooper Gold Mines, Limited..... 128
Copings, sewer, statistics.....2, 3, 41
Copper.
Industry and statistics.....2, 3, 5, 24-26
production and value.....2, 3, 5, 24, 25
from silver ores..... 21
Mines.
see also Cuniptau Mines; Falconbridge Nickel Mines; Internat. Nickel Co. of Canada.
managers and addresses..... 58
profit tax..... 51
reports.....156-161
Refinery..... 24
see also Ontario Refining Co.
precious metals from.....11, 25, 26
statistics.....2, 24-26
Copper Cliff.
Acid plants.....32, 58, 60, 166
Nickel-copper. *See* Internat. Nickel Co. of Canada.
Refinery (copper).....24, 25, 59
see also Ontario Refining Co.
Smelter (nickel-copper).....24, 59, 159
Corbet, J. M. R..... 123
Corkill, E. T..... 108
Corner, Austin A..... 65
Cornucopia shaft. *See* Cedar Island g. m.
Corporation Management and Executors, Ltd..... 87
Corrin, P..... 131
Corson, E. C..... 147
Coulson tp.
See Coulson Consolidated Gold Mines.
Coulson Consolidated Gold Mines, Ltd.
Capital; officers; operations..... 86
Mine manager and address..... 55
Countryman, Gordon..... 61
Courtright, salt..... 62
Cowie, Geo. S..... 61
Cowley, Mrs. K..... 66
Cox, G. E.....62, 63
Craig, Ernest.....58, 61, 127, 156
Craig, R. M..... 64
Craig, T. H..... 60
Craig Gold Mines, Ltd.
Capital; officers; operations..... 86
Incorporated..... 45
Mine manager and address..... 55

PAGE
Craine, J. L..... 65
Crannie, Robt..... 64
Crawshaw, P. H..... 148
Creighton nickel m.
Labour employed..... 161
Manager and address..... 59
Operations..... 160
Cripple Creek Mining and Milling Co., Ltd..... 45
Croesus g. m. *See* Munro Croesus g. m.
Cromwell, William N..... 159
Cross, J. G.....55, 92
Cross lake.
See Cross Lake s. m.; Smith Cobalt Mines.
Cross Lake silver m.
Manager and address..... 58
Operations..... 163
Crossroads Gold Mines, Ltd..... 45
Crow, H. C..... 69
Crow River area.
See Central Patricia Gold Mines; Pickle L.-Crow R. area.
Crown Reserve silver m.....58, 162
Crown Reserve Mining Co., Ltd.
Dividends..... 22
Culvert pipe, cement..... 38
Cummings, J. D.....57, 145
Cummings, M. N..... 65
Cuniptau Mines, Ltd.
Capital; officers; operations..... 156
Mine manager and address..... 58
Cunningham tp.
See Swayze-Huycke Gold Mines.
Cushing, D. E..... 127
Custom assaying..... 52
Custom Smelters of Canada, Ltd..... 43
Cyanamid, lime for..... 39

D

Dakota, U.S.A. *See* S. Dakota.
Dalton, J. A..... 109
Damascus gold m.
See also Duport Mining Co.
Mine manager and address..... 55
Operations..... 92
D'Amour, A..... 131
Dark, Samuel J..... 93
Darling, H. A..... 138
Darwin, R. A..... 87
Darwin Gold Mines, Ltd.
Capital; officers; operations..... 87
Incorporated..... 45
Mine manager and address..... 55
Davidson, Jacob A..... 154
Davidson gold m., production..... 13
Davis, Norman R..... 108
Dawn tp., petroleum..... 34
Dawson, A. E..... 110
Dawson, A. S.....57, 149
Day, James E.....87, 106, 108
Day, T. J..... 106
Deacon, Thos. R..... 77
Deagle, Fred..... 78
Deagle, Lloyd..... 78
Decewsville, limestone quarry..... 63
Decewsville Crushed Stone, Ltd..... 63
Declute gas field..... 33
Deep Brook, N.S., gypsum mill..... 155
Defoe, S. J..... 154

PAGE
Delhi (Temagami) Gold Mines, Ltd.... 45
Delnite Mines, Ltd.
Capital; officers; operations.....87, 88
Incorporated..... 45
Mine manager and address..... 55
Deloro. *See* Deloro Smelting and Refining Co.
Deloro tp.
Gold mg. *See* Buffalo Ankerite g. m.; Excello Mines; Jones Porter g. m.; La Roche g. m.; McLaren-Porcupine Gold Mines; Marbuan g. m.
Deloro Smelting and Refining Co., Ltd.
Arsenic production..... 31
Manager and address..... 59
Operations; silver production.....19, 166
Delta, lime..... 63
De Luca, Luigi..... 88
Dempster, E. A..... 156
Deneault, F..... 61
Denman, R. O..... 67
Dennis, Geo. H..... 63
Dennis, W. R..... 124
Dent tp.
Gold mg. *See* Hudson Patricia Gold Mines.
Department of Highways.
Limestone quarries..... 64
Sand and gravel production..... 39
Department of Mines, Ontario, created 4
Department of Northern Development.
Gravel and sand production..... 39
Road construction, Hudson..... 80
De Pencier, H. P.....55, 89
Deroche tp., silica brick..... 61
De Santis, Peter.....55, 88
De Santis gold m.
Manager and address..... 55
Operations..... 89
Production..... 13
De Santis Gold Mg. Co., Ltd.
See also De Santis g. m.
Capital; officers..... 88
Deschênes, Que., refinery..... 24
Dewart, D. R..... 92
De Wolf, A..... 64
Diamond-drilling operations..... 5, 6
Diatomite.
Industry..... 31
producers listed..... 59
production and value..... 2, 3
Diatomite Products, Ltd..... 59
Dibblee Construction Co..... 64
Dickenson, E. H..... 129
Dickenson, J. G.....163, 164
Dickson, George..... 52
Digby Vet gold claim..... 81
Dignam, B. A. R..... 105
Dignam gold claims..... 81
Dikdik gold m.
Manager and address..... 56
Mill, proposed, capacity..... 8
Operations..... 123
Production..... 11
Dikdik Exploration Co., Ltd.
See McMartin, J. Bruce.
Dimbarr Gold Mines, Ltd..... 45
Dime Long Lac Gold Mines, Ltd..... 45
Dings, P. C..... 149
Diplock, H. T..... 167
Disputes, mg. divisions, statistics..... 49

PAGE
Dividends and bonuses.
Gold mines.....5, 15, 16
Metal mines..... 5
Nickel-copper mines.....5, 25, 26
Silver-cobalt mines.....5, 22, 23
Dixon, R..... 50
Dixon Pencil Co.
Canadian graphite process..... 32
Doane, A. J..... 150
Doane, George.....55, 93
Dodge, H. E..... 130
Dodsworth, J. R., Jr..... 135
Dome gold m.
See also Dome Mines, Ltd.
Manager and address..... 55
Mill, capacity..... 8
Operations.....89-91
Production.....10, 12
Dome tp. *See* Howey g. m.
Dome Lake Mg. and Milling Co., Ltd.. 133
Dome Mines Co., Ltd..... 15
Dome Mines, Ltd.
See also Dome g. m.
Dividends.....15, 16
Officers; financial statement.....89, 90
Profit tax..... 51
Dominion Bureau of Statistics.....1, 36, 38
Dominion Diatomite, Ltd..... 59
Dominion Explorers, Ltd..... 45
Dominion Foundries and Steel, Ltd.... 27
Dominion Mines and Quarries, Ltd.... 61
Dominion Reduction silver m..... 19
Lessee; production.....58, 165
Dominion Rock Products, Ltd..... 63
Dominion Royalty Corpn., Ltd..... 43
Dominion Salt Co., Ltd..... 62
Donaldson, Oliver G..... 151
Donaldson, Samuel..... 64
Dorfman, Andre..... 69
Dougherty, Hugh..... 92
Dougherty, J. E..... 92
Dougherty Syndicate..... 92
Douglas, Archibald..... 130
Douro tp. *See* Lakefield.
Dover tp.
Natural gas..... 33
Petroleum..... 34
Dow, E. Y.....54, 77
Downing, C. E..... 63
Dowsett, C. W..... 91
Doyle, W. L..... 142
Drain pipe, cement..... 38
Drain tile, statistics.....2, 3, 38, 41
Drake, A. B..... 142
Drake, C.C..... 77
Draughting Office, report..... 53
Dredging, sand and gravel.
Operators listed..... 66
Output and value..... 39
Royalties and licenses..... 48
Drilling.
See Boring permits; Diamond-drilling.
Drummond silver m..... 19
Drummond-Hay, H. R..... 137
Dry-press bricks, statistics..... 41
Du Bois, P..... 77
Dufferin Paving and Crushed Stone Co. 64
Duguid, E..... 96
Dulles, John F..... 159
Dumbrille, J. C.....55, 99
Duncan, Herbert..... 99

PAGE
Dundas, limestone quarry..... 63
Dunlop, A. C..... 62
Dunn, George.....56, 124
Dunwich tp., petroleum..... 34
Duport Mining Co., Ltd.
Capital; officers; operations..... 92
Mine manager and address..... 55
Production..... 11
Durham, sand and gravel..... 66
Durham Stone and Sand Co..... 66
Durkee, C. A..... 123
Dutton, petroleum..... 34
Dye, Robert.....54, 57, 69, 136
Dyer, W. S.
Notes by, on refractory clay.....40, 41
Dyment, gold mg. near..... 139
Dysart tp. *See* Haliburton.

E

Eager, F. J.....58, 161
Earl, Charles..... 147
Earle, A. P..... 149
Earle, E. P..... 162
East Flamborough tp. *See* Waterdown.
East Lamaque Gold Mines, Ltd..... 45
East Neebish island, quartzite..... 61
Eby tp.
Gold mg. *See* Lucky Kirkland Gold Mines.
Eden, W. A..... 145
Edgar Irvine Co., quarry..... 64
Edgecreek Consolidated Gold Synd., Ltd..... 45
Edgelake Gold Mining Co., Ltd..... 45
Ed. Hargreaves Kirkland Gold Mines.
Capital; officers; operations..... 92
Incorporated..... 45
Mine manager and address..... 55
Edwalt Corporation, Ltd..... 45
Edwards gold m.
See also Gold Lands Synd. of Algoma.
Manager and address..... 55
Operations.....95, 96
Eganville, lime..... 63
El-Bonanza Mining Corpn., Ltd..... 45
Elderkin, C. F..... 132
Eldon tp., limestone..... 63
Eldorado Gold Mines, Ltd..... 30
Electric accidents..... 172
Electrolytic copper refining.
See Ontario Refining Co.
Electro-Metallurgical Co. of Canada. 27
Elgin co. *See* Bayham, Dunwich, Malahide tps.
Elk Lake. *See* Ashley g. m.; Young-Davidson g. m.
Ellen Gold Mines, Ltd..... 45
Ellice tp., peat..... 61
Elliott, R. A..... 166
Elma tp., peat..... 61
Elora, lime.....63, 155
Elzevir tp., actinolite..... 59
Embossed brick, production..... 41
Emery, V. H..... 109
Emison, J. C..... 147
Emmons, K. P..... 145
Empire. *See* Northern Empire Mines Co.
Employment, increase in..... 1, 7
See also Labour statistics.

PAGE
Enamelled brick, production..... 41
Engineering construction contracts.
Value of..... 36
England. *See* Acton; Birmingham; London.
Englebright, W. H..... 114
Ennis, R. J.....56, 117
Enniskillen tp., petroleum..... 34
Ensign Gold Mines, Ltd..... 43
Eramosa tp., lime..... 63
Erie Canadian Mines, Ltd..... 87
Errington, Jos.....72, 99, 106, 115, 127
Esquesing tp.
See Limehouse; Milton.
Essex co.
See also Amherstburg; Anderdon tp.
Sand and gravel..... 66
Etobicoke tp., sand and gravel..... 66
Evans, A. Kelly..... 103
Evans, D. Owen..... 159
Evelyn, S..... 136
Eves, C..... 65
Excello Mines, Ltd..... 55
Capital; officers; operations.....92, 93
Exchange, commodity.
See Canadian Commodity Exchange.
Exchange, monetary..... 17
Exchange adjustments, compensation.
See Exchange equalization.
Exchange equalization.
Effect of, on mining industry..... 1, 6
Gold mines.....1, 2, 4, 10, 11, 18
Notes and corrections.....17, 18
Exchange premium on gold. *See* Exchange equalization.
Exolon Company, Ltd..... 27
Expenditures, mining..... 48
Explosives, accidents due to..... 171
Exton, Wm., Jr..... 83

F

Face brick, statistics.....2, 3, 41
Fahrenholtz, P..... 114
Fairlie, M. F.....71, 121
Fairs, S. E..... 141
Falconbridge Nickel Mines, Ltd.
Dividends..... 26
Mine manager and address..... 58
Officers; operations.....156-158
Profit tax..... 51
Quarry..... 61
Refinery..... 158
Smelter..... 59
Fancy brick, statistics.....2, 3, 41
Fasken, Alexander.....89, 162
Fatalities. *See* Accidents, mining.
Favel. *See* Howey g. m.
Federated Mining Corpn. Ltd.
See also New York Porcupine g. m.
Capital; officers; operations..... 93
Incorporated..... 45
Mine manager and address..... 55
Fees, recording, etc., revenue..... 48-51
Feine, George R.....74, 125
Feldspar.
Industry and statistics.....2, 3, 31
Mines and managers listed..... 60
Felton, A. J..... 149
Fennell, Robert.....86, 135

PAGE

Ferguson gold m.
Optioned to Golden Star Consol....55, 97
Ore from dump..... 97
Ferreri, Biagio..... 88
Ferro-alloys.
Producers; statistics.....27, 28
Ferro-chrome..... 29
Fertilizer, lime for..... 39
Finance Department, purchases bullion 17
Finch tp., marble..... 64
Fire-clay blocks, production..... 41
Fire-clay deposits.
Northern Ont., notes by W. S. Dyer.40, 41
Fireproof tile, production..... 41
Fires in mines.....172, 173
Hazard, reduction of. *See* Carbide refuse.
Fisher, D. K. E..... 138
Fisher, Paul..... 129
Fitzgerald, F. G..... 96
Fleming, John..... 61
Fleming, S. E..... 78
Fletcher, L. K..... 124
Floor tile, statistics.....2, 3, 41
Flower pots, production..... 41
Flower station. *See* Caldwell pyrite m.
Flue linings, statistics.....2, 3, 41
Fluorspar.
Industry and statistics.....2, 3, 32
Mines and managers listed..... 60
Flux, limestone for..... 27
"Foamite"..... 173
Foley O'Brien Corpn., Ltd.
Capital; officers; operations.....93, 94
Incorporated..... 45
Mine manager and address..... 55
Foley O'Brien, Ltd..... 93
Foley Syndicate.
Mill, capacity..... 8
Mine manager and address..... 55
Operations..... 94
Production..... 11
Foot, G. A..... 123
Forbes, D. L. H..... 145
Forest permits..... 49
Forrester, F. E..... 149
Fort Frances mg. division.
Recorder's report.....49, 50
Fort Hope Consolidated Gold Mines, Ltd..... 45
Fort William.
Classes for prospectors..... 175
Trap, quarry..... 65
Foster, R. R.....64, 66
Foster silver m.
Manager and address..... 58
Operations..... 164
Foster Cobalt Mining Co., Ltd.
Dividends..... 22
Four Nations Consol. Gold Mines, Ltd. 55
Capital; officers; operations.....94, 95
Fox, E. D..... 117
Fox Lake Gold Syndicate.
Mine manager and address..... 55
Officers; operations..... 95
Franklin Gold Mining Co., Ltd..... 45
Fraser, F. C..... 123
Fraser tp., feldspar..... 60
Free assays..... 52
Friel, Jos. V..... 88
Fritzsche, K. W.....56, 123
Frohberg, M. H.....55, 87

PAGE

Frohe, Ferdinand..... 108
Frontenac co. *See* Kingston tp.; Loughborough Mg. Co.; Verona.
Frontenac Floor and Wall Tile Co.....31, 60
Frontier Red Lake Gold Mines, Ltd... 45
Frood nickel m.
Blister copper from ore..... 24
Labour employed..... 161
Manager and address..... 58
Operations..... 160
Fuller, A. S..... 133
Fuller, sand and gravel..... 66
Fuller Gravel, Ltd..... 66
Furness Mines, Ltd..... 92
Futterer, Edward.....55, 103

G

Gage, F. H..... 73
Gairdner, J. A..... 141
Gale Gold Mines, Ltd..... 45
Gallagher, C. W..... 137
Gallagher, J. J..... 152
Gallagher, Raymond..... 63
Gallagher Lime and Stone Co., plant.. 63
Gardner, John J..... 92
Gardner Guibord gold m..... 57
See also Talisman Gold Mines.
Gardner Silver Mines, Ltd..... 45
Garrison tp.
Gold mg. *See* McKenzie g. claims.
Gas, coal, statistics..... 29
Gas, natural. *See* Natural gas.
Gauthier tp.
Gold mg. *See* Four Nations Consol. Gold Mines; Kirkland Consol. Gold Mines.
Geddes, F. H..... 82
Gelines, P..... 131
General Electric Co., mica mg..... 61
General Mining and Development, Ltd. 45
General Ventures Mining Corpn., Ltd.. 45
George H. Gillespie Co.....35, 62, 165
Georgetown, sandstone quarry..... 65
Geraldton. *See* Little Long Lac g. m.
German Exploration Co., Ltd..... 43
Gibbs, F. B..... 155
Gibson, Clifford..... 78
Gilbertson, Gordon..... 63
Giles, T. S..... 138
Gilgreer Mines, Ltd..... 69
Gill, J. R.....59, 156
Gillespie, Geo. H..... 62
Gillespie Co., Geo. H.
Manager and address..... 62
Operations..... 165
Production..... 35
Gillies, Alex.....55, 95
Gillies, R. A.....59, 167
Gillies Lake–Porcupine Gold Mines.
Mill, proposed, capacity..... 8
Ginn, H. G..... 50
Giustini, Giuseppe..... 88
Glasgow, Scotland, rolling mills..... 159
Glass industry.
Lime consumption..... 39
Nepheline syenite for..... 31
Glass Manufacturers' Federation..... 31
Gleeson, E. P..... 73
Glendenning, H. G..... 59
Glenelg tp., lime..... 63

PAGE
Globe, A. R. 54, 67
Gloucester tp.
Limestone quarry 64
Mineral water. *See* Carlsbad Springs.
Sand and gravel 66
Goderich, salt 62
Goderich Matachewan Gold Mines, Ltd. 45
Goderich Salt Co. 35, 62
Godfrey, A. 110
Goetz, E. P. 89
Gold.
Industry and statistics 1-18
labour statistics 7, 9
milling, lime consumption 39
plants, capacity 8
premium on exchange. *See* Exchange equalization.
prices 17, 146
increased, effect of 1, 7
production and value 2, 3, 5, 9-13
from nickel-copper ores 11, 25, 159
from refineries 26
increases 1, 7
world 18
Mines
see also Algoma, Cochrane dists.; Hastings co.; Kenora dist.; Patricia portion; Rainy River, Sudbury, Thunder Bay, Timiskaming dists.
accidents; fires in 168
dividends paid by 5, 15, 16
managers and addresses 54-57
profit tax 51
reports 67-154
Ores, revenue from treatment of.
see Temiskaming Testing Laboratories.
Gold standard, abandoned by U.S. 17
Gold Centre Mines, Ltd. 81
Gold Eagle Gold Mines, Ltd.
Capital; officers; operations 95
Incorporated 45
Mine manager and address 55
Gold Hill gold m.
Production (1927, 1928) 14
Gold Island gold m.
Employees 101
Optioned to Hollinger 103
Gold Lands Syndicate of Algoma.
Capital; officers; operations 95, 96
Mine manager and address 55
Gold Range Mines, Ltd.
Capital; officers; operations 96
Incorporated 45
Mine manager and address 55
Gold Reef gold m., production (1915-17) 13
Gold Valley Mines, Ltd. 45
Goldale shaft, Coniaurum g. m.
Central Porcupine g. m. worked from 82
Goldcrest Mines, Ltd. 45
Golden Arm Mines, Ltd. 45
Golden Arrow Mining Co., Ltd. 45
Golden Gate Mining Co., Ltd. 55
See also Lucky Cross g. m.
Capital; officers; operations 96
Incorporated 45
Golden Spur Syndicate, Ltd. 45
Golden Star gold m.
See also Golden Star Consol. Mines.
Mill, capacity 8

PAGE
Golden Star gold m.—*Continued*
Operations 97
Production 11
Golden Star Consolidated Mines, Ltd. 55
See also Golden Star g. m.
Capital; officers; operations 96, 97
Incorporated 45
Golden Summit Mines, Ltd.
Capital; officers; operations 97
Mine manager and address 55
Goldfinders, Ltd. 45
Goldsborough, C. B. 123
Goodall tp.
Gold mg. *See* Hudson Patricia Gold Mines.
Goodelle, G. G. 103
Goodfish Gold Mines, Ltd. 97
Goodfish Mining Co., Ltd.
Capital; officers; operations 97
Fire underground 172
Mine manager and address 59
Goodings, K. M. 66
Goodwin, E. M. C. 64
Goodwin, R. F. 147
Goodwin Gold Mines, Ltd. 45
Gordon, A. B. 99, 114, 115
Gosark Golds, Ltd. 45
Goudreau Gold area.
Gold mg. *See* Algood Mines; Algoma Summit Gold Mines; Kozak g. m.
Gow, James 64
Gowdy, Wm. 63
Gowganda mining div.
Recorder's report 49, 50
Gowganda silver area.
See also Miller Lake O'Brien s. m.
Silver shipments 20
Grace gold mine.
See also Darwin Gold Mines, Ltd.
Mine manager and address 55
Operations 87
Graham, P. J. 137
Graham, R. 109
Graham, S. N. 109
Graham Bousquet Gold Mines, Ltd. 45
Granite.
Operators listed 65
Statistics 2, 3, 40
Grant, Sir A. Hamilton 69
Grant, Gideon 154
Grant, H. R. 136
Grant, Jas. E. 56, 128, 145
Graphite.
Industry and statistics 2, 3, 32
Mg. *See* Black Donald Graphite Co.
Grattan, F. 64
Grattan tp. *See* Eganville.
Gravel. *See* Sand and gravel.
Gray, J. J. 67, 68, 116
Gray, M. D. 98, 114
Great Bear l., pitchblende 30
Great Lakes, sand and gravel 39, 66
Greater Canada Mines Corpn., Ltd. 45
Green, W. F. 53
Green, W. J. 114
Greene, Dr. E. H. 72
Greene, Richard T. 162
Greenlaw tp.
Gold mg. *See* Greenlaw Gold Mines.
Greenlaw Gold Mines, Ltd. 55
Capital; officers; operations 98

PAGE
Greenshields, C. G. 70
Gregnon, limestone 63
Grenfell tp.
Gold mg. *See* Alsbach Gold Mg. Co.; Four Nations Consol. Gold Mines; Golden Summit Mines; Kirkland Consol. Mines.
Grenon, Jas. 64
Grey co.
See Durham; Glenelg tp.; Owen Sound; Sullivan tp.
Grierson Sturgeon River Mines, Ltd. 45
Griffith, J. A. 145
Groundhog Gold Mines, Ltd. 45
Grover, G. A. 135
Guelph, lime quarry and plant 63, 155
Guelph tp.
See also Guelph.
Limestone 64
Guertin, L. 142
Guess, H. A. 147
Guibord tp.
Gold mg. *See* Talisman Gold Mines.
Gunter, Judson A. 60
Gurd, Chas. and Co. 61
Gypsum.
Industry and statistics 2, 3, 32
Mg. *See* Canadian Gypsum Co.; Gypsum, Lime and Alabastine, Canada.
Gypsum, Lime and Alabastine, Canada, Ltd.
Gypsum mg. 60, 155
production 2, 3, 32
Lime plants and quarry 63
Limestone quarries 64
Gypsum Packet Co. 155
Gypsumville, Man., limestone quarry 155

H

Haddleton, H. J. 129
Hadley's Chatham, Ltd. 66
Hagersville.
Gypsum. *See* Canadian Gypsum Co.
Limestone 64
Hagersville Contracting Co. 63
Hagersville Quarries, Ltd. 64
Haight, Ingersoll E. 93
Haight, J. C. 109
Haileybury.
Limestone quarries 64
Prospectors' classes at 175
Haines, G. S. 86
Haire, H. J. 155
Haire, R. E. 155
Halcrow tp.
Gold mg. *See* Halcrow-Swayze Mines.
Halcrow-Swayze Mines, Ltd.
Capital; officers; operations 98
Mill, capacity 8
Mine manager and address 55
Haldimand co.
See also Decewsville; Oneida, Seneca, Walpole tps.
Natural gas 33
Haldimand Quarries and Construction, Ltd. 54
Haliburton, limestone 63
Haliburton co.
See Cardiff tp.; Haliburton.
PAGE
Halite. *See* Salt.
Hall, J. B. 65
Halladay, Reginald 159
Halliday, Fred. 64
Halton co.
See also Esquesing, Nassagaweya tps.
Sandstone quarries 65
Hamilton.
Iron industry 27, 28, 58
Lime plant 63
Hamilton, F. H. 69
Hamilton, Patrick 88
Hammell, Mrs. Eola 135
Hammell, J. E. 103, 155
Hamrick, F. G. 147
Hannam, A. V. 55, 96
Harbour Brick Co. 66
Hard Rock Gold Mines, Ltd.
Capital; officers; operations 98, 99
Incorporated 45
Mine manager and address 55
Hard Rock Syndicate 99
Hardy, J. Gordon 156
Hargreaves, Eric 54, 71
Hargreaves Kirkland Gold Mines, Ltd., Ed. *See* Ed. Hargreaves Kirkland Gold Mines.
Harker tp.
Gold mg. *See* Teddy Bear Valley Mines.
Harkness, J. G. 57, 137
Harkness, R. B.
See Natural Gas Commissioner.
Harkness-Hays Gold Mines, Ltd.
Capital; officers; operations 99
Incorporated 45
Mine manager and address 55
Harkness-Hays Gold Mining Co., Ltd. 99
Harlake Gold Mines, Ltd. 45
Harris, G. H. 89
Harris, P. J. 55
Harris, Sam. 94
Harrison and Co., Ltd., W. F. 45
Hart, R. S. 67
Harwood Lake Mines, Ltd. 45
Hastings co.
See also Actinolite; Huntingdon, Madoc, Marmora, Rawdon, Thurlow, Tudor tps.
Gold (1866-1909) 9
Hattie, Alex. 57, 135
Hawkesbury, limestone quarry near 64
Hawkins, J. J. 86
Hayden, Charles 158, 159
Hayden gold m.
See also Naybob Gold Mines.
Manager and address 56
Mill, capacity 8
treats ore from De Santis g. m. 13, 89
Operations 129
Production 13
Hayden Gold Mines, Ltd. 129
See also Hayden g. m.
Haydite.
Production and value 2, 3, 41
for cement products 38
Headlight gold m.
Manager and address 57
Work suspended 139
Hearst tp.
Gold mg. *See* Martin Bird Synd.

PAGE
Heavy clay products 41
Heidenreich, L. H. 124
Heinze shaft. *See* Paymaster gold m.
Henderson talc m. 62, 165
Hendricks, Robert J. 57, 131
Hendry, F. W. 68
Henniger, M. G. 64
Henning, C. F. 154
Henry, R. J. 57, 145
Henvey tp., feldspar 60
Hepburn, B. R. 105
Herbert, A. L. 73
Hershman, Charles L. 54, 56, 76, 125
Hervey, Brig.-Gen. C. L. 96
Hespeler, lime plant 63, 155
Hetherington, J. R. 114
Heyson tp. *See* Howey g. m.
Higgins, W. J. 58, 165
High Falls 159
Highways, increase in construction 40
Highways, Dept. of.
See Dept. of Highways.
Hilder deposit (fire-clay) 40
Hill, H. 63
Hillsborough, N. B., gypsum 155
Hillside Gold Mines, Ltd.
Capital; officers; operations 99
Incorporated 45
Mine manager and address 55
Hinde, James H. 66
Hinde Bros. 66
Hislop gold m. 55
Employees 101
Operations 102
Hislop tp.
Gold mg. *See also* Hislop g. m.
by McIntyre Porcupine 118
Hitchcock, C. H. 74
Hocken, W. V. 57, 136
Hodgetts, A. W. 133
Hodgson, J. C. 85
Hoffmann, C. Ellwood 147
Hogarth, D. M. 83, 139
Holden, John B. 100
Holland, H. E. 50
Hollinger, J. J. 56, 131
Hollinger gold m.
See also Hollinger Consol. Gold Mines.
Fire, underground 173
Manager and address 55
Mill, capacity 8, 102
Operations 101-103
Production 10, 12
Hollinger Consolidated Gold Mines, Ltd.
See also Hollinger g. m.; Young-Davidson g. m.
Capital; officers; financial statement. 100
Dividends 15, 16
Mines owned and under option 55
Profit tax 51
Hollinger Gold Mines, Ltd. 15
Hollow building blocks 38
Holloway tp.
Gold mg. *See* Teddy Bear Valley Mines.
Holt, Sir Herbert 85
Honsberger, A. H. 151
Hood, W. C. 139
Hook, O. M. 60
Hoover, W. J. 57, 141
Hore, R. E. 86
PAGE
Horne, Frank E. 93
Horne, William 65
Horseshoe Mines, Ltd.
Capital; officers; operations 103
Mine manager and address 55
Horton tp.
Limestone. *See* Renfrew.
Horwood, Eric 92
Hotchkin, M. W. 57, 127, 147
Hough, Ira E. 137
Howard Holdings, Ltd. 43
Howe, J. P. 64
Howells, E. M. 114
Howes, G. A. 116
Howey, M. R. 150
Howey gold m.
See also Howey Gold Mines.
Manager and address 55
Mill, capacity 8
Operations 103-105
Production 11
Howey Gold Mines, Ltd.
See also Howey g. m.
Capital; officers 103
Dividends 15, 16
Financial statement 104, 105
Profit tax 51
Howry Creek area.
See Bousquet Gold Mines.
H. R. 944, 1,001-02 gold claims.
See Delnite Mines.
Huddlestone and Cline, gold production 13
Hudson.
Route from to Pickle L.-Crow R. area 134
Hudson Bay silver m. 19
Hudson Bay Mines, Ltd., dividends ... 22
Hudson Patricia Gold Mines, Ltd.
Capital; officers; operations 105, 106
Incorporated 45
Mine manager and address 55
Huff, W. C. 154
Hughes, G. B. 150
Hughes gold m., production (1926) 13
Humberstone tp. *See* Port Colborne.
Hummel, Wm. L. 61
Hunt, Jessie L. 97
Hunt, Melvin G. 97
Hunter, J. 64
Huntingdon tp. *See* Fuller; Henderson talc m.
Huntington, W. Va., nickel mill 159
Hurd, Ralph 56, 108
Hurd, W. E. 124
Huron co. *See* Goderich.
Huronian Mining and Finance Co. 69
Hurst, M. E. 83, 136
Hussey, W. J. 123
Hutchinson, F. L. 68
Hutchinson, R. A. 68
Huycke, F. G. 142
H. W. 416 gold claim. *See* Sakoose Gold Mines.
Hybla.
Feldspar 60
Quartz 61
Hyde, B. S. 60
Hydrated lime.
Plants listed 62, 63
Production and value 2, 3, 39
Hydro-electric plants.
Owned by Internat. Nickel Co. 159

I

PAGE

Imperial Oil Refineries, Ltd. 34
Ince, Geo. H. 55, 106, 107
Incorporations of mg. companies 41-47
Industrial conditions improved 1, 30
Industrial construction contracts.
  Value of 36
Inez, Ltd. 43
Infection, incidence of 171
Infusorial earth.
  See Diatomite.
Ingham, Clark L. 87, 142
Inglis, M. O. 148
Ingram, J. 69, 128, 135
Inksater, Jas. R. 155
Innerkip Lime and Stone Co. 63
Innerkip Quarries, Ltd. 64
Insecticides. *See* Arsenic.
Inspectors of Mines.
  Reports on Mines of Ontario 67-167
  Reports on Mining Accidents 168-174
Inspiration Gold Mines, Ltd. 69
Interlac Gold, Ltd. 45
International Nickel Co.
  Dividends (1906-1928) 26
International Nickel Co. of Can., Ltd.
  Dividends 26, 27
  Mines, managers and addresses 58
  Operations 24-26, 158-161
  Ore reserves 161
  Profit tax 51
  Rare metals, production 26
  Refineries.
    see also Ontario Refining Co.
    Port Colborne 24-26, 58, 159-161
  Smelters.
    Coniston 24, 59, 160
    Copper Cliff 24, 59, 160
Iona, petroleum 34
Iona, N. S., gypsum mill 155
Iridium, production 26
Iron and steel industry 27, 28
  Blast furnaces 28, 58, 165
  Lime consumption 39
  Statistics 4, 5, 27, 28
Iron pyrites.
  Industry and statistics 3, 32
  Mine and manager 60
Irvine Co., Ltd., Edgar 64
Irwin and Co., Ltd., William 44

J

Jackpine-Sturgeon Gold Synd., Ltd. 43
Jackson-Manion gold m.
  See also J-M Consolidated Mines.
  Manager and address 55
  Mill, capacity 8
  Operations 106
Jackson Manion Mines, Ltd.
  See J-M Consolidated Mines.
James, E. S. 165
James Kirkland Mines, Ltd. 45
Jamieson, A. 114
Jamieson, J. A. 63
Jamieson Lime Co. 63
Jaquays, H. M. 167
Jardine, Hugh 54, 77, 128
Jaroba Sturgeon Gold Mines, Ltd. 45
Jellicoe Gold Mining Co., Ltd. 45

PAGE

J-M Consolidated Mines, Ltd.
  See also Jackson-Manion g. m.
  Capital; officers; operations 106
  Mill, capacity 8
  Production 11
Johnson, H. 107
Johnson, Thos. 148
Johnston, Albert W. 145
Johnston, Robert 113
Johnston, Strachan 117
Joliette, Que., lime plant 155
Jomac Gold Syndicate, Ltd. 43
Jones, John G. 129
Jones Porter gold m.
  Manager and address 54
  Operations 83
Jones Porter Mines, Ltd. 83
Jordan, E. 58, 166
Joseph, Henry 85
Jowsey, R. J. 124, 141
Joynt, George 156
Jubilee gold m.
  See also Minto Gold Mines.
  Manager and address 56
  Operations 128
Jupp Construction Co., A. E. 66

K

Kaplan, Max 94
Kapuskasing.
  Classes for prospectors 175
Karl Springer Exploration Co., Ltd. 43
Kashabowie. *See* Moss g. m.
Kawinogan Gold, Ltd. 43
Keeley, E. C. 67, 168
Keeley silver m. 69
Keeley Extension silver m. 69
Keeley Silver Mines, Ltd. 69
  Dividends 22
Kelly-Evans, A. *See* Evans, A. Kelly.
Kemp, C. H. 96
Kendall, M. 131
Kendall, W. B. 103
Kendrick, H. 77
Kennedy, A. C. 83
Kennedy, C. S. 77
Kennedy, H. G. 58, 164
Kennedy, Wm., and Sons, Ltd. 27
Kennett, R. J. 93
Kenning, A. F. 93
Kenogami lake.
  Gold mg. *See* Four Nations Consol. Gold Mines.
Kenogamisis Gold Mines, Ltd. 43
Kenora, classes for prospectors 175
Kenora district.
  See also Patricia portion.
  Gold mg. *See* Dyment; Lake of the Woods area; Straw l.
  Mining lands, sales and leases 48
Kenora mining div., recorder's rept. 49, 50
Kenora Prospectors and Miners, Ltd.
  Capital; officers; operations 106, 107
  Mine managers and addresses 55
Kent, W. C. 61
Kent co.
  See Bothwell oil field; Chatham; Dover tp.; Thamesville; Tilbury E. tp.; Wallaceburg.

PAGE
Kenty Brothers. *See* Brennan and Kenty Bros. Prospecting Co.
Kenty Gold Mines, Ltd. 56
Capital; officers; operations 107, 108
Kerr, Benjamin, Jr. 97
Kerr Lake Mines, Ltd. 23
Kerr Lake Mining Co., Ltd., dividends 22
Kerswill, E. J. 141
Kert-MacDonald Red Lake Gold Mines, Ltd. 45
Key Properties, Ltd. 43
Keyroc Gold Mining Co., Ltd. 45
Kidder, S. J. 58, 161
Killarney, quartzite quarry 61
Killeen, Kevin 108
Killer, Fred 94
Killoran-Horne Mines, Ltd. 45
Kincardine, salt 62
Kincardine Salt, Ltd. 35, 62
Kinch, Wm. H. 93
Kinghorn Sturgeon Mines, Ltd. 45
Kingsland, N. W. 122
Kingston.
Feldspar plant 31, 60
Penitentiary, limestone quarry 64
Kingston tp. *See* Kingston.
Kinkel, Edward G. 74, 124
Kinkel, Revere P. 73, 74, 125
Kinsella, Nicholas 86
Kirby Co., The T. Sidney 64
Kirkfield Crushed Stone, Ltd. 64
Kirkland Consolidated Mines, Ltd.
Capital; officers; operations 108
Incorporated 45
Mine manager and address 56
Kirkland Divide Gold Mines, Ltd. 148
Kirkland Gateway gold m.
Mill, capacity 8
Production 14
Kirkland Gateway Gold Mines, Ltd. 96
Kirkland Gold Belt Mines, Ltd.
Capital; officers; operations 108
Mill, capacity 8
Mine manager and address 56
Kirkland Lake.
See also Kirkland Lake gold area.
Classes for prospectors 175
Kirkland Lake gold area.
Dividends 16
Exchange equalization 10, 11, 18
Gold production 9, 11
and silver 10, 11, 14
Labour statistics 9
Mills, capacity 8
Mines.
see also Lebel, Teck tps.
producing 7, 10
Ore, average value 7
Kirkland Lake gold m.
See also Kirkland Lake Gold Mg. Co.
Manager and address 55
Mill, capacity 8
Operations 109
Production 10, 14, 109
Kirkland Lake Gold Mining Co., Ltd.
See also Kirkland Lake g. m.
Capital; officers 108, 109
Dividends 15, 16
Profit tax 51
Kirkland Securities, Ltd. 110
Kirkpatrick, G. C. 116
PAGE
Kirkpatrick, S. F. 166
Kirmaque Gold Mines, Ltd. 45
Kitchen, J. H. 70
Kitchigami gold m. *See* Centennial Gold Mines.
Kitley tp., limestone 64
K. L. Exploration Co., Ltd. 43
Knapp, E. B. 114
Knode, O. M. 155
Knott, C. G. 154
Knox, John 55, 100
Knox, John, Jr. 56, 128
Knox, Marion E. 128
Knox, W. R. 67, 82
Knox Sturgeon River Mines, Ltd. 43
Knutson, Fred 89
Knutson, Martin O. 76, 93
Knutson, Oscar 54, 73
Kobler, Henry 74, 125
Koch Daneff Gold Mines, Ltd. 43
Koons, Edward L. 87, 142
Korson, Harry 73
Kowkash area.
Gold mg. *See* New York Porcupine g.m.; Tom Johnson–Nipigon Mines.
Kowkash mining div., recorder's rept. 49, 50
Koza, Harry 73
Kozak gold m. 56
Operations 131
Kozak Gold Mines, Ltd. 46
Kranenberg, G. H. 155
K. R. L. 9,681 gold claim 77
See also Casey Summit g. m.

L

Labour statistics 2
Cement 2, 38
Chromite; clay products 2
Diamond-drilling 5
Feldspar; fluorspar 2
Gold 2, 7, 9
Graphite 2
Gypsum 2, 32
Lime 2, 39
Mica; natural gas 2
Nickel-copper mines, smelters and refineries 2, 24, 25
Petroleum, crude; quartz and quartzite 2
Salt 2, 35
Silica brick 2
Silver-cobalt mines, smelters and refineries 2
Structural materials 2
Talc 2, 35
Wages index, building trades 36
Lac Development, Ltd. 46
Lac-Teck Gold Mines, Ltd. 43
Ladoucer, A. A. 83
La Fond Gold Mines, Ltd. 43
Lafontaine, A. 131
Laird, H. W. 69
"Lake" iron ore imported 4
Lake Caswell Mines, Ltd.
Capital; officers; operations 109, 110
Incorporated 46
Mine manager and address 56
Lake Erie, sand and gravel dredging 66
Lake Huron.
Quartzite quarry 61

PAGE

Lake Nipigon
Prospecting activity east of 1, 7
see also Little Long Lac, Sturgeon R. g. areas.
Lake of the Woods area.
Gold mg. *See* Regina g. m.; Shoal l.; Sultana g. m.; Witch bay.
Revival of mg..... 1
Lake Rowan Gold Mines, Ltd..... 42
Lake St. John Co., Ltd..... 46
Lake St. John Quarry Co., Ltd..... 64
Lake Shore gold m.
See also Lake Shore Mines.
Manager and address..... 56
Mill, capacity..... 8
Operations.....110-113
Production.....10, 14
Lake Shore Mines, Ltd.
See also Lake Shore g. m.
Capital; officers..... 110
Dividends.....15, 16
Profit tax..... 51
Lake Superior.
Sand and gravel dredging..... 66
Silver. *See* Silver islet.
Lakefield, cement plant.....37, 62
Lakeland Gold, Ltd.
Capital; officers; operations..... 113
Incorporated..... 46
Mill, capacity..... 8
Mine manager and address..... 56
Lakeside-Kirkland Gold Mines, Ltd.
Capital; officers; operations.....113, 114
Mine manager and address..... 56
Lambton co.
See also Brooke, Dawn, Enniskillen, Moore, Plympton, Sarnia tps.
Salt..... 35
Lamport, W. A..... 103
Lanark co.
See Bathurst, N. Burgess, Ramsay tps.
Land sales. *See* Mining lands.
Lang, H. H..... 87
Langford, Richard W..... 108
Langmuir Longlac Gold Mines, Ltd... 46
Langton, Thos..... 63
Lapa Cadillac Gold Mines, Ltd..... 46
La Palme Porcupine Mines Co..... 131
Larder Lake mining div.
Recorder's report.....49, 50
Larkin, Ida..... 97
La Roche gold m.
See also Delnite Mines.
Mine manager and address..... 55
Operations.....87, 88
La Roche Mines, Ltd..... 87
La Rose Mines, Ltd., dividends..... 22
Lash, John F..... 145
Laundry tubs, cement..... 38
Lauper, R. A..... 63
Lavallee, P. A..... 105
Laverty, W. H..... 141
Law, R. E..... 65
Law Construction Co..... 64
Lawrence, Frederick..... 68
Lawton, N. O.....54, 71
Layden, L. J..... 110
L. B. United Mines, Ltd..... 46
Lead.
Production and value.....2, 3, 5
from silver ores..... 21

PAGE

Leader Gold Mines, Ltd..... 46
Leasa, Wm..... 61
Leases, mining, statistics..... 48
Lebel tp.
Gold mg. *See* Bidgood g. m.; Ed. Hargreaves Kirkland Gold Mines; Kirkland Gold Belt Mines; Lakeside-Kirkland Gold Mines; Moffatt-Hall g. m.
Lebel Oro Mines, Ltd..... 56
See also Long Lake g. m.
Capital; officers; operations..... 114
Le Brocq, S. E..... 167
Lee A. J..... 61
Lee, Dwight B..... 89
Lee, W. W., and Son..... 61
Lee Gold Mines, Ltd..... 56
Capital; officers; operations..... 114
Leeds co.
See also Delta; Kitley tp.
Granite quarry..... 65
Legate, J. H..... 63
Lemmen, H..... 86
Lennox and Addington co.
Limestone. *See* Centreville.
Leo, Clarence..... 125
Le Pard, Sherman J..... 129
Leslie, Norval..... 78
Le Sueur, R. V..... 109
Letters, mining divisions..... 49
Lewis, W. H..... 78
Ley, William..... 53
Licenses.
Of occupation..... 48
Miners'.....48-51
Sand and gravel..... 48
Lieberman, D..... 82
Lightball, W. S..... 136
Lillico, L. A..... 128
Lillico, R. L..... 145
Lime.
For coking industry..... 29
Industry and statistics.....2, 3, 38, 39
Operators listed.....62, 63
Limehouse, lime..... 63, 155
Limestone.
Operators listed..... 63-65
Statistics.....2, 3, 40
flux..... 27
Limestone Products Co..... 64
Lincoln co. *See* Niagara tp.
Lindsay, J. A..... 145
Lindsley, Halstead.....83, 139, 156, 162
Lindsley, I. A..... 106
Lindsley, Thayer. 83, 85, 92, 106, 115, 127, 156
Lionite Abrasives, Ltd..... 27
Little Long Lac area.
Gold mg. *See* Bankfield Gold Mines; Hard Rock Gold Mines; Little Long Lac g. m.; MacLeod-Cockshutt Gold Mines; Roche Long Lac Gold Mines; Wells Longlac Mines.
Little Long Lac gold m.
See also Little Long Lac Gold Mines.
Manager and address..... 56
Mill, capacity..... 8
Operations..... 115
Production..... 11
Little Long Lac Gold Mines, Ltd.
See also Little Long Lac g. m.
Capital; officers.....114, 115

PAGE
Little Turtle lake.
Gold mg. *See* Saundary Synd.
Livermore, R. 139
Load-bearing tile, production 41
Lochalsh. *See* Gold Lands Synd.
Loesch, Gustave R. 74, 125
Logan, Harry 65
Lois Lake Gold Mines, Ltd. 46
London, Eng.
Canadian gold marketed in 17
Long Lac Inlet Mines, Ltd. 43
Long Lake gold m.
See also Lebel Oro Mines.
Mill, proposed 8
Operations 114
Production 11
Longacre Long Lac Gold Mines, Ltd. 46
Longlac Adair Mines, Ltd. 46
Longlac Lagoon Gold Mines, Ltd. 46
Longwell, Alexander 83, 165
Lorrain Trout Lake Mines, Ltd.
Dividends 22
Lough, D. 127
Loughborough Mining Co., Ltd. 61
Lucky Cross gold m.
See also Golden Gate Mg. Co.; Lucky Cross Leasing Synd.
Mill, capacity 8
Operations 96
Production 14
Lucky Cross Leasing Syndicate 56
See also Lucky Cross g. m.
Capital; officers; operations 115, 116
Lucky Kirkland Gold Mines, Ltd.
Capital; officers; operations 116
Incorporated 46
Mine manager and address 56
Ludwig, M. H. 165
Lumbers, J. H. 103
Lymburner, L. C. 64
Lythmore. *See* Gypsum, Lime and Alabastine, Canada.

M

Mabou, N. S., limestone quarry 155
MacAlpine, C. D. H. 72, 82, 139
McAndrew, J. A. 67
Macandrew Red Lake Gold Mines, Ltd. 46
McArthur, T. A. 50
Macartney, C. G. 136
MacAskill, Donald 161
Macassa gold m.
Manager and address 56
Mill, capacity 8
Operations 116, 117
Production 10, 14, 116
Underground connection Kirkland Lake g. m. 109
Macassa Mines, Ltd.
See also Macassa g. m.
Capital; officers 116
Dividends 15, 16
McAuley, N. J. 50
Macauley, R. M. 131
McCandless, George F. 161
McCarthy-Webb gold m.
See also Algoma Summit Gold Mines.
Manager and address 54
McCarthy-Webb-Goudreau Mines, Ltd. 68
McClelland, H. L. 82, 161
PAGE
McClintock, W. 142
McCloskey, H. C. 82, 103, 146
McConnell, J. E. 155
McConnell, J. W. 159
McCracken, E. C. 149
McCurdy, R. S. 155
McDonald, Cameron 139
Macdonald, L. A. 115
MacDonald, P. 60, 61
Macdonald, Peter 59
MacDonald, S. L. 56, 116
MacDonnell, Angus 156
McDonough, W. J. 137
McDougald, W. L. 100
McDougall, Maj.-Gen. Alex. 93
McDougall, D. H. 117
McDougall tp., granite quarry 65
McEachern, W. T. 139
McFarlane, F. J. 140
MacFarlane Long Lac Gold Mines, Ltd. 46
MacFetridge, C. K. 62, 63
McGowan, Sir Harry 159
McGregor, C. F. 50
McGregor, J. G. 56, 124
McGrory, D. 139
McHarg, Norrie and 65
Machin, I. M. 106
McInerney, J. J. 70
McInnes, J. A. 83
McIntyre, Hugh 145
McIntyre Birch Lake gold m. 55, 86
McIntyre-Porcupine gold m.
See also McIntyre-Porcupine Mines.
Manager and address 56
Mill, capacity 8
Operations 118-121
Production 10, 12, 118
McIntyre-Porcupine Mines, Ltd.
See also McIntyre-Porcupine g. m.
Capital; officers 117
Dividends 15, 16
Profit tax 51
Macjoe Sturgeon Gold Mines, Ltd. 46
McKay, F. M. 154
McKay, J. Albert 135
McKee, Geo. M. 132
McKellar-Longworth gold m.
See also North Shores Gold Mines.
Mill, capacity 8
McKenna, D. 86
McKenzie, J. W. 54, 72
McKenzie gold claims.
Operations 85
Optioned to Consol. Mg. and Smelting Co. 55, 85
McKenzie is., Red l.
Gold mg. *See* Gold Eagle Gold Mines; Martin-McNeeley g. m.
McKenzie Red Lake Gold Mines, Ltd.
Capital; officers; operations 121, 122
Mill, proposed, capacity 8
Mine manager and address 56
Mackey Point g. m.
Operations 85
Optioned to Consol. Mg. and Smelting Co. 55, 85
McKim tp. *See* Frood nickel m.
McKinley-Darragh-Savage silver m. 19
See also Cobalt Properties.
McKinley-Darragh-Savage Mines of Cobalt, Ltd., dividends 22

PAGE

McKinnon, Donald 72
McKinnon tp.
Gold mg. *See* Bob Tough Gold Mines.
Mackle, W. F. 122
Macklem, F. P. 59
Macklem tp.
Gold mg. *See* Porcupine Peninsular Gold Mines.
McKnight, Wesley 68
McLaren, G. R. 134
McLaren, J. M. 122
Gold production 10
McLaren, Robt. D. 122
McLaren, W. M. 122
McLaren-Porcupine Gold Mines, Ltd.
Capital; officers; operations 122
Incorporated 43
Mill, capacity 8
Mine manager and address 56
Production 10, 14
McLaughlin, G. 140
McLaughlin, R. S. 85, 159
McLean, A. B., and Sons 66
McLean, B. L. 76
McLean, Colin M. 154
McLean Building Review 36
McLean Gold Mines, Ltd. 133
MacLeish, J. E. 155
McLellan, Donald 68
MacLeod, F. G. 122
MacLeod-Cockshutt Gold Mines, Ltd.
Capital; officers; operations 122, 123
Mine manager and address 56
McMartin, Allen A. 100
McMartin, J. Bruce 56, 123
See also Dikdik g. m.
McMaster, R. H. 159, 167
McMillan, E. V. 99
McMillan, G. E. 99
McMillan Gold Mines, Ltd.
Capital; officers; operations 123, 124
Mill, capacity 8
Mine manager and address 56
Production 11
Macmurchy tp.
Gold mg. *See* Neville Canadian Gold Mines; Westree g. m.
McNab, A. J. 93
McNeil Longlac Gold Mines, Ltd. 43
McNeill, W. K.
Report by, on Assay Offices 52, 53
McPherson, W. B. 74, 76, 98, 114
McQuaig Red Lake Gold Mines, Ltd. 46
McRae, W. L. 64
McSherry, George 127
MacVichie, J. A. 55, 92
McVittie tp.
Gold mg. *See* Kirkland Consol. Mines.
McWatters Gold Mines, Ltd. 69
Madoc.
Limestone quarry 64
Talc mg. 35, 62
Madoc tp.
See also Madoc.
Fluorspar 32, 60
Slate quarry 40, 65
Magnet Lake area.
Gold mg. *See* Bankfield Gold Mines; Wells Longlac Mines.
Magnet Lake Gold Mines, Ltd. 46

PAGE

Maguire, W. S. 88
Magwell Long Lac Gold Mines, Ltd. 46
Mahood and Co., Ltd., Grant 46
Maisonville tp.
Gold mg. *See* Golden Summit Mines; Lakeland Gold, Ltd.
Malahide tp., sand and gravel 66
Malden tp. *See* Amherstburg.
Maloney, M. J. 139
Manganese ferro-alloys 28
Manitario Investments & Exploration, Ltd. 46
Manitoba.
See also Winnipeg.
Diamond-drilling 5, 6
Gypsum quarry 155
Manitoba and Eastern Mines, Ltd. 56
Capital; officers; operations 124
Incorporated 42
Manitou Gold, Ltd. 46
Manitoulin dist. *See* Killarney.
Manley Gold Mines, Ltd. 46
Manley Quebec Gold Mines, Ltd. 46
Maple Leaf Mines, Ltd.
Option on Casey Summit g. m. 77
Maple Mountain s. area.
Production (1909-30) 20
Maps revenue from sale of 48, 50
Marble.
See also Limestone.
Operators listed 63, 65
Statistics 40
Marbuan gold m.
See also Marbuan Gold Mines; March g. m.
Mill, capacity 8
operated by Buffalo Ankerite 12
Production 10, 12
Marbuan Gold Mines, Ltd.
See also Marbuan g. m.
Officers; capital; operations 124-126
March gold m.
See also Marbuan g. m.; March Gold, Ltd.
Manager and address 56
Production 12
March Gold, Ltd.
See also Marbuan Gold Mines; March g. m.
Taken over by Marbuan Gold Mines 125
Marcy, William L. 87, 142
Marcy, William L., Jr. 95
Margo Mines, Ltd. 43
Markus quarry 64
Marmora, classes for prospectors 175
Marmora tp.
See also Deloro.
Limestone 63
Marth, J. J. 68
Martin, A. G. 61
Martin, C. H. 142
Martin, Ernest 110
Martin, George.
Operations: Crown Reserve s. m. 162
Martin, Henry 151
Martin, J. 127
Martin, R. 123
Martin Bird Syndicate.
Mine manager and address 56
Officers; operations 127
Prosecution 174

PAGE
Martin-McNeeley gold m.
See also McKenzie Red Lake Gold Mines.
Mine manager and address..... 56
Operations.....121, 122
Martin's Siding, diatomite..... 59
Mason, Bruce..... 113
Matachewan gold area.
Exchange equalization.....10, 11
Mills, capacity..... 8
Mines..... 7, 10
see also Bannockburn, Cairo, Powell tps.
Ore, average value..... 7
Production.....10, 11, 14
Matachewan Canadian Gold, Ltd..... 127
Matachewan Consolidated gold m.
Manager and address..... 56
Mill capacity..... 8
Operations..... 127
Production.....10, 14
Matachewan Consolidated Mines, Ltd.
See also Matachewan Consol. g. m.
Capital; officers..... 127
Mat-a-Lac Gold Syndicate, Ltd..... 43
Matheson, Dr. J. J..... 97
Matheson District Gold Mines, Ltd... 46
Mattagami r., fire clay.....40, 41
Matthews, A. C..... 109
Matthews, W. J..... 92
Maulson, Frank E..... 89
Maw, F. J..... 67
May-Spiers Gold Mines, Ltd..... 46
Medonte tp., limestone..... 63
Meech, R. G..... 145
Meen, W..... 131
Mein, Wm. W..... 159
Melchett, Rt. Hon. Lord..... 159
Melkman, A. C.....57, 149
Merica, Paul D.....158, 159
Merrick, J. G.....67, 82
Metal mines.
See also next ref.
Dividends paid..... 5
Metallic minerals.
Industry and statistics..... 1-30
production and value..... 2-5
increase..... 1
Mines.
listed..... 54-58
reports. *See* Cobalt (mineral); Chromite; Copper; Gold; Molybdenite; Nickel; Radium; Silver.
Metallurgical works.
See also Refineries; Smelters.
Accidents in.....168-174
Lime consumption..... 39
Listed.....58, 59
Operations.....165-167
Metals Development Co., Ltd..... 105
Methuen tp.
Nepheline syenite.....31, 61
Trap quarry..... 65
Mexico.
Gold production (1930-1934)..... 18
Mica.
Industry and statistics.....2, 3, 33
Mines and managers listed..... 61
Michael-Boyle g. m..... 56
Operations..... 131
Michie, A..... 63
PAGE
Michipicoten gold area.
Gold mg. *See also* Township 29, ranges 22 and 23.
Mills, capacity..... 8
Michipicoten Gold Mines, Ltd..... 46
Middle Bay Mines, Ltd..... 46
Middlesex co. *See* Mosa tp.
Middleton, J. N..... 64
Mid-Tyrrell Gold, Ltd..... 46
Mikado gold m.
Manager and address..... 55
Operations..... 107
Miles, C. H..... 141
Mill lake, McDougall tp.
Granite quarry..... 65
Millar Mineral Exploration Co., Ltd... 46
Miller, A. R..... 70
Miller, Edward Lang..... 151
Miller, G. M..... 123
Miller, George C.....89, 145
Miller, Gerard F..... 151
Miller, H. C..... 96
Miller, M. M..... 63
Miller, R. E..... 114
Miller, Theodore G..... 97
Miller, W. N..... 50
Miller Independence Mines (1924), Ltd. 56
Capital; officers; operations..... 127
Miller Lake O'Brien silver m.
See also O'Brien, M. J., Ltd.
Manager and address..... 58
Operations..... 164
Profit tax..... 51
Millerton Gold Mines, Ltd..... 15
Millman, H. A..... 71
Millward, M. F.....109, 110
Milne, G. F..... 129
Milton, lime plant.....63, 155
Mine rentals, revenue..... 48
Mine Centre.
Gold mg. *See* Foley Synd.; Golden Star g. m.; Saundary Synd.; South Vermillion Gold Mines; Stagee g. m.; Stellar Gold Mines.
Mine Seekers and Developers, Ltd..... 46
Minefinders, Ltd.
Fire-clay deposits.....40, 41
Minemakers, Ltd..... 43
Mineral industry.
Production and value..... 1-5
metallic, increase in value..... 1
Review, statistical, by A. C. Young. 1-53
Mineral oil.
See Petroleum.
Mineral waters.
Industry and statistics.....2, 3, 33
Springs and managers listed..... 61
Miners' licenses and permits.
Statistics..... 48-51
Mines Department, Ontario, created... 4
Mines of Ontario.
Listed, and managers..... 54-58
Reports on, by Inspectors of Mines..67-167
Mining accidents, rept. on.....168-174
Mining claims, statistics.....6, 48, 51
Mining company incorporations..... 41-47
Mining divisions.
Claims recorded in.....49, 50
Revenue derived from.....49, 50
Summary of business transacted.... 49
Mining expenditure..... 48

PAGE

Mining lands.
Leases, statistics....48, 49
Sales, statistics....48-51
Mining recorders.
Mining land sales.... 48
Statement of monies remitted.... 50
Mining revenue and expenditure....48-51
Mining Act of Ontario.... 52
Prosecutions under.... 174
Mining Claims Mart, Ltd.... 43
Mining Corporation of Canada.
See also Ashley g. m.; Cobalt Properties; Smith Cobalt Mines.
Dividends....22, 23
Operations....19, 162, 164
Profit tax.... 51
Mining Court, appeals to.... 49
Mining Tax Act.... 51
Minnesota, U.S., iron ore imported from 4
Mint, Royal Canadian.... 17
Mint Ore Mines, Ltd.
See J-M Consol. Mines.
Minto gold m.
See also Minto Gold Mines
Manager and address.... 56
Mill, capacity.... 8
Operations.... 128
Production.... 11
Minto Gold Mines, Ltd.
See also Minto g. m.
Anglo-Huronian interest.... 69
Capital; officers; operations....127, 128
Misener, Scott.... 67
Mispickel. *See* Arsenic.
Missinaibi r., fire clay.... 40
Mitchell, H. K.... 149
Mitchell, R. F....54, 68, 82
M. J. O'Brien, Ltd. *See* O'Brien, M. J., Ltd.
Moffatt, L. R.... 128
Moffatt, T.... 64
Moffatt-Hall gold m.
Mine manager and address.... 54
Operations....73, 128
Production....10, 14
Moffatt-Hall Mines, Ltd.
See also Moffatt-Hall g. m.
Capital; officers.... 128
Molybdenite.
Mg. *See* Phoenix Molybdenite Corpn.
Production.... 3, 5
Monarch Mines, Ltd.... 46
Mond, Sir Robert L.... 159
Mond Nickel Co....26, 27
Monel metal.... 159
Monetary Metals, Ltd.... 46
Mongowin tp.
Gold mg. *See* Fox L. Gold Synd.; McMillan Gold Mines.
Montague, F. F.... 78
Montgomery, Jos....82, 129
Montgomery, R. J.... 66
Montreal, Que.
Gypsum plant.... 155
Pig iron, price.... 27
Montreal River mg. division.
Recorder's report....49, 50
Montreal River silver area.
Production (1909-1923).... 20
Montreal Trust Co.... 66
Moore, James.... 147

PAGE

Moore tp., petroleum.... 34
Mooshla Gold Mines, Ltd.... 46
Moot, Welles V....87, 142
Morden, W. S.... 165
Morin, D. M....72, 115
Morlock, W. S....115, 156
Morris, George W.... 108
Morris, Stanley.... 63
Morris Kirkland Mines, Ltd.... 108
Morrisette tp.
Gold mg. *See* Goodfish Mg. Co.
Morrison, J. W.... 156
Morrison, Thomas.... 159
Morrison, William....31, 61
Morse, Geo. F.... 64
Mortmain companies licensed.... 42
Mosa tp., petroleum.... 34
Mosher, I. E....55, 97
Mosher Long Lac Gold Mines, Ltd.... 46
Moss gold m.
See also Ardeen Gold Mines.
Manager and address.... 54
Mill, capacity.... 8
Operations.... 70
Production.... 11
Moss tp. *See* Moss g. m.
Moss Gold Mines, Ltd.... 70
See also Moss g. m.
Mott, R. C.... 156
Moulthorp, C.... 63
Mount Dennis, sand-lime brick.... 66
Mountain l., nepheline syenite.... 31
Moyle, H....58, 164
Mud Lake, Que.
McIntyre claims at.... 118
Mungovan, T. M....124, 129
Munro Croesus gold m.
See also Munro Croesus Mines.
Manager and address.... 56
Mill, capacity.... 8
Production....10, 13
Munro Croesus Mines, Ltd.
See also Munro Croesus g. m.
Capital; officers; operations.... 128
Muntz, E. P.... 156
Murdoch, G. C.... 83
Murdoch, James Y....100, 151
Murphy, Ambrose.... 162
Murr, Leon.... 73
Murray-Algoma Mg. Co., Ltd.... 43
Murwood Gold Mines, Ltd.... 46
Muskin, Sidney....57, 149
Muskoka district. *See* Martin's Siding.
Muskoka Diatomite, Ltd.... 59
Muskoka Falls, diatomite.... 59
Muton-Champagne Gold Mines, Ltd.... 46
Mutz, H. J.... 161

N

Nairn Falls.... 159
Nassagaweya tp.
Limestone quarry.... 64
Sandstone quarry.... 65
Nathanson, N. L.... 155
National Sand and Material Co.... 66
Natural gas.
Industry, notes by Commissioner.... 33
Production and value....2, 3, 33
increases.... 33
Revenue from leases and permits.... 48

PAGE
Natural Gas Commissioner....33, 48
Naybob Gold Mines, Ltd.
See also Hayden g. m.
Capital; officers; operations.... 129
Incorporated.... 46
Mine manager and address.... 56
Naylor, R. J....56, 129
Neda Gold Mines, Ltd.... 46
Neebing tp. *See* Fort William; Sault Ste. Marie.
Neelands, R. J.... 115
Neilly, Balmer.... 117
Nepean tp.
Limestone.... 64
Sand and gravel.... 66
Nepheline syenite....31, 61
Nepheline Co., Ltd.... 31
Incorporated....43, 46
Neswoba Mines, Ltd.... 46
Net Lake Timagami Mines, Ltd.... 46
Neukom, Geo.... 77
Neville Canadian Gold Mines, Ltd.... 56
Capital; officers; operations.... 129
Incorporated.... 43
New Goudreau Mines, Ltd.... 67
New Guinea, gold production.... 18
New York, U. S.
Funds, graph showing fluctuations in buying rate of.... 17
New York Porcupine gold m.
See also New York Porcupine Mines.
Manager and address.... 55
Operations.... 93
Production.... 13
New York Porcupine Mines, Ltd.
See also New York Porcupine g. m.
Acquired by Federated Mg. Corpn... 93
Ore treated by Buffalo Ankerite.... 12
New Zealand, gold production.... 18
Newall, H.... 66
Newfoundland South Coast Syndicate, Ltd.... 43
Newman, Harry A.... 137
Newray gold m., production (1917, 1918).... 12
Nezah Long Lac Gold Mines, Ltd.... 46
Niagara bar, sand and gravel.... 66
Niagara tp., limestone.... 63
Niagara Falls.
Chromite ore shipped to.... 67
Iron industry.... 27
Lime kilns.... 62
Niagara Falls, N. Y., ferro-chrome.... 29
Nichol tp. *See* Elora.
Nicholls, John C.... 158
Nichols, C. W.... 162
Nichols, Joseph.... 73
Nickel.
Industry and statistics....1-3, 5, 24-26
production and value....2, 3, 5, 24, 25
from silver ores.... 21
increase.... 1, 24
Mines.
see also Cuniptau Mines; Falconbridge Nickel Mines; Internat. Nickel Co. of Canada.
accidents in.... 168
dividends paid by....5, 25, 26
managers and addresses.... 58
profit tax.... 51
reports....156-161

PAGE
Nickel—*Continued*
Refineries.
see also Clydach; Norway; Port Colborne.
precious metals from....11, 25, 26
statistics....2, 24-26
Smelters. *See* Smelters.
Nickel Hill Syndicate.... 20
Nickel Holdings Corpn.... 26
Nicol tp.
Silver mg. *See* Miller Lake O'Brien s. m.
Nielsen, A. M.... 99
Night Hawk lake.
Gold mg. *See* Gold Island g. m.; Porcupine Peninsular g. m.
Night Hawk Lake Mining Co.... 135
Night Hawk Peninsular gold m.
Production (1924-1927).... 12
Night Hawk Peninsular Mines, Ltd.... 135
Nipigon, Lake, staking east of.... 1
Nipissing district
See also Sabine, Strathy tps.
Mining lands, leases and sales.... 48
Nipissing silver m.
See also Nipissing Mines Co.; Nipissing Mg. Co.
Manager and address.... 58
Production.... 163
Nipissing Mines Co., Ltd
See also Nipissing Mg. Co.
Capital; directors.... 162
Dividends.... 23
Nipissing Mining Co., Ltd.
See also Nipissing s. m.
Capital; directors.... 162
Dividends.... 23
Operations....162, 163
Nipsona Mines, Ltd....46, 148
Non-fatal accidents, details....171, 172
Non-metallic minerals.
Industry and statistics....2-4, 21, 30, 41
production and value....2-4, 21, 30
increase.... 1
Mines, quarries, and works.
see also Graphite; Gypsum; Talc.
listed.... 59-62
Noranda, Que.
See also Noranda Mines.
Ore shipped to, cobalt.... 19
gold.... 13
Noranda Mines, Ltd.
Limestone operators.... 64
Norbell Gold Mines, Ltd.... 46
Norco Thompson Mines, Ltd.... 46
Nordic Sturgeon Gold Mines, Ltd.... 46
Norfolk co. *See* Waterford.
Norontic Gold Mines, Ltd.... 46
Norrie and McHarg.... 65
North Bay, draughting office.... 53
North Burgess tp., barite.... 59
North Cayuga tp. *See* Decewsville.
North Oxford tp., limestone quarry.... 64
North Shores Gold Mines, Ltd.
Capital; officers; operations....129, 130
Mill, capacity.... 8
Mine manager and address.... 56
North Tiblemont Gold Mines, Ltd.... 46
North West Territories, diamond-drilling.... 6
North Whitney Gold Syndicate, Ltd.... 46

PAGE
Northcrown gold m.
Production (1920, 1921) 12
Northern Aerial Canada Golds, Ltd... 134
Northern Aerial Minerals Exploration, Ltd..... 135
Northern Development, Dept. of.
Road construction, Hudson..... 80
Sand and gravel production..... 39
Northern Empire Mines Co., Ltd.
Capital; officers; operations.....130, 131
Mill, capacity..... 8
Mine manager and address..... 56
Production..... 11
Northern Mining Syndicate, Ltd..... 43
Northern Quebec Prospectors, Ltd..... 46
Northern Turnbull gold m.
Mill, capacity..... 8
Production.....10, 13
Northway, John A..... 103
Northwestern Ontario.
See also Kenora dist.; Patricia portion; Rainy R., Thunder Bay dists.
Cobalt production..... 21
Gold mg..... 7
exchange equalization.....11, 18
labour statistics..... 9
ore, average value..... 7
production..... 9, 11
and silver..... 11
Norton, A. W..... 65
Norway.
Falconbridge nickel-copper refinery.. 158
Nova Scotia. *See* Deep Brook; Iona; Mabou; Windsor.
Nu Sigma Gold Syndicate, Ltd..... 43
Nugold Mines, Ltd..... 46

O

Oakes, Harry..... 110
Obonga Lake area.
Chromite mining.....29, 54, 67
O'Brien, C. J..... 133
O'Brien, J. A..... 166
O'Brien, M. J..... 166
O'Brien, M. J., Ltd.
See also Cross Lake s. m.; Miller Lake O'Brien s. m.; O'Brien s. m.
Operations.....163, 164
Profit tax..... 51
O'Brien silver m., profit tax..... 51
O'Connell, G. B..... 131
O'Connell Gold Mines, Ltd.
Capital; officers; operations..... 131
Mine manager and address..... 56
Occupation, licenses of..... 48
Oceania, gold production (1930-1934).. 18
O'Flynn, W. A.....58, 163
Ogden, P. W..... 145
Ogden tp.
Gold mg. *See* De Santis g. m.; Naybob Gold Mines.
Oil, for coking industry..... 29
Oil, mineral. *See* Petroleum.
Oil gas, for coking industry..... 29
Oil Springs, petroleum..... 34
Oklend Gold Mines, Ltd..... 43
Olds, R. E..... 77
O'Leary Malartic Mines, Ltd.
Optioned to McIntyre..... 118
Oliver, John T..... 95
PAGE
Oliver Severn Gold Mines, Ltd..... 43
O'Meara, Gerald D.....115, 127
Onakawana lignite field..... 40
Onaman Lake area.
Gold mg. *See* Tashota Goldfields.
Oneida tp. *See* Hagersville; Lythmore.
Onondaga tp., petroleum..... 34
Ontario co. *See* Whitby tp.
Ontario gold production, percentage of Canadian output..... 18
Ontario Chemical Minerals, Ltd..... 43
Ontario Department of Mines, created 4
Ontario Kirkland gold m.
Production (1922)..... 14
Ontario Refining Co., Ltd..... 2, 24
Manager and address..... 59
Operations.....160, 166
Ontario Reformatory, limestone quarry 64
Ontario Rock Co..... 65
Ontario Slate Mines, Ltd..... 40
Quarry..... 65
Orecana, Ltd..... 43
Orecana Trusts, Ltd.
Edwards g. m., option..... 96
Mines and address..... 56
Operations..... 131
O'Reilly, E. L..... 133
Orford process plant, Copper Cliff....24, 160
Orillia, iron industry..... 27
Orillia tp., limestone quarry..... 64
Ornamental brick, statistics.....2, 3, 41
Ornamental Stone Products..... 64
O'Rourke, M. F..... 50
Orser, Edward H.....57, 147
Orser, S. H..... 64
Orton, R. C..... 131
Osler, Britton..... 159
Osler, F. G..... 85
Osmium, production..... 26
Ottawa.
See also Royal Canadian Mint.
Classes for prospectors..... 175
Otter Lake Gold Syndicate, Ltd..... 46
Owen Sound.
Iron industry..... 27
Lime pit..... 63
Limestone quarry..... 64
Oxford co. *See* Beachville; N. Oxford tp.

P

Pa. 746-7 gold claims.
See Pickle Crow Gold Mines.
Pacaud tp.
Gold Mg. *See* Barry-Hollinger g. m.; Miller Independence Mines.
Pacitto, A.....57, 140
Pain, S. A.....96, 115
Painkiller Lake. *See* Blue Quartz g. m.
Palladium.
Production and value (1930-1934)... 26
Palmer, Chas..... 149
Palmer, R. N.....56, 129, 130
Pamour Porcupine Mines, Ltd.
Capital; officers; operations.....131, 132
Incorporated..... 42
Mine manager and address..... 56
Paper. *See* Pulp and paper industry.
Paris.
Alabastine plant..... 155
Sand and gravel..... 66

PAGE
Park, A. P. ... 59
Park, Hugh ... 58, 162
Parker, A. G. ... 69
Parker, R. D. ... 161
Parker, W. R. ... 137
Parkhill gold m.
Manager and address ... 56
Mill, capacity ... 8
Operations ... 132, 133
Production ... 11
Parkhill Gold Mines, Ltd.
See also Parkhill g. m.
Capital; officers ... 132
Profit tax ... 51
Parkinson, N. F. ... 156
Parmac Porcupine Mines, Ltd. ... 81
Parry Sound district. *See* Henvey, McDougall, Perry tps.
Parry Sound mg. division ... 50
Parsons, C. S. ... 78
Passon, F. M. ... 151
Patricia gold m.
See also Barry-Hollinger g. m.
Production (1918) ... 14
Patricia portion of Kenora.
Gold mg. *See* Bathurst Gold Mines; Casummit L. area; Central Patricia Gold Mines; Pickle Crow Gold Mines; Red Lake g. area; Vermilion Lake Gold Mines; Woman Lake area.
Mills, capacity ... 8
Mining lands, sales and leases ... 48
Patricia Participators, Ltd. ... 46
Patterson, John P. ... 72
Patterson, R. L. ... 123
Paulore Gold Mines, Ltd. ... 46
Paymaster gold m.
See also Paymaster Consolidated Mines.
Fire in carbide refuse ... 173
Manager and address ... 57
Operations ... 133, 134
Production ... 10, 12
Paymaster Consolidated Mines, Ltd.
See also Paymaster g. m.
Capital; officers ... 133
Mill, capacity ... 8, 133
Payne, Gordon ... 149
Payne, Lewis ... 69
Payore Gold Mines, Ltd. ... 46
Pearl, H. L. ... 86
Pearl lake ... 84
Peat industry ... 2, 3, 34
Producers listed ... 61
Peel co., sandstone ... 65
Pembroke.
Municipal limestone quarry ... 64
Pencil-leads, graphite for ... 32
Penhorwood tp., barite ... 59
Penitentiary, Kingston, limestone quarry ... 64
Penn-Canadian Mines, Ltd., dividends 23
Pentz, F. E. ... 114
Permits. *See* Boring permits; Building permits; Forest permits; Miners' licenses and permits.
Perrin, John D. ... 116
Perron, A. J. ... 97
Perry tp., diatomite ... 59
Perryman, A. M. ... 60
PAGE
Pershing Gold Syndicate, Ltd. ... 43
Perth co. *See* St. Marys.
Peterborough co.
See Belmont tp.; Lakefield; Methuen tp.
Peters, C. A. ... 132
Peterson Cobalt Mines, Ltd. ... 58
Operations ... 164
Peterson Lake Silver-Cobalt Mg. Co., Ltd., dividends ... 23
Petroleum.
Industry, notes by Commissioner ... 34
Production and value ... 2, 3, 34
Petrolia, petroleum ... 34
Pfeiffer, Geo. F. ... 108
Phoenix Molybdenite Corpn., Ltd.
Capital; officers; operations ... 156
Mine manager and address ... 57
Pickle Crow Gold Mines, Ltd.
Capital; officers; operations ... 134, 135
Incorporated ... 46
Mill, proposed ... 8
Mine manager and address ... 57
Road construction ... 80
Pickle Lake–Crow River area.
See Crow R. area; Pickle Crow Gold Mines.
Pig iron
See also Iron and steel industry.
Prices at Montreal ... 27
Pigments from uranium ... 30
Pike Consolidated Gold, Ltd. ... 46
Pilgrim Gold Mines, Ltd. ... 46
Piper, M. L. ... 96
Pipestone bay, Red l.
See Ball, Todd tps.
Pirson, John ... 64
Pit operators. *See* Sand and gravel.
Pitchblende ... 30
Pitfield, W. C. ... 155
Platinum metals.
Industry and statistics ... 2, 3, 5, 24-26
production and value ... 2, 3, 5, 26
increase ... 1
Plator Longlac Gold Mines, Ltd. ... 46
Plaxton, A. G. ... 131
Playfair tp.
Gold mg. *See* Ramore Gold Mining Co.
Playfair Iron Mines, Ltd. ... 43
Plumbago. *See* Graphite.
Plympton tp., petroleum ... 34
Poles, cement ... 38
Pollard, F. A. ... 113
Pontardawe, Wales ... 159
Pope, Thos. ... 113
Porcupine, South. *See* South Porcupine.
Porcupine gold area.
Barite. *See* Canada Night Hawk Mines.
Dividends ... 16
Exchange equalization ... 10, 11, 18
Gold production ... 9
and silver ... 10-12
Labour statistics ... 9
Mills, capacity ... 8
Mines.
see also Deloro, Ogden, Shaw, Tisdale, Whitney tps.
ore, average value ... 7
producing ... 7, 10, 12

PAGE
Porcupine mining div.
Recorder's report....49, 50
Porcupine Crown gold m., production.. 12
Porcupine Crown Mines, Ltd., dividends....15, 16
Porcupine Grande Gold Mines, Ltd.... 132
Porcupine Night Hawk Mines, Ltd.... 135
Porcupine Ores and Metals, Ltd..... 46
Porcupine Peninsular Gold Mines, Ltd.
Capital; officers; operations....135, 136
Mill, capacity..... 8
Mine manager and address..... 57
Porcupine Pet gold m.
Production (1914, 1915)..... 13
Porcupine United gold m.
Production (1929-1931)..... 13
Porcupine Watborn Gold Mines, Ltd.. 46
Porphyry Hill gold m.
Production (1913-1915)..... 13
Port Arthur, classes for prospectors... 175
Port Arthur mining div.
Recorder's report....49, 50
Port Colborne.
Cement plant....37, 62
Iron blast furnace....28, 58, 165
Nickel refinery....24, 25, 58, 160
Port Franks, salt..... 35
Port Hope, radium plant..... 30
Porteous, Henry M..... 116
Portland cement.
See also Cement products.
Industry..... 37
operators..... 62
production and value....2, 3, 37
for cement products..... 38
Portland tp.
Granite quarry..... 65
Limestone quarry..... 64
Portsmouth, limestone quarry..... 64
Posts and poles, cement..... 38
Pottery industry, statistics....2, 3, 41
Powell tp. *See* Matachewan Consol. g. m.; O'Connell Gold Mines; Young-Davidson g. m.
Premium on exchange.
See Exchange equalization.
Premier Paymaster Mines, Ltd..... 133
Prescott co. *See* Caledonia tp.
Pressed brick, production..... 41
Presswood and Gibbs..... 65
Prest, F..... 88
Preston gold m., production (1914).... 13
Price, C. W....58, 164
See also Foster s. m.
Pringle, John....54, 83
Prosecutions..... 174
Prospecting activity.
Increase in..... 1
Statistics....6, 48, 51
Prospectors, classes for..... 175
Prospectors Airways Co., Ltd..... 69
Prosser, Seward..... 159
Provincial Assay Office, report.....51, 52
Pulp and paper industry.
Lime consumption..... 39
Puslinch, lime plant..... 155
Puslinch tp.
See also Puslinch.
Limestone..... 63
Puslinch Quarry, Ltd....63, 64

PAGE
Pyke Salvage Co..... 66
Pyrite. *See* Iron pyrites.

Q

Quarries.
Accidents in..... 168-174
Listed..... 62-66
Quartz and quartzite.
Industry and statistics....2, 3, 34
Quarries listed..... 61
Quebec.
See also Deschênes; Joliette; Montreal; Noranda; St. Mark.
Diamond-drilling..... 5, 6
Quebec Eureka Gold Mines, Ltd..... 43
Quebec Gold Mining Corpn..... 132
Quebec Viking Gold Mines, Ltd..... 47
Queen Lebel gold m.
See also Lakeside-Kirkland Gold Mines.
Manager and address..... 56
Queen Lebel Gold Mines, Ltd..... 113
See also Lakeside-Kirkland Gold Mines.
Queen Lebel Gold Mining Co., Ltd.... 113
Incorporated..... 47
Queenston Quarries, Ltd....63, 64
Quicklime.
Plants listed....62, 63
Production and value....2, 3, 39
for cement products..... 38
Quinn, F. P..... 73
Quinn, G. W..... 121

R

Racine, G. F..... 132
Racine, H. H..... 149
Radium....30, 58, 161
Rahill Red Lake Mining Co., Ltd..... 47
Rahn Lake Mines Corpn., Ltd..... 43
Rainy River district.
Gold mg. *See* Mine Centre; Sapawe L. area.
mills, capacity..... 8
Lands, sales and leases..... 48
Rainville, G. H..... 131
Raleigh, tp.
See also Chatham.
Natural gas..... 33
Petroleum..... 34
Rama tp., limestone..... 64
Ramore area. *See* Playfair tp.
Ramore Gold Mining Co.
Capital; officers; operations..... 136
Incorporated..... 47
Mine manager and address..... 57
Ramsay tp., lime..... 63
Raney, Fraser..... 77
Rankin, John I..... 100
Ratcliffe, E. B....54, 73
Rattray, J. H..... 79
Raven River Mines, Ltd..... 47
Rawdon tp., limestone..... 64
Raymond Tiblemont Gold Mines, Ltd. 47
Rayner Construction, Ltd..... 64
Rea, John R..... 137
Rea, T. H....83, 99
Rea gold m., production (1913-1914).. 12
Rea Consolidated Gold Mines, Ltd.
Dividends....15, 16

PAGE
Recorders. *See* Mining recorders.
Recording fees, revenue....48, 49
Red lake.
See McKenzie is.; Pipestone bay.
Red Crest Gold Mines, Ltd.
Capital; officers; operations.... 136
Incorporated.... 42
Mine manager and address.... 57
Red Lake gold area.
See also Cochenour-Willans g. m.; Howey g. m.; Red l.; Red Lake Gold Shore Mines.
McIntyre-Porcupine claims.... 118
Red Lake mining div.
Recorder's report....49, 50
Red Lake Gold Shore Mines, Ltd.
Capital; officers; operations.... 137
Mine manager and address.... 57
Redington, John....54, 83
Refineries.
Cobalt.
see Deloro Smelting and Refining Co.
Copper.
see also Ontario Refining Co.
precious metals from....11, 25, 26
statistics....2, 24-26
Gold. *See* Ontario Refining Co.
Listed.... 59
Nickel.
see also Clydach; Norway; Port Colborne.
precious metals from....11, 25, 26
statistics....2, 24-26
Platinum, precious metals.
see Acton; Ontario Refining Co.
Silver.
see also Deloro Smelting and Refining Co.
sale of bullion by.... 19
statistics....2, 19, 21
Reformatory, Ontario, limestone quarry 64
Refractory clays.
Northern Ont., notes by W. S. Dyer..40, 41
Regina gold m....55, 103
Reid, Agnes.... 162
Reid, Fraser D....77, 103, 121
Reid, S. H. J.... 155
Reilley, William W.... 146
Reliance Gold Mining Co.... 42
Rendix gold claim.... 88
Renfrew.
Feldspar.... 60
Lime.... 63
Molybdenum. *See* Phoenix Molybdenite Corpn.
Renfrew co.
See Bagot, Brougham tps.; Eganville; Fraser tp.; Pembroke; Renfrew; Wilberforce tp.
Rennick, A.... 115
Rentals, revenue.... 48
Residential construction contracts.... 36
Retort coal gas. *See* Gas, coal.
Revenue, mining....48-51
Reward Mining Co.... 149
Rhodesia, Southern.
Gold production (1930-1934).... 18
Rhodium, production.... 26
Richardson, J. A.... 159
Richelieu Gold Mines, Ltd.
Capital; officers; operations.... 137

PAGE
Richelieu Gold Mines, Ltd.—*Continued*
Incorporated.... 47
Mine manager and address.... 57
Richland Gold Mines, Ltd.... 47
Richmond Development Co., Ltd.... 47
Rickaby tp.
Gold mg. *See* Dikdik g. m.
Rickard Ramore Gold Mines, Ltd.... 47
Ridgeley gold claims.
Anglo-Huronian interest.... 69
Ridgeway, limestone quarry.... 65
Riggs, Thomas.... 116
Right of Way silver m.
See Cobalt Properties.
Right of Way Mines, Ltd., dividends.. 23
Right of Way Mining Co., dividends.. 23
Riley, Jas. E.... 85
Ritchie, A.... 86
Robb, Walter B.... 108
Roberts, A. Kelso.... 164
Robinson, D.... 134
Robinson, F. A.... 127
Robinson, J. H.... 63
Robinson, John B.... 89
Robinson, L. V....60, 155
Robinson, T. F....63, 64
Robinson, W. E.... 150
Rocdor Gold Mines, Ltd.... 47
Roche, P. J.... 137
Roche Long Lac Gold Mines, Ltd.... 57
Capital; officers; operations....137, 138
Incorporated.... 47
Rockwood Lime Co.... 63
Rodgers, C. E....57, 142
Roe, Stephen.... 61
Rogers, H. Dix.... 149
Rogers, J. C.... 145
Ronaldson, J. V.... 96
Ronaldson, T. S.... 96
Roof slabs. *See* Haydite.
Roofing tile, statistics....2, 3, 41
Rook, W. G.... 94
Rope tests.... 174
Fees for, revenue.... 48
Rose, E. H.... 71
Ross, A. Calvin.... 154
Ross, James A.... 129
Rothwell, H. D.... 133
Rothwell, T. E.... 53
Roussac, J. A. S.... 131
Routly, H. T.... 64
Rouyn Reward Gold Mines, Ltd.... 47
Rowan Discovery gold claim.
See also Red Crest Gold mines.
Manager and address.... 57
Operations.... 136
Royal Canadian Mint.... 17
Royalties.
Sand and gravel.... 48
Timmins and Tisdale tp., on gold.... 103
Royce, Geo.... 87
Rudhard, J. W.... 108
Ruel, Gerald.... 122
Rupert's Land Gold Syndicate, Ltd.... 47
Russell co.
See Bourget Springs; Russell tp.
Russell tp., limestone.... 63
Russia, gold production.... 18
Ruthenium, production.... 26
Rutherford tp. *See* Killarney.
Ryckman, W. C.... 142

S PAGE

Sabine tp., feldspar 60
St. Anthony gold m.
Manager and address 57
Mill, capacity 8
Operations 138
Production 11
St. Anthony Gold Mines, Ltd.
See also St. Anthony g. m.
Capital; officers 138
St. Charles, Dr. W. P. 110
St. Clair r., sand and gravel 66
St. Lawrence r., sand and gravel 66
St. Mark, Que., lime plant 155
St. Marys.
Cement works 37, 62
Limestone quarry 64
St. Marys Cement Co. 37
St. Mary's Crushed Stone, Ltd. 64
St. Paul, Chas. E. 95, 137
Sakoose Gold Mines, Ltd.
Capital; officers; operations 139
Incorporated 42
Mine manager and address 57
Salkeld, C. D. 54, 55, 69, 86
Salmon, H. H. 64
Salmon River, B.C.,
Limestone plant 155
Salt.
Industry and statistics 2, 3, 34, 35
Operators, listed 62
Salter, W. R. 105
Sand and gravel.
See also Dredging.
Accidents in pits 168-174
Industry and statistics 2, 3, 39
cement products, consumption 38
Operators listed 66
Royalties; licenses 48
Sand-lime brick.
Industry and statistics 2, 3, 40
lime consumption 39
Plants and managers 66
Sandoe, Richard 58, 164
Sandstone.
Operators listed 65
Production 2, 40
Sandwich, salt 62
Sapawe Lake area.
Gold mg. *See* Central Canada Mines.
Sarnia tp.
Petroleum 34
Salt 62
Saskatchewan.
Diamond-drilling 6
Sault Ste. Marie.
Iron industry 27, 28, 58, 165
Prospectors' classes 175
Sault Ste. Marie mining div.
Recorder's report 49, 50
Saundary Syndicate.
Mill, capacity 8
Mine manager and address 57
Operations 139
Production 11
Saunders, A. E. 57, 139
Savage, James 88
Saxton, Stanley 56, 122
Scadding Gold Mines, Ltd. 47
Scarborough, sand-lime brick 66
Schmelzle, George 56, 113
Schram, Robert 77

PAGE

Schreiber.
Gold mg. near. *See* Gold Range Mines; Harkness-Hays Gold Mines; North Shores Gold Mines.
Schreiber Pyramid Gold Mines, Ltd. 47
Schulze, Theodore 88
Schumacher.
See Coniaurum g. m., McIntyre-Porcupine g. m.
Schumacher gold m. 12
Schumacher Gold Mines, Ltd.
Dividends 15
Scott, H. L. 65
Scott, J. R. 148
Scott, R. P. 78
Scottish-Ontario gold m.
See also Canusa g. m.
Production (1927, 1928) 13
Seal Harbor Gold Mines, Ltd. 47
Searchmont, gold mg. near 140
Searls, Carroll 93, 130
Searls, Fred, Jr. 130
Security Gold Mines, Ltd. 43
Segsworth, W. E. 141
Selected Canadian Golds, Ltd. 57
Capital; officers; operations 139
Selenium.
Internat. Nickel Co., sales 159
Production statistics 2, 3, 5, 25
Seneca tp. *See* Caledonia.
Seneca-Superior Silver Mines, Ltd.
Dividends 23
Serson, John R. 92
Sesekinika.
See Kirkland Consol. Mines.
Sewer brick, statistics 2, 3, 41
Sewer copings, statistics 2, 3, 41
Sewer pipe, statistics 2, 3, 38, 41
Shaft accidents 169
Shane, George R. 63
Shannon, H. S. 148
Sharpe, Alfred H. 142
Shaw, John W. 56, 121, 122
Shaw, Quincy 139
Shaw tp.
Gold mg. *See* Excello Mines, Ltd.
Shawinigan Chemicals, Ltd.
Notes on carbide 173
Shawkey Gold Mining Co., Ltd. 47
Sheppard, W. J. 117
Shipley, Grant B. 159
Shoal lake, Kenora dist.
Gold mg. *See* Damascus g. m.; Kenora Prospectors and Miners.
Shulman, M. S. 139
Shunsby, Martin J. 98, 114
Sigma Mines, Ltd. 91
Silica brick.
Industry and statistics 2, 3, 34
Operators listed 61
Silica sand 41
Silicon ferro-alloys 28
Silver.
Industry and statistics 2, 3, 5, 10, 19-23
price 19, 163
production and value 2, 3, 5, 19-21
from gold ores 10, 17, 19
from nickel-copper ores 25, 26, 159
Mines.
see also Cobalt, Gowganda s. areas.
accidents in 168

PAGE
Silver—*Continued*
Mines—*Continued.*
dividends paid by....5, 22, 23
managers and addresses.... 58
profit tax.... 51
reports....162-165
Nationalization by U.S.... 19
Ores, revenue from treatment of.... 48
Refineries.
see also Deloro Smelting and Refining Co.
sale of bullion by.... 19
statistics....2, 19, 21
Silver islet, silver production.... 20
Silverstone Black Marble Quarries.... 65
Simcoe co.
See Medonte tp.; Orillia tp.
Simons, H. J.... 73
Simpson, W. J....55, 97
Sinclair, Dr. Alex....57, 140
Sinclair, D. G....67, 168
Sinclair Mines, Ltd.... 47
Sinclair Mines Syndicate.
Mine manager and address.... 57
Operations.... 140
Sin-Mac Lines, Ltd.... 66
Siscoe, Stanley E.... 141
Sixt, Wm. M.... 109
Skead tp. *See* Telluride g. m.
Skinner tp.
Gold mg. *See* Bathurst Gold Mines.
Slaght, Arthur G.... 116
Slate.
Market for.... 40
Production and value....2, 3, 40
Quarry.... 65
Slee, Frederick C.... 165
Slingsby, E. O.... 68
Smeaton, H.... 147
Smelters.
Nickel-copper.
see also Coniston; Copper Cliff; Falconbridge Nickel Mines.
lime consumption.... 39
listed.... 59
statistics....2, 24, 25
Silver.
see also Deloro Smelting and Refining Co.
sale of bullion by.... 19
statistics....2, 19, 21
Smith, A. L.... 135
Smith, Alex. C.... 136
Smith, Angus.... 127
Smith, Bernard E.... 117
Smith, C. G.... 78
Smith, F. L.... 127
Smith, Harold.... 78
Smith, J. D. C.... 50
Smith, M. C.... 108
Smith, P.... 73
Smith, R. Home.... 69
Smith, R. M.... 64
Smith, S. B.... 57
Van Sickle g. m., operations.... 140
Smith, Thos. K.... 93
Smith, W. H.... 164
Smith and Co., Canada, Ltd., C. Morrison.... 47
Smith Cobalt Mines, Ltd.... 58
Capital; officers; operations.... 164

PAGE
Smyth, W. A.... 66
Smyth, W. J.... 64
Smythe, Ltd., C.... 64
Snelgrove, H. P.... 74
Snider tp. *See* Copper Cliff.
Soapstone, industry and statistics.... 3
Soft-mud brick, statistics.... 41
Sol-D'Or Gold Mines, Ltd.
Incorporated.... 47
Production.... 11
Soliague, L.... 116
South Africa.
Gold production (1930-1934).... 18
South Dakota, U.S.
Gold production (1930-1934).... 18
South Dumfries tp. *See* Paris.
South Lorrain tp.
See also Keeley s. m.
Silver shipments.... 20
South McKenzie Island Mines, Ltd.... 47
South Porcupine.
See Buffalo Ankerite, Dome, Marbuan, Paymaster g. mines.
South Porcupine Mines, Ltd.... 43
South Vermillion Gold Mines, Ltd.
Capital; officers; operations.... 140
Incorporated.... 47
Mine manager and address.... 57
Southern Rhodesia.
Gold production (1930-1934).... 18
Southwestern Ontario.
See Natural gas; Petroleum; Salt.
Soviet, The.
Gold production (1930-1934).... 18
Spar. *See* Feldspar.
Speiss residues.... 21
Spence, J., gold production.... 13
Spence, W. H.... 62
Spence Lake Diatomite, Ltd.... 59
Spencer, C. L....57, 150
Spiegeleisen, production....28, 165
Spontaneous combustion in carbide.
Notes, rules for prevention....173, 174
Spreckels, R.... 137
Spring Vale, sand and gravel.... 66
Springbrook Sturgeon Gold Mines, Ltd. 47
Springer gold claim.
See Central Patricia Gold Mines.
Springer Sturgeon Gold Mines, Ltd.... 43
S.S.M. 301 gold claim.
See Van Sickle g. m.
S.S.M. 4,925 gold claim.
See Hillside Gold Mines.
Stabell Lake Gold Mines, Ltd.... 47
Stagee gold m.
Mine manager and address.... 57
Operations.... 149
Optioned to Wells Longlac Mines..57, 149
Stamford, iron industry.... 27
Stamford tp., limestone quarry....64, 65
Standard Gold Mines, Ltd.... 133
Standard Minerals of Canada, Ltd.... 47
Stanley, Robt. C....158, 159
Notes by, on copper production.... 24
Stanley Gold Mines, Ltd.... 57
Capital; operations.... 141
Starke, Robert.... 83
Statistical review, mineral industry (1934), by A. C. Young.... 1-53
Steel industry.
See Iron and steel industry.

PAGE
Steel Company of Canada.
Manager and address ... 59
Officers; operations ... 28, 166
Steindler, L. L. ... 141
Stellar Gold Mines, Ltd.
Capital; officers; operations ... 141
Mine manager and address ... 57
Stephens, J. ... 63
Stephenson, J. W. ... 145
Sterling Exploration Co., Ltd. ... 44, 47
Stern, Morton F. ... 89
Stevens, Frank G. ... 54, 82
Stevens, J. H. ... 73
Stevenson, C. D. ... 56, 132
Stevenson, J. G. A. ... 55, 86
Stewart, C. H. E. ... 56, 123
Stewart, J. C. ... 149
Stewart Bros. ... 61
Stiff-mud brick, statistics ... 41
Stillar-Temagami Gold Mines, Ltd. ... 47
Stinson, F. L. ... 57, 156
Stinson, T. H. ... 72
Stokes, R. J. ... 145
Stoklosar, Charles A. ... 60
Stone.
Industry and statistics ... 2, 3, 40
Operators listed ... 63-65
Stout, Andrew V. ... 159
Strathy tp.
Copper mg. *See* Cuniptau Mines.
Gold mg. *See* Manitoba and Eastern Mines.
Rare metals ... 26
Strathy Basin Mines, Ltd. ... 47
Strathy Explorers, Ltd. ... 44
Straw lake.
Gold mg. *See* Straw Lake Beach Gold Mines.
Straw Lake Beach Gold Mines Synd.
Capital; officers; operations ... 141
Incorporated ... 44
Mine manager and address ... 57
Streight, J. E. ... 150
Strong, Horace F. ... 98
Structural materials.
See also Clay products.
Industry and statistics ... 2-4, 36-40
production, increased value ... 1
Operators and managers listed ... 62-66
Structural tile, statistics ... 2, 3, 41
Stucco, cement ... 38
Sturgeon Aurora Mines, Ltd. ... 44
Sturgeon Bridge Gold Mines, Ltd. ... 44
Sturgeon Lake area.
Gold mg. *See* Richelieu Gold Mines; St. Anthony g. m.
Sturgeon River area, gold "rush" ... 7
Sturgeon River Gold Basin Synd., Ltd. 44
Sturgeon River Gold Mines, Ltd. ... 7
Incorporated ... 47
Sudbury district.
Barite mg. *See* Penhorwood tp.
Feldspar mg. *See* Burwash tp.
Gold mills, capacity ... 8
Gold mg. *See* Afton g. m.; Bob Tough Gold Mines; Bousquet Gold Mines; Long Lake g. m.; Mongowin tp.; Swayze area; W. Shining-tree area; Young-Shannon Gold Mines.
Mining lands, sales and leases ... 48

PAGE
Sudbury district—*Continued*
Nickel-copper.
industry ... 24-26
mining. *See* Falconbridge Nickel Mines; International Nickel Co. of Canada.
Platinum metals. *See* Platinum metals.
Sudbury mining div.
Recorder's report ... 49, 50
Sudbury Basin Mines, Ltd.
Matachewan Consol. stock option ... 127
Sugar industry, lime consumption ... 39
Sullivan, F. J. ... 56, 109, 110
Sullivan, J. E. ... 71
Sullivan tp., lime ... 62
Sulphur, production ... 2, 3
Sulphur fumes.
Sulphuric acid extracted from ... 32
Sulphuric acid.
Amt. used in coking industry ... 29
Industry and statistics ... 3, 32
Plant for ... 60, 166
Sultana gold m.
Operations ... 139
Optioned to Selected Canadian Golds ... 57, 139
Summerhayes, M. W. ... 57, 151
Summit lake.
See Casey Summit g. m.
Superior Alloys, Ltd. ... 27
Supreme Gold Mines, Ltd. ... 47
Sutherland, H. H. ... 127
Sutton, L. V. ... 86
Swayze gold area, Sudbury dist.
See Greenlaw Gold Mines; Halcrow Swayze Mines; Kenty Gold Mines; Lee Gold Mines; Swayze-Huycke Gold Mines.
Swayze tp.
Gold mg. *See* Kenty Gold Mines.
Swayze Gold Field, Ltd. ... 47
Swayze-Huycke Gold Mines, Ltd. ... 57
Capital; officers; operations ... 142
Prosecution ... 174
Sweet-Sturgeon Syndicate, Ltd. ... 44
Sydenham tp. *See* Owen Sound.
Sylvanite gold m.
See also Sylvanite Gold Mines.
Manager and address ... 57
Mill, capacity ... 8, 144
Operations ... 142-145
Production ... 10, 14, 142
Sylvanite Gold Mines, Ltd.
See also Erie Canadian Mines; Sylvanite g. m.
Capital; officers ... 142
Dividends ... 15, 16
Option on Delnite shares ... 87
Profit tax ... 51
Symmes, B. L. H. ... 145

T

Tait, Sir Thomas ... 132
Talc.
Industry and statistics ... 2, 3, 35
increase ... 36
Mines.
accidents ... 168
listed ... 62
reports ... 165

PAGE
Talisman Gold Mines, Ltd. 57
Capital; officers; operations 145
Tallack, R. 131
Tamarac Gold Mining Co., Ltd. 47
Tanneries, lime consumption 39
Tapley, P. Nugent 145
Tar, from coking industry 29
Tarentorus tp. *See* Sault Ste. Marie.
Tashota Gold Mines, Ltd. 145
Tashota Goldfields, Ltd.
Capital; officers; operations 145
Mill, proposed, capacity 8
Mine manager and address 57
Tasmania, gold production 18
Tasmijopen Mining Co., Ltd. 44
Taxes, mining, revenue 48, 51
Taylor, A. 154
Taylor, Charles 106
Taylor, Nelson S. 95
Taylor, R. F. 138
Taylor, Roy 62, 165
Taylor, W. A. 68
Taylor, W. D. 58, 162
T. B. 3,326 gold claim.
See Gold Range Mines.
T. B. 3,327, 3,354 gold claims.
See Harkness-Hays Gold Mines.
T. B. 9,985 gold claim.
See Hard Rock Gold Mines.
T. B. 10,213 gold claim.
See Bankfield Gold Mines.
T. B. 11,071 gold claim.
See McMartin, J. Bruce.
Teare, R. P. 57, 138
Teck tp.
Gold mg. *See* Canadian Kirkland Mines; Kirkland Lake, Lake Shore, Lucky Cross, Macassa, Sylvanite, Teck-Hughes, Toburn, Wright-Hargreaves g. mines.
Teck-Hughes gold m.
See also Teck-Hughes Gold Mines.
Kirkland Lake g. m. connected with. 109
Manager and address 57
Mill, capacity 8
Operations 146, 147
Production 10, 14, 146
Teck-Hughes Gold Mines, Ltd.
See also Teck-Hughes g. m.
Capital; officers 145, 146
Dividends 15, 16
Profit tax 51
Teddy Bear Valley Mines, Ltd.
Capital; operations 147
Mine manager and address 57
Teddy Bear Valley Syndicate 147
Tees Transit Co. 66
Telfer, R. A. 154
Telluride gold m., production 14
Tellurium.
International Nickel Co., sales 159
Production, statistics 2, 3, 5
Temagami Development Co., Ltd. 44
Temiskaming silver m.
Lessees and address 58
Operations 164
Temiskaming and Hudson Bay Mining Co., Ltd., dividends 23
Temiskaming Mines Co., Ltd. 118
Temiskaming Mining Co., Ltd. dividends 23

PAGE
Temiskaming Testing Laboratories.
Fees collected 48
Operations; financial statement 51, 52
Terra Cotta Quarries, Ltd. 65
Terry, S. D. 68
Tests on rope 174
Tetreault, J. L. A. 105
Thames river.
Sand and gravel 66
Thamesville, petroleum 34
Thomas, David E. 130
Thomson, D. M. 55, 106
Thomson, R. G. O. 108
Thompson, C. N. 97
Thompson, J. M. 55, 106
Thompson, John 156
Thompson, John F. 146, 158, 159
Thompson, R. E. 73
Thornber, B. 113
Thorold, iron industry 27
Three Nations Mining Co., Ltd. 132
Thunder Bay district.
See also Fort William; Sault Ste. Marie.
Chromite. *See* Obonga Lake area.
Gold mg. *See* Beardmore area; Dikdik g. m.; Kowkash area; Little Long Lac area; Moss g. m.; Schreiber; Sturgeon Lake area; Tashota Goldfields.
mills, capacity 8
Mining lands, sales and leases 48
Thunder Bay Gold Mines, Ltd. 47
Thurlow tp.
See also Belleville.
Limestone 64
Tiblemont Central Gold Mines, Ltd. 47
Tiedt, Henry J. 73, 74, 125
Tilbury East tp., petroleum 34
Tile production 2, 3, 41
Timagami Forest Reserve.
Gold mg. *See* Afton g. m.
Timagami Gold Mines, Ltd. 47
Timiskaming district.
See also Haileybury.
Barite mg. 59
Cobalt mg. *See* Cobalt (mineral).
Copper. *See* Cross Lake s. m.
Gold mg. *See* Bannockburn, Eby, Gauthier, Grenfell, Hearst, Lebel, McVittie, Maisonville, Morrisette, Pacaud, Powell, Skead, Teck tps.
Mining lands, sales and leases 48
Silver mg. *See* Coleman, Nicol tps.
Timiskaming mining div.
Recorder's report 49, 50
Timmins, Jules R. 100
Timmins, Leo. H. 100
Timmins, Noah A. 100
Timmins, Ont.
Gold mg. *See* Hollinger g. m.; La Roche Mines; Vipond g. m.
Taxes paid to, by Hollinger 103
Timms, A. R. 113
Tionaga, barite deposit 31, 59
Tisdale tp.
Gold mg. *See* Canusa, Coniaurum, Dome, Hollinger, McIntyre-Porcupine, New York Porcupine, Paymaster, Vipond g. mines.
Taxes paid to, by Hollinger 103

PAGE

Toburn gold m.
See also Toburn Gold Mines; Tough-Oakes Burnside g. m.
Manager and address..... 57
Mill, capacity..... 8
Operations..... 148
Production.....10, 14, 148
Toburn Gold Mines, Ltd.
See also Toburn, Tough-Oakes Burnside g. mines.
Capital; officers..... 147
Dividends.....15, 16
Profit tax..... 51
Todd, E. W.....56, 110
Todd tp.
Gold mg. *See* Red Crest Gold Mines; West Red Lake Gold Mines.
Tolman, J. D..... 71
Tom Johnson–Nipigon Mines, Ltd.
Capital; officers; operations.....148, 149
Mine manager and address..... 57
Tommy Burns g. m., production (1917) 13
Tomney, H. E..... 162
Toronto.
Building permits..... 36
Classes for prospectors..... 175
Mining claims recorded..... 50
Provincial Assay Office.....52, 53
Sand-lime brick industry.....40, 66
Toronto Brick Co..... 66
Tough, George..... 76
Tough, R. R..... 73
Tough-Oakes Burnside gold m.
See also Toburn g. m.; Tough-Oakes Gold Mines.
Production..... 14
Tough-Oakes Gold Mines, Ltd.
See also Tough-Oakes Burnside g. m.
Dividends.....15, 16
Townsend tp. *See* Waterford.
Township 11, Sudbury.
Gold mg. *See* Bousquet Gold Mines.
Township 23, range 10, Algoma.
See Sinclair Mines Synd.
Township 27, range 25, Algoma.
See Michael-Boyle g. m.
Township 27, range 29, Algoma.
See Algoma Summit Gold Mines.
Township 28, range 26, Algoma.
See Algood Mines; Kozak g. m.
Township 29, range 22, Algoma.
See Centennial Gold Mines.
Township 29, range 23, Algoma.
See Grace g. m.; Hillside Gold Mines; Mackey Point g. m.; Minto Gold Mines; Parkhill g. m.; Stanley Gold Mines; Van Sickle g. m.; Wawa Goldfields
Township 48, range 27, Algoma.
See Gold Lands Synd.
Township 69, Sudbury.
Gold mg. *See* Long Lake g. m.
Townsite silver m.
See Cobalt Townsite s. m.
Trafalgar Gold Mines, Ltd..... 47
Trafford, C. E..... 71
Trail, B.C., cobalt ores shipped to..... 19
Trans-Canada Mining Corpn., Ltd.... 44
Transvaal.
Gold, grade decrease..... 7
production (1930-1934)..... 18

PAGE

Trap rock.
Operators..... 65
Statistics.....2, 3, 40
Traynor, D. H.....57, 139
Treatment of ores, revenue..... 48
Tretheway, F. L..... 107
Tretheway Silver Cobalt Mines, Ltd.
Dividends..... 23
Trident Gold Mines, Ltd..... 47
Trout Creek g. m., production (1931).. 14
T. Sidney Kirby Co..... 64
Tubs, laundry, cement..... 38
Tuck, Dr. J. A..... 69
Tudhope, H. R.....150, 151
Tudhope, J. B.....103, 117
Tudor, H. D.....150, 151
Tudor tp.
Gold mg. *See* Craig Gold Mines.
Tuer, C. F..... 128
Turk, Eric..... 69
Turner, H. R. M.....92, 93
Tylac Sturgeon Gold Mines, Ltd..... 47
Tyrrell, J. B..... 108
Tyx, C. C..... 108

U

Ullmann, John G..... 93
Underground accidents.....168, 170
Underground fires.....172, 173
United Algoma Mines, Ltd..... 87
United Mineral Lands Co., Ltd..... 133
United States.
See also Exchange equalization; Minnesota; New York; S. Dakota; Wisconsin.
Gold production (1930-1934)..... 18
Gold standard abandoned..... 17
Silver, nationalization..... 19
Universal Exploration Syndicate, Ltd. 44
Unwrought Metal Sales Act.
Record books for..... 48
Uranium..... 30
U.S.S.R. *See* Russia.

V

Valora Gold Exploration Co., Ltd..... 47
Van Camp, H. N..... 136
Vancouver, B.C., gypsum plant..... 155
Van Der Voort, M. C..... 67
Vanguard Long Lac Mines, Ltd..... 47
Van Horne, A. D..... 69
Van Norstrand, H. L..... 99
Vanquelin-Sifton Lake Mines, Ltd.... 44
Van Sickle gold m.
Manager and address..... 57
Operations..... 140
Vaughan, H. H..... 145
Velma Gold Mining Synd., Ltd..... 44
Ventures, Ltd.
See also Coniaurum Mines.
Matachewan Consol. stock held by.. 127
Vermilion Lake Gold Mines, Ltd.
Capital; officers; operations..... 149
Mine manager and address..... 57
Verona, granite near..... 65
Vetter, L. J..... 96
Victoria co.
See also Coboconk; Eldon tp.
Limestone..... 65

PAGE
Vimy Gold Mines, Ltd. 47
Vincent, G. G. 60, 166
Vipond gold m.
See also Anglo-Huronian; Vipond Consol. Mines.
Manager and address 54
Mill, capacity 8
Operations 69, 70
Production 10, 12, 69
Vipond Consolidated Mines, Ltd.
See also Vipond g. m.
Bought by Anglo-Huronian 12, 69
Dividends 15, 16

W

Wabageshik, power plant 159
Wack, Otis 155
Wages.
See also Labour statistics.
Average yearly, gold mg. 9
Building trades, index 36
Wainwright, Thos. A. 162
Waite, J. H. C. 72
Walker, G. C. 62
Walker, J. G. 65
Walker Bros., Ltd. 65
Walker Salt Corpn., Ltd. 35
Incorporated 44
Wallaceburg, lime 63
Wallaceburg Sand and Gravel Co. 66
Wallbridge Estate 60
Walpole tp.
See also Spring Vale.
Limestone 63, 64
Walter, H. W. 59
Walton, W. S. 87, 99, 109, 142
Wanapitei Basin Mines, Ltd. 47
Wanup, mica 61
Warren, Jas. J. 85
Warwick tp., salt 62
Warwick Pure Salt Co. 35, 62
Warwick Salt Corpn., Ltd. 62
Wasapika-Ribble gold m. 56
Operations 129
Water, mineral. *See* Mineral waters.
Water power. *See* Hydro-electric plants.
Waterdown, sand and gravel 66
Waterford, sand and gravel 66
Waterford Sand and Gravel Co. 66
Waterloo tp. *See* Hespeler; Preston.
Waters, H. W. 94
Watkins, B. W. 156
Watkins, Walter G. 156
Watson, J. G. 71
Watson, J. P. 71
Watts, Ernest E. 129
Waugh, S. A. 92
Wawa. *See* Centennial Gold Mines; Grace g. m.; Hillside Gold Mines; Jubilee, Minto, Parkhill, Van Sickle g. mines; Wawa Goldfields.
Wawa Goldfields, Ltd.
Capital; officers; operations 149
Mine manager and address 57
Weaver (Minerals), Ltd. 59
Webster, A. R. 67, 168
Webster, G. B. 79, 122
Weimar, Matthew 86
Weir, Rt. Hon. Lord 159
Welch, John 64

PAGE
Weldon, L. 138
Weldon, Roy 108
Welland, iron industry 27
Welland co.
See Humberstone tp.; Niagara Falls; Ridgeway; Stamford tp.; Welland ship canal.
Welland ship canal.
Limestone quarry 65
Welland Electric Steel Foundry 27
Wellington co.
See Elora; Guelph, Puslinch tps.
Wells, oil. *See* Petroleum.
Wells, Thos. L. 56, 127
Wells Longlac Mines, Ltd.
Capital; officers; operations 149, 150
Incorporated 47
Mine manager and address 57
Wende, Albert 110
Wendigo Gold Mines, Ltd.
Capital; officers; operations 150
Mine manager and address 57
Wentworth co.
See Dundas; Hamilton; Waterdown.
Weppler, Henry 63
Wessels, D. D. 77
West, C. W. 65
West Australia, gold production 18
West Dome Lake gold m.
Production (1915-1930) 12
West Dome Lake Gold Mines, Ltd. 133
West Dome Mines, Ltd. 133
West Flamborough tp. *See* Dundas.
West Oxford tp. *See* Beachville.
West Red Lake Gold Mines, Ltd. 57
Capital; officers; operations 150, 151
Incorporated 47
West Shiningtree area.
See also Churchill, Macmurchy tps.
Mills, capacity 8
West Side Long Lac Mines, Ltd. 47
Western Canada Flour Mills Co.
Salt operators 62
Western Salt Co. 62
Westervelt, J. W. 95
Westree gold m.
See also Lake Caswell Mines.
Manager and address 56
Operations 110
Wettlaufer, Conrad E. 145
Wettlaufer Lorrain Silver Mines, Ltd.
Dividends 23
Wheatley, R. O. 131
Whitby tp., sand and gravel 66
White, Geo. S. 86
White, H. G. 70
White Rock Mining Co., Ltd.
Production 14
Whitfield, H. S. 73
Whitney tp.
Gold mg. *See* Canusa g. m.; Pamour Porcupine Mines.
Whittingham, H. 83, 127
Wholesale prices index 1, 36
Wilberforce tp., lime 63
Wilcox, Charles S. 167
Wildor Gold Mines, Ltd. 47
Willford and Co., R. F. 65
William Irwin and Co., Ltd. 44
Williams, A. D. 53
Williams, B. J. 64

PAGE
Williams, R. M. 108
Williams, W. A. 70
Williamson, E. M. 94
Williamson, R. S. 77
Williamson, W. R. M. 77
Williamson Mines, Ltd. 47
Willis, Harvey M. 92
Willisville.
See Bousquet Gold Mines.
Wilmac Trusts, Ltd. 44, 47
Wilson, J. A. 77
Wilson, J. M. 57, 136
Wilson, W. J. B. 85
Wilson, W. P. 13
Wilton Gold Mines, Ltd. 47
Winchester tp., peat 61
Windigokan Lake Gold Mines, Ltd. 47
Windmill Point Crushed Stone Co. 65
Windsor, N.S., gypsum plant 155
Winnipeg, Man., gypsum plant 155
Wire-cut brick, production 41
Wire rope testing 174
Wisconsin, U.S.
Iron ore imports from 4
Wishart, A. A. 78
Witch bay, Lake of the Woods.
See Wendigo Gold Mines; Witch Bay Gold Mines.
Witch Bay Gold Mines, Ltd. 57
Capital; officers; operations 151
Incorporated 47
Witkon, B. 62
Wolf lake.
Gold mg. *See* Lakeland Gold, Ltd.
Woman Lake area.
Gold mg. *See* Hudson Patricia Gold Mines; Jackson-Manion g. m.
Woman River Gold Mines, Ltd. 44
Wood, A. 57, 165
Wood, C. Lindley 59
Wood, E. B. 114
Wood, H. K. 72
Wood, L. P. 74, 129
Woodhouse, Ltd., H. 47
Woolatt Fuel and Supply Co. 66
World production of gold 18
Wright, D. G. H. 82
Wright, E. Ward 82
Wright, Kenneth W. 161
Wright, S. B. 59, 166
Wright, W. H. 110, 151
Wright and Co. 61

PAGE
Wright-Hargreaves gold m.
See also Wright-Hargreaves Mines.
Manager and address 57
Mill, capacity 8
Operations 151-154
Production 10, 14, 152
Wright-Hargreaves Mines, Ltd.
See also Wright-Hargreaves g. m.
Capital; officers 151
Dividends 15, 16, 152
Profit tax 51
Wynman, M. D. 113

Y

Y. 104 gold claim. *See* Mackey Point g. m.
Yarrow tp., barite 31, 59
Yates, Harry 88, 142
Yates, Richard C. 165
Yellow Metal Syndicate, Ltd. 44
Yellowknife Gold Mines, Ltd. 47
Yeoell, W. J. 98
York co. *See* Etobicoke, York tps.
York tp.
See also Toronto.
Sand and gravel 66
York Investments, Ltd. 47
York Sandstone Brick Co. 66
Young, C. T. 57, 154
Young, H. G. 150, 151
Young, Horace G. 136
Young-Davidson gold m.
See also Young-Davidson Mines.
Manager and address 57
Mill, capacity 8
Operations 102
Optioned to Hollinger 154
Production 10, 14
Young-Davidson Mines, Ltd.
See also Young-Davidson g. m.
Capital; officers 154
Young-Shannon Gold Mines, Ltd.
Capital; officers; operations 154
Mine manager and address 57

Z

Zinc, production 3, 5
Zirconium manganese silicon 28
Zuck, C. W. 92
Zuck, Floyd J. 92

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

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Geology and Ore Deposits of the Matachewan-Kenogami Area, by W. S. Dyer - - - - - - - - - - - - - - - 1-55

Geology of the Martin-Bird Property in Hearst Township, by W. S. Dyer - - - - - - - - - - - - - - - 56-58

Notes on Some Properties in Lebel Township, by W. S. Dyer - 59-61

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TABLE OF CONTENTS

Vol. XLIV, Part II

GEOLOGY AND ORE DEPOSITS OF THE MATACHEWAN-KENOGAMI AREA

PAGE

Introduction 1
History 1
Previous Geological Work 2
Scope of the Present Report 3
Acknowledgments 3
Access to the Area 4
Natural Resources 5
Physical Features and Glacial Deposits 6
General Geology 8
Keewatin 9
Andesites and Basalts 9
Rhyolites and Dacites 10
Tuffs 10
Agglomerates 11
Sediments and Iron Formation 11
Carbonate Schist 12
Timiskaming 13
Southern Syncline of Powell and Cairo Townships 13
Northern Syncline of Powell and Cairo townships 14
Flavelle, Holmes, and Eby Townships 15
Relationship of the Timiskaming to the Keewatin 16
Characteristic Features of the Timiskaming of the Matachewan area. 16
Algoman 17
Diorite 17
Powell and Cairo Townships 17
Eby Township 18
Holmes and Flavelle Townships. 18
Granite and Granite Porphyry 19
Syenite 21
Syenite Porphyry 21
Lamprophyre 24
Matachewan 25
Cobalt Series 27
Keweenawan 28
Structural Geology 28
Folding 28
Faulting 29
The Montreal River and Mistinikon Lake Faults 29
Other Faults 30
Economic Geology 31
Gold 31
Powell and Cairo Townships 31
Young-Davidson Mines, Limited. 31
Matachewan Consolidated Mines, Limited 36
Bloom Lake Consolidated Mines, Limited 42
Otisse Lake Group 42
North Powell Group 42
Cairo Group 43

PAGE

Economic Geology—*Continued*
O'Connell Gold Mines, Limited.. 43
Matachewan Townsite Mines... 43
Matachewan Pioneer Syndicate.. 43
Margo Mines 43
Other Claims 44
Baden Township 44
Baden Gold Mines 44
Central Matachewan Mining Corporation, Limited 46
Thesaurus Gold Mines, Limited.. 46
French Property 47
Arbade Gold Mines, Limited.... 47
Theodore Kallies 47
J. Quilty 48
Woman River Gold Mines, Limited 48
McNeil Township 48
McNeil Syndicate and Oliver Gold Syndicate 48
Yarrow Township 50
Christie Properties 50
Holmes Township 50
L. Brookbank 50
Flavelle Township 51
Allen-Coghill Claims 51
Eby Township 52
Lucky-Kirkland Gold Mines, Limited 52
Notes for Prospectors 53
Burt, Holmes and Flavelle Townships 53
Alma Township 53
Eby Township 53
Barite 54
Biederman Deposit 54
Yarrow Deposit 54

GEOLOGY OF THE MARTIN-BIRD PROPERTY IN HEARST TOWNSHIP

Introduction 56
General Geology 56
Structure 57
Description of Ore Bodies 58
Conclusions 58

NOTES ON SOME PROPERTIES IN LEBEL TOWNSHIP

Introduction 59
Description of the Properties 59
Moffatt-Hall Mines, Limited 59
Bidgood Kirkland Gold Mines, Limited 60
Kirkland Gold Belt Mines, Limited.. 60
Other Properties 61

ILLUSTRATIONS

	PAGE
Specimen of Young-Davidson ore	*frontispiece*
Floating bridge across Mistinikon lake	4
Settlement at Matachewan townsite looking east, 1933	6
Timiskaming conglomerate south of Kenogami station	15
Photomicrograph of diorite, northeastern part of Flavelle township	17
Photomicrograph of granite from the batholith in Baden and Alma townships	18
Photomicrograph of a basic dioritic rock which is a phase of the granite stock in Bannockburn and Powell townships	19
Photomicrograph of typical porphyry characteristic of granite apophyses	20
Photomicrograph of syenite porphyry, Matachewan area	22
Photomicrograph of syenite porphyry from the Young-Davidson mine	23
Cobalt conglomerate lying unconformably upon a diabase dike of Matachewan age	25
Porphyritic diabase (Matachewan), west of Matachewan townsite	26
View looking north over Davidson creek at the Young-Davidson mill	31
Photomicrograph of a polished section of Young-Davidson ore	33
Trench-sampling by the Hollinger Consolidated Gold Mines on the Young-Davidson property	34
Quartz stockwork on the Young-Davidson property	35
Specimen of typical ore from the 160-foot level, Matachewan Consolidated mine	37
Photomicrograph of a polished section of Matachewan Consolidated ore	41
Quartz stringers in the "South" dike, McNeil Syndicate	49

SKETCH MAPS AND PLAN

	PAGE
Key map showing the position of the Matachewan-Kenogami area	1
Geological sketch map of part of the properties of Young-Davidson Mines, Matachewan Consolidated Mines, and Bloom Lake Consolidated Mines	*insert facing* 36
Plan of the 160-foot level east, Matachewan Consolidated mine, showing the ore bodies	40
Sketch map of the claims of Baden Gold Mines	45
Geological sketch map of the Martin-Bird property	*insert facing* 56

COLOURED GEOLOGICAL MAPS

(In pocket at back of report)

Map No. 44a—Matachewan Gold Area, Townships of Powell and Cairo, District of Timiskaming, Ontario. Scale, 2,000 feet to the inch.

Map No. 44b—Matachewan-Kenogami Area, District of Timiskaming, Ontario. Scale, 1 mile to the inch.



Specimen (natural size) of Young-Davidson ore showing syenite, quartz, coarse cubic pyrite, and gold (white).

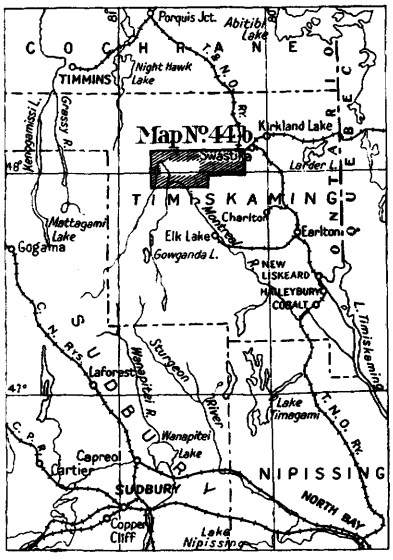
Geology and Ore Deposits of the Matachewan-Kenogami Area

By W. S. Dyer

INTRODUCTION

History

The recent entry of Hollinger Consolidated Gold Mines, Limited, and Ventures, Limited, into the Matachewan area has directed fresh interest to this old camp. The Hollinger, after intensive sampling of the Young-Davidson property in Powell township, assumed control of the property in August, 1933, and at once prepared to erect a mill; on September 8, 1934, production was begun at the rate of 500 tons per day. Ventures, Limited, after completing



Key map showing the position of the Matachewan-Kenogami area. Scale, 60 miles to the inch.

an extensive programme of development work by drifting, diamond-drilling, and sampling on the old Otisse property (Matachewan Canadian) also decided to erect a mill; work was begun on it on August 1, 1934, and the mill started production at 85 tons per day early in November of the same year. These properties, with that of the Ashley Gold Mining Corporation, Limited, in Bannockburn township about 13 miles to the west, make three producing properties in the Matachewan area.

Desultory prospecting had been carried on in the Matachewan area from time to time since the discovery in 1906 of silver in James township at Elk lake, and some gold had been found in the southeastern part of Alma township and in the north central part of Cairo township. The first real interest in the

area, however, was started by Jake Davidson's discovery in 1916 of gold on Davidson creek, on what is now part of the Young-Davidson property, and by Sam Otisse's discovery shortly afterwards on claims a short distance to the east, now part of the Matachewan Consolidated property.

In subsequent years both of these properties were investigated by various companies; the Young-Davidson chiefly by the Porcupine Goldfields Development and Finance Company, Limited, and the Matachewan Canadian by the Colorado-Ontario Development Company, Limited, which in 1919 was reorganized under the name of Matachewan Gold Mines, Limited. Work was discontinued, however, as the ore was considered too low in grade to be mined. From about 1924 the properties lay idle until, with the rise in the price of gold, the attention of the mining companies was again aroused, and production was started.

Previous Geological Work

A. G. Burrows summarized the early references to the area as follows:[1]—

In 1875 Robt. Bell, of the Canadian Geological Survey, made an exploration survey of a route from Lake Huron to James bay.[2] In his report he describes the east and west branches of the Montreal river, which flow through the Matachewan area. The geology is of necessity very briefly described, but reference is made to the conglomerate and other rocks along the route. The igneous rocks are for the most part called diorite, a general term for the basalt, diabases and other rocks in the complex of basic igneous rocks. Bell describes a quartz vein containing specular iron ore, along the East branch, about ten miles south of the junction with the main Montreal river.

In the Report of Survey and Exploration of Northern Ontario, 1900, J. L. R. Parsons,[3] geologist with Exploration Survey Party No. 3, gives a brief description of the geology along the Montreal river where it traverses the Matachewan area. He obtained low values in gold from two samples of quartz and pyrite in veins near the first rapid below Fort Matachewan.

In 1903 G. F. Kay made an examination of an area to the southwest of Lake Abitibi. His report has a description of a canoe route from the Black river to Fort Matachewan. Part of this route is shown in the northeast portion of the accompanying geological map of the Matachewan gold area. Microscopical descriptions of rocks occurring on Turtle, Separation and other lakes in the Indian Reserve or in Alma township, are given in Mr. Kay's report.[4]

In 1911, the Bureau of Mines, Ontario, published a sketch map, by W. M. Goodwin, showing part of the geology of the area between Porcupine and Gowganda. On this map the geology of part of the west portions of Powell and Baden townships is given.

In 1914, P. E. Hopkins, of the staff of the Bureau of Mines, examined claims in Yarrow township, on which iron ore was reported, and also some fluorite and barite veins in Cairo township.

Following the gold discoveries in Powell township in 1916, the area was surveyed geologically by A. G. Burrows[5] and H. C. Cooke.[6] Burrows spent the summer of 1917 in the area and surveyed the townships of Powell, Cairo, Baden, and Alma, and the northern parts of Yarrow and Kimberley. The township boundaries and water routes were traversed, and some sections away from the waterways were made. In a report published in 1920 he described fully the property of Matachewan Gold Mines, Limited, now Matachewan Consolidated Mines, Limited.[7] Cooke spent the summers of 1917 and 1918 in the Matachewan area and covered a greater area than Burrows, including Hincks, Argyle, Montrose, and Bannockburn townships. He also studied in

[1]A. G. Burrows, Ont. Bur. Mines, Vol. XXVII, pt. 1, 1918, p. 217.

[2]Robt. Bell, "Report on an exploration in 1875 between James bay and Lakes Superior and Huron," Geol. Surv. Can., Rept. of Progress, 1875-76, p. 301.

[3]Page 111.

[4]Geo. F. Kay, "The Abitibi Region," Ont. Bur. Mines, Vol. XIII, pt. 1, 1904, p. 112.

[5]A. G. Burrows, Ont. Bur. Mines, op. cit., pp. 215-240.

[6]H. C. Cooke, Geol. Surv. Can., Mem. 115, 1919.

[7]A. G. Burrows, Ont. Dept. Mines, Vol. XXIX, pt. 3, 1920, pp. 57-62; reprinted in Bull. No. 77, 1931.

detail the property of Matachewan Gold Mines.[1] In 1931, as a result of the Ashley discovery and the prospecting activity which ensued, H. C. Rickaby[2] made a report on the Bannockburn area, which includes Bannockburn, Montrose, Hincks, and Argyle townships, lying west of the area described in this report.

Scope of the Present Report

Since the work of Burrows and Cooke was completed, development work has been done on many claims, and gold discoveries have been made at several widely scattered localities; the country has been burned over, uncovering rocks that had formerly been buried under moss and forest growth. Accordingly, it was thought advisable to make a fresh detailed study of the area, and the writer with one assistant commenced work there in June, 1933.

On properties where recent development work had been done or was still in progress, claim boundaries and, in some cases, base lines had been recently cut, and traversing at close intervals was possible. In the case of the Young-Davidson and the western claims of the Matachewan Consolidated properties virtually all outcrops were mapped. Elsewhere, most of the claims had been staked for 15 years and boundaries could not be followed, and it was possible to locate only a few of the corner posts. Here traverses were for the most part made from known points on the Elk Lake–Ashley highway or on rivers and lakes.

In 1933 the townships of Powell and Cairo and most of Baden were covered. In the late winter of 1934 the Forestry Branch of the Ontario Government made an aerial photographic survey map of the townships between Matachewan and Kirkland Lake, including Holmes, Burt, Eby, and the northern halves of Flavelle, Gross, and Blain. June, July, and August of the following summer, therefore, were spent by the writer and three assistants in mapping the geology of these townships and Alma township, and in completing work in the township of Baden. A map of the townships of Powell and Cairo (No. 44a), on a scale of 2,000 feet to the inch, and a map of the entire area (No. 44b), on a scale of one mile to the inch, are included in the present report.

Acknowledgments

The writer is indebted to his assistants, particularly G. H. Charlewood, his only assistant in 1933, and G. M. Furnival, his first assistant in 1934, for unstinting co-operation in the field and for valuable advice in writing this report. E. H. Shaw and B. C. Coles were also very efficient assistants during 1934. A. W. Derby, who is making a critical study of the porphyries of the Matachewan and Kirkland Lake areas for his doctorate thesis at the University of Toronto, has helped considerably in the microscopic study of these rocks.

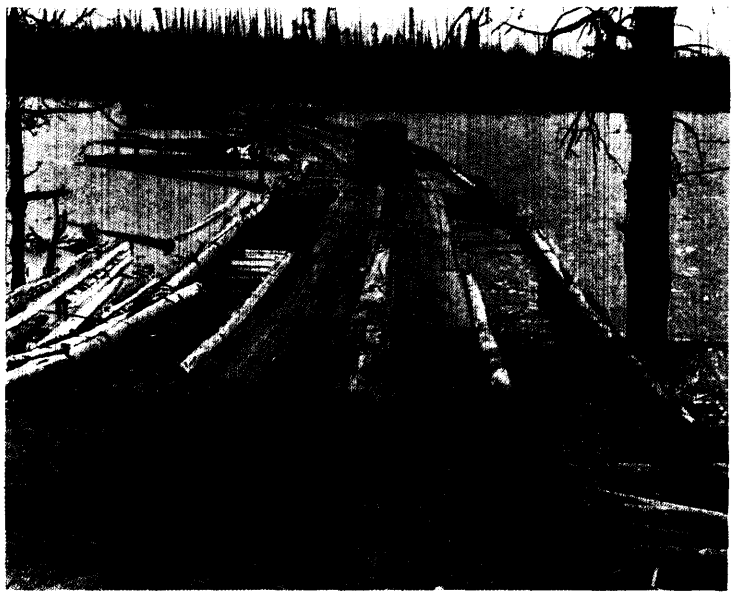
It is possible to name only a few of the many individuals, chiefly prospectors and officers of mining companies, who extended courtesies during the progress of the work. J. B. Moyneur and the late Mrs. Moyneur, at whose hotel the writer and his assistants stayed for several weeks, could not have been more hospitable and helpful. The late William J. Shields, who had long been active in the Matachewan area, aided the writer in many ways. W. C. Young and A. P. Dunbar also extended many courtesies. Various members of the staffs of the Hollinger Consolidated Gold Mines, Limited, particularly

[1]H. C. Cooke, op. cit.
[2]H. C. Rickaby, Ont. Dept. Mines, Vol. XLI, pt. 2, 1932.

W. P. Murdoch and D. J. Ludgate, and of Ventures, Limited, especially E. C. Craig and T. H. Wells, assisted in innumerable ways. Geological maps were drawn for photo-lithography by J. F. Jameson.

Access to the Area

In the early days of the camp a canoe route was used up the Montreal river from Elk Lake, the terminus of the branch line of the Temiskaming and Northern Ontario railway that leaves the main line at Earlton Junction. This 30-mile trip was arduous, owing to the swift water in the river above Indian chute and to the three portages. Later a gasoline boat was utilized as far as the foot of Long portage, with one short portage around Indian chute. An



Floating bridge across Mistinikon lake.

alternate route from Elk Lake required transportation of supplies and canoes over the Gowganda road to Longpoint lake, from which there is a water route downstream by way of the East branch of the Montreal river. In 1931, after the discovery of the Ashley mine, work began on an old road from Elk Lake following the Montreal river, and in 1932 this was made passable for motor trucks as far as the Ashley mine. This road has from time to time been improved and now forms the chief means of access to the area. The distance from Elk Lake to the Matachewan townsite is 24 miles, and the Ashley mine is 14 miles farther west. Airplanes can land at several points on rivers and lakes in the area, and the Hollinger Consolidated Gold Mines, Limited, have their own airplane which flies regularly between Porcupine lake and Mistinikon lake above the floating bridge. The survey of a proposed road from Matachewan to Swastika has been completed by the Department of Northern Development, and work has been started on it at the east end.[1] The distance from

[1]This road is shown on map No. 44b as a finished road. About 5 miles of it, at the Kenogami end, has been constructed. The rest is located only, and should be noted as a proposed road.

Matachewan townsite to Swastika by this survey is 28 miles, only 4 miles farther than the road from Matachewan to Elk Lake.

Trails and roads connecting with the Elk Lake–Ashley highway lead to various parts of the area; one of them crosses Powell creek and extends for 5 miles into Baden township, passes the Arbade and French properties, and terminates at the properties at the head of Matachewan lake (Baden, Central Matachewan, and Thesaurus). The last-named properties, however, are usually reached in the summer by canoe or motor boat from Matachewan townsite; the distance is only 12 miles and there is but one short portage at Old Woman rapids. Trails lead from the head of Matachewan lake northwest into McNeil township and northward to a chain of lakes on the water routes to Radisson, Watabeag, and Night Hawk lakes. A trail extends from Montpetit's farm at mileage 20 of the highway in a northeasterly direction for 6 miles past St. Paul and Morrison lakes to the Allen-Coghill claims at Wyley lake in Flavelle township; a branch leads off to the Brookbank claims in Holmes township.

Any part of Eby township can be easily reached from the Ferguson highway or from roads which lead off it, but Burt township and the eastern part of Holmes are difficult of access. There are no navigable waterways and no roads. A good trail, however, connecting to the southwest with the Elk Lake highway, extends from the Allen-Coghill camp eastward through the northern parts of Flavelle and Gross townships (where it is shown on the map as a road) to the transmission line, and thence runs along the transmission line through Eby township to connect with the Ferguson highway. To reach any point in the eastern part of Holmes township or the western part of Burt, one must strike off across country from this trail. The eastern and southern parts of Burt township may be reached by a trail which extends south by west from the southwest bay of Kenogami lake. Trails also lead westward from Kenogami lake to Bompas and Burt lakes.

Natural Resources

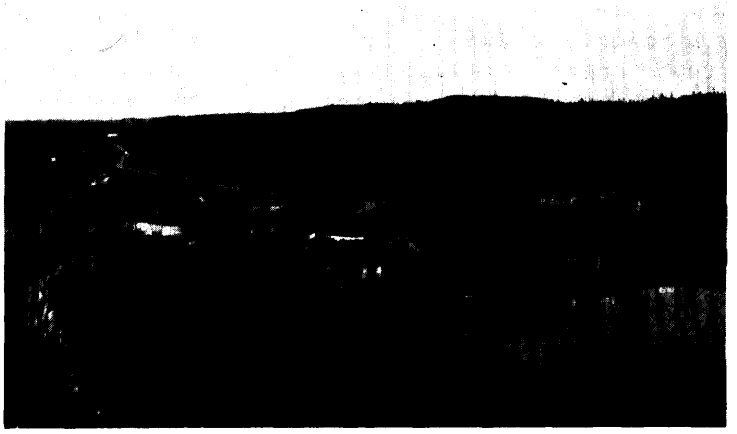
The only waterfall capable of generating electric energy in the Matachewan-Kenogami area is at Matachewan falls in Baden township, where Mistinikon lake empties into Matachewan lake. The head here is 40 feet. A dam has been constructed, but no power-house has been built, and the dam is used as a control by the power development at Indian chute. The area is well served by the power companies, however; the high-voltage transmission line of the Canada Northern Power Corporation, Limited, connecting the Quinze with the power developments on the Mattagami river near Timmins, crosses Cairo, Powell, and Baden townships. There is a transformer station at Matachewan falls, from which a branch line leads off to the Ashley mine. The transmission line of the same company from Indian chute to Kirkland Lake also crosses Gross and Eby townships. The Young-Davidson and Matachewan Consolidated mines are served by the Hydro-Electric Power Commission of Ontario, whose line from Abitibi canyon to Kirkland Lake is extended over the same right of way as the Kirkland Lake–Indian Chute line as far southwest as concession II of Gross township, from which point it leads almost due west to Matachewan townsite, and from there to the mines.

Very little timber is left in the Matachewan area. What was not burned was cut down by the Booth Lumber Company in their drive a few years ago. In the Kenogami area some good timber is still standing. Part of the mine timber

for the Kirkland Lake camp comes from Eby township, where it is harvested by Finnish settlers.

The western part of the area is not suitable for farming. There is, however, enough good soil to grow garden vegetables at the mines and in Matachewan townsite. In Eby township there are extensive areas of low, flat land, part sandy and part swampy, which eventually may be made into farms. Within the area fishing is poor.

The earliest settlement in the area was at the old Hudson's Bay post (now abandoned) at Fort Matachewan, which has given the name to the area. A few Indians still make the old fort their headquarters, and Steve L'Africaine, who was for many years the factor of the post and who has nearly reached the century mark in years, is still living among them. The chief settlement at the present time is at Matachewan townsite, where the Elk Lake–Ashley road crosses the Montreal river. Several hotels and stores have been built, and the population is rapidly growing.



Settlement at Matachewan townsite looking east, 1933.

Physical Features and Glacial Deposits

The topography of the western part of the Matachewan-Kenogami area is in general rugged and rocky. Rapid changes in elevation of 50 feet and 100 feet are frequent, and several hills reach heights of 200 feet or more. The Cobalt series is resistant to erosion and forms high hilly country. The diabase dikes also tend to stand out in relief and at certain localities form high hills, such as those west of Log lake and east of Fort Matachewan. In the western part of the area, and as far east as the Englehart sand plain, glacial till deposits are thin and rock outcrops are frequent and of wide extent. There are some rather extensive sand plains, however, particularly in the western part of Baden township and in Cairo township around Moyneur lake.

In the eastern part of the area the sand plain through which the Englehart river flows extends in a northwest-southeast direction through Holmes, Burt, and Gross townships, with an average width of 1½ miles. It is very flat and featureless, except in the immediate vicinity of the river and creeks, where there are steep gullies. This sand plain was probably formed by the Englehart river in the early part of its history when it was larger than it is now and carried sand

southward from the extensive sandy areas between Matachewan and Porcupine. The Englehart river is now small and meandering, and is navigable only to the south boundary of Burt township.

East of the Englehart sand plain the country, with the exception of that part underlain by the Cobalt series, is quite flat with large stretches of muskeg and sand. Rock outcrops are less extensive than they are in the western part of the area.

Practically the whole of the four western townships is drained by the Montreal river and its tributaries into Lake Timiskaming, and eventually into the St. Lawrence river. The height-of-land crosses the northwestern part of Baden township, north of which the waters flow northeastward into James bay. The eastern part of the area is drained by the Englehart river and Crooked creek, branches of the Blanche river, which drains into Lake Timiskaming.

The largest lakes in the area are Kenogami lake in the northern part of Eby township, Matachewan lake in Baden township, and Mistinikon lake in Powell township. Kenogami lake is used extensively in summer by campers, since it is only 4 miles from Swastika by the Ferguson highway; it is three miles long and 1 mile wide, with a long northern arm. Matachewan lake is really an expansion of the Montreal river. It has an average width of a quarter of a mile and extends for 8 miles between high rocky banks. The construction of the dam at Matachewan falls has flooded the West branch of the Montreal river for at least 10 miles above it, and this part of the river is now actually a lake and continuous with Mistinikon lake, which extends through the southern part of Powell township and through Yarrow.

There are few instances in the area of physical features being determined by pre-existing structure in the rocks. Part of Mistinikon lake, as well as part of the Montreal river above Matachewan townsite, follows large north-south faults. It is possible also, as noted elsewhere, that the northward-trending chain of lakes in the southwestern part of Holmes township and in the eastern part of Cairo follow faults or faulted zones.

An interesting physical feature has been the diversion of the West branch of the Montreal river from its former to its present course. Burrows[1] describes this as follows:—

> At one time the river flowed easterly from a point one and a half miles north of the south boundary of Powell, through what are now the Davidson claims, and emptied into the Montreal river a mile north of the junction with the East branch. The ancient channel followed for three-quarters of the distance the course of Davidson creek, shown on the map. From a small pond [claim No. 5,400] at the end of the small stream flowing to Davidson creek there is a depression for three-quarters of a mile to the present West branch [Mistinikon lake]. The divide between this pond and the West branch is 17 feet above the latter, in low water, as determined by Sutcliffe and Neelands in their hydro-electric survey of Matachewan or Big Bend falls.[2] At the west end of the pond there is a large dry pot-hole in the greywacké slate formation, and also a large cavern-like basin in the pond itself which had been formed by the cutting action of a strong eddy in the old river. For a half mile along Davidson creek, near Davidson camp, there is an accumulation of huge boulders along the bed of the old stream, while near Davidson's landing [Moyneur's hotel], at the mouth of the creek, there are numerous large pot-holes in the Keewatin rocks. . . . The West branch empties into Lake Matachewan at Matachewan falls, where there is a drop of 41 feet in 600 feet. The diversion of the river from its former course has been quite recent, geologically speaking, since the falls have been carried back only a short distance from the lake, with practically no gorge. There are two small rapids above the falls and below Mistinigon lake,[3] and it is probable that formerly this lake was a long narrow body of water closed at its north end, and discharging easterly from opposite the big island.

[1] A. G. Burrows, Ont. Bur. Mines, Vol. XXVII, pt. 1, 1918, pp. 218, 219.

[2] This is now less, since the West branch has been flooded by the construction of the dam at Matachewan falls.

[3] These have now been flooded out.

GENERAL GEOLOGY

The oldest and most extensive formation in the Matachewan area is the Keewatin, which consists almost wholly of volcanic flows and volcanic fragmentals. Prominently developed in Powell and Cairo townships are the conglomerates, quartzites, cherts, and other sediments of Timiskaming age, which are in the form of two parallel eastward-trending synclines closely folded within the Keewatin. The formations have been so closely folded that the dips approach the vertical. The strike of the beds is east to northeast, conforming to that of the Kirkland Lake area. The Keewatin and Timiskaming formations, although they occur in more or less interrupted bands, are thought to be continuous from the Matachewan to the Kirkland Lake area, but in Burt township they are hidden by a wide ridge of Cobalt formation and by the broad sand plain which borders the Englehart river. Intruding the Keewatin and Timiskaming formations are a large number of stocks and dikes of igneous rock, ranging in composition from basic diorite to granite and including syenites and syenite porphyries of widely varying types, which are all regarded as Algoman. A series of diabase dikes, which trend nearly north and south, occur with great regularity over most of the area. They may be considered as the last manifestation of Algoman activity but are usually classed by themselves in the Matachewan formation.

The gold deposits of the area are found in these early pre-Cambrian rocks, and most of them are closely related to one or more of the types of syenite porphyry. They are found either in the porphyries themselves or in the Keewatin adjacent to the porphyry. The most important deposits found up to the present time are linked with some marked structural feature, such as the belt of weakness between the Timiskaming and the Keewatin.

Lying with very marked angular uncomformity upon the earlier pre-Cambrian formations is the Cobalt conglomerate. It is a much fresher-looking formation than any of those upon which it lies, and its attitude is much flatter. It is distributed along the southern edge of the Matachewan area but at intervals sends long tongues northward to lie upon the Keewatin and Timiskaming. Its only economic importance is negative, in that it covers rocks which otherwise might have been good prospecting ground.

The Keweenawan is represented by at least one dike of diabase, which cuts through the Cobalt conglomerate in Powell township.

Table of Geological Formations

QUATERNARY	
PLEISTOCENE:	Glacial sands, gravel, and till; fluviatile sands and gravels.
PRE-CAMBRIAN	
KEWEENAWAN:	Quartz diabase.
	Intrusive contact
COBALT SERIES:	Conglomerate, greywacké, argillite, arkose.
	Great unconformity
MATACHEWAN:	Quartz diabase dikes.
	Intrusive contact
ALGOMAN:	Lamprophyre. Syenite porphyry, basic syenite. Syenite. Granite and granite porphyry. Diorite.

Intrusive contact

TIMISKAMING:	Quartzite, chert, argillite, greywacké, slate. Conglomerate, conglomeratic quartzite, conglomeratic greywacké.

Erosional unconformity

KEEWATIN:	Volcanics: andesite, basalt, rhyolite, dacite, and their tuffs and agglomerates. Carbonate schist. Sediments and iron formation (rare).

Keewatin

The Keewatin formation consists chiefly of basalts, andesites, tuffs, and agglomerates. Rhyolites, dacites, sediments, and iron formation are of sporadic occurrence only. In Powell and Cairo townships the predominant type is basalt and andesite, but tuffs are quite abundant, and some good examples of agglomerate may be seen. North of the northern syncline of Timiskaming sediments, tuffs become increasingly more abundant until in Baden and Alma townships the outcropping rocks are mainly tuffs or agglomerates. Tuffs and agglomerates are also extensive in Argyle township and the northern part of Bannockburn. The agglomerates are particularly coarse along the Ashley road in Bannockburn township.

In Flavelle township and the southern part of Holmes the frequent alternation between flows and tuffs suggests thin flows interbedded with pyroclastics. In the northern part of Holmes township the Keewatin rocks are mainly finely banded tuffs; in the southern part of Burt, also, banded tuffs predominate, but in the northern part the Keewatin rocks are greenstones highly affected by granitic injection. In Eby township, the Keewatin consists mostly of flows, in which are several good examples of pillow lava.

Andesites and Basalts

No sharp line is drawn in this report between basalts and andesites; basalts are regarded as the darker, more basic looking types, and andesites as the somewhat lighter-coloured types which often show phenocrysts of feldspar. These rocks consist essentially of plagioclase and hornblende or pyroxene, but they have been altered to the familiar type known as greenstone. In this process the ferromagnesian constituents have been altered to chlorite or secondary hornblende, and the plagioclase has been sericitized and saussuritized; epidote and magnetite altering to leucoxene are prominent as secondary minerals. Although alteration and shearing have been intense in many places, particularly in the southern parts of Powell and Cairo townships, flow structures are often preserved. Pillow lavas are quite commonly found, and amygdaloidal and spherulitic beds, ropy horizons, and brecciated zones are also seen locally. Excellent pillow lavas may be seen east of the floating bridge, north of the Ashley road, and also in the northeastern part of Eby township along the Ferguson highway.

Coarse diabasic or dioritic rocks were found in a few places in the area. These are more altered than the Matachewan diabase and are probably of Keewatin age. On the southeast bay of Separation lake in Alma township an altered diorite of this type shows intrusive relations to the agglomerates and is probably an ancient dike, but in most places no intrusive relations were seen and the rock would appear to be the coarse middle part of a flow. In the southern part of Burt township there is an extensive development of coarse-grained rocks made up almost entirely of black hornblende crystals with some porphyritic white

feldspar. They are interbedded with the tuffs and are, therefore, considered to be altered flows, but at places crosscutting relations with the tuffs were seen and it is possible that a basic intrusive is present as well, which has altered the flows to a hornblende-rich rock which can with difficulty be distinguished from the intrusive.

Rhyolites and Dacites

Rhyolites are of sporadic occurrence throughout the Matachewan-Kenogami area. Perhaps the most typical are those which occur on Hugh Kells' property in Cairo township in the southeast corner of claim No. 6,391, and near the cabin on claim No. 6,393. They are fine-grained, light-green rocks consisting of about equal amounts of orthoclase and plagioclase with minor amounts of biotite and quartz.

Medium-grey basic rhyolites were found in several places in the central part of Powell township between the two Timiskaming synclines. In the southwestern part of Baden township, near the transmission line from Matachewan falls to the Ashley mine, there are outcrops of rhyolite and basic rhyolite, some of which is amygdaloidal. One outcrop consists of amygdaloidal rhyolite lava having distinct pillows, with dimensions of 6 by 12 feet. Other occurrences of rhyolite were noted on the shores of Steve lake in Alma township, west of the lake north of Holmes lake in Holmes township, and 2 miles south of the southeast bay of Kenogami lake in Eby township.

Dark-green siliceous flow rocks, probably originally dacites, occur in the central part of Powell township between the two Timiskaming synclines, and were also seen in Cairo township on claim No. 10,030, south of St. Paul lake.

Tuffs

Although ordinarily there is no sharp division between tuffs and agglomerates, the finer-grained tuffs grading into the coarser pyroclastics with rounded to subangular fragments termed agglomerates, in the Matachewan-Kenogami area they do seem to be rather sharply divided in areal distribution and are hence described separately. Well-bedded medium-grained tuffs comprised largely of materials similar to the andesitic flows with which they are interbedded are found over most parts of Powell and Cairo townships. The tuffs in Baden township are more massive than those farther south in Powell, and there is more variation in grain; beds of fine-grained material can be seen alternating with beds of coarser material.

Tuffs of rhyolitic composition are of quite common occurrence. A white, finely banded, soft, carbonatized variety occurs on claim No. 5,372 of the Young-Davidson property in the altered schist zone lying just south of the syenite porphyry intrusion. Rhyolite tuff occurs with rhyolite on Hugh Kells' property in Cairo township on claims Nos. 6,391 and 6,393 and at several other localities in this vicinity. A peculiar white tuff, probably rhyolitic, was seen 1,000 feet east of the south end of Narrow lake in Cairo township.

Finely banded rocks, probably originally tuffs but now largely granitized by intruding igneous rocks, are found in a number of places in the Matachewan-Kenogami area. They are conspicuous on the shores of Blackburn lake in Alma township, where they are crumpled and thrown into folds by the nearby granite. Similar banded rock is the dominant type in the northern part of Holmes township between the granite batholith and the pink hornblende syenite stock. In Gross township, about one mile south of the northwestern corner of the township,

there are finely banded acid and basic tuffs with occasional bands of agglomerate. Bands of silica and hematite and magnetite, comprising a sort of iron formation, are interbedded with the tuffs. In the area of Keewatin rocks in the southeastern part of Burt township and extending over into the southwestern corner of Eby township there is much banded tuff. Similar rocks outcrop also on the east side of the granite in the eastern part of Eby township. These rocks were made the subject of detailed study by H. C. Cooke.[1]

Agglomerates

Agglomerates occur along with tuffs or by themselves at many localities in the Matachewan-Kenogami area. In Powell township spectacular beds, in which the rounded fragments or bombs reach a diameter of a foot, occur on the west shore of Hollinger lake. Very coarse agglomerates may also be seen along the highway between Matachewan townsite and the Ashley mine in the northern part of Bannockburn, the township adjoining Powell on the west. In these agglomerates the fragments or bombs are for the most part rounded or subangular and consist of materials resembling the andesitic or basaltic flows in the immediate neighbourhood; they differ from the groundmass in being slightly more acidic or basic.

In Alma township, on Turtle, Separation, Bird, and Beaver lakes, the north end of Bastian lake, and the south end of Squaw lake, the rocks largely consist of light-greenish or greyish agglomerates of a rather peculiar type. Both fragments and groundmass consist of rhyolitic material with small specks or larger laths of white and sometimes brown feldspar up to half an inch in length, giving them the appearance of feldspar porphyry. Similar rocks occur on Matachewan lake above Matachewan falls.

Sediments and Iron Formation

Sediments, other than pyroclastics, and iron formation are of infrequent occurrence in the Keewatin formation in the Matachewan-Kenogami area. On Matachewan lake, about half a mile southeast of Fort Matachewan, and also on the transmission line near by, there are outcrops of massive-bedded grey quartzites, similar lithologically to quartzites of the Timiskaming formation but apparently interbedded with greenstones. One mile to the southeast similar quartzite occurs and is apparently of the same horizon; its location so far to the south and off the regional strike is caused by its position on the opposite side of the great fault that passes north and south along Matachewan lake.

In Alma township, 600 feet north of the north end of Chief lake, there is an isolated outcrop of white-weathering, fine-grained, cherty, finely banded rock. Its general appearance strongly suggests Timiskaming quartzite, but since all the rocks round about are of Keewatin greenstone the rock may be a quartzite horizon in the Keewatin.

In Holmes township, along the south side of the small lake in the southern part of lot 9, concession III, there is a 6-foot bed of rusty-weathering, finely banded, massive to schistose, carbonate rock in a highly schistose, more resistant, carbonaceous material. North of the carbonate band there is a width of about 25 feet of carbonaceous schist. It is regarded as originally a bed of dolomite or limestone with the more resistant carbonaceous material intercalated as beds.

Iron formation is represented in the Matachewan-Kenogami area only by a few widely scattered exposures of limited extent. In Cairo township some bands

[1]H. C. Cooke, Geol. Surv. Can., Mem. 131, 1922, pp. 6, 7.

of iron formation occur on the claims of the Matachewan Pioneer Syndicate about one mile east of the Matachewan townsite. Incipient iron formation with narrow bands of dark chert and rusty greenstone with a little pyrite and pyrrhotite occur in the same township about one mile southeast of Fort Matachewan and also east of Narrow lake. There are lenses of sulphides, chiefly pyrite, at several other localities in Cairo and Powell townships, but these are later in age than the Keewatin and related to Algoman faulting.

In Gross township, about one mile south of the northwestern corner of the township, bands of silica with hematite and magnetite occur interbanded with Keewatin tuffs. In the southeastern part of Burt township, also, there are some thin bands of sulphides interbedded with the tuffs, and again in the eastern part of Eby township there are similar occurrences, but with the iron formation better developed as alternating bands of silica and magnetite.

Carbonate Schist

Along the southern contact of the southern syncline of Timiskaming sediments the Keewatin formation has been altered to carbonate schist for widths of 200 feet or more. The adjacent Timiskaming sediments also have been carbonatized, but not so extensively nor so thoroughly as the volcanics. The softer Keewatin beds, which along the contact with the Timiskaming are believed to have consisted in part of finely banded tuffs, were squeezed against the hard massive Timiskaming conglomerates by movement from the south in early Algoman time, which resulted in a wide shear zone along the contact. With the intrusion of the syenite porphyry later in Algoman time these rocks were extensively altered to carbonate schist In places quartz stockworks and lenses of pyritized grey schist, with which gold values are associated, were developed as a late phase of this period of igneous intrusion. This band of metamorphosed rock is best seen on the Young-Davidson and Matachewan Consolidated properties and is described in detail in the section dealing with these properties.[1]

To the west the band is first seen on claim No. 5,372 of the Young-Davidson group; it extends eastward across the Young-Davidson property and claims Nos. 5,379 and 5,380 of the Matachewan Consolidated property. On claim No. 5,402 it is virtually absent, since greenstones were seen next to the sediments, but on claim No. 5,396 it comes in again and appears to follow the contact to the Montreal river. On the west bank of the Montreal river the carbonate schists are nearly 1,000 feet wide, possibly owing to the comparatively flat southerly dips at this locality. On the east side of the river the schist band has been shifted to the north about 3,000 feet by the great north-south striking fault;[2] it has been followed eastward through the north end of Knott lake. There is a gradual change eastward in the character of the carbonatization as shown by the difference in weathering of the schist. Toward the west the schist is rusty-weathering, suggesting ankerite, with appreciable amounts of green chrome mica, either fuchsite or mariposite, whereas toward the east and on the Montreal river the schist weathers to a grey colour with little rust, suggesting calcite, and there is no green mica.

Some carbonate schist also occurs on the north boundary of the southern Timiskaming syncline in Powell township, about 1,000 feet north of Otisse lake, but elsewhere in the western part of the area the contacts between the Timiskaming and the Keewatin appear to be more or less free of it.

[1]See pages 35, 37–39.
[2]See page 29.

In the northern part of Eby township carbonate schist is found along the south contact of the Timiskaming sediments with the Keewatin volcanics. On the Lucky-Kirkland property it is within the sediments, but near the contact with the greenstones. Farther west, near the gravel road running south to the Finnish settlement, it crosses the contact into the greenstone. South of Kenogami lake the carbonate schist band appears to be in the sediments again, although close to the contact. The origin of the carbonate schist band in Eby township is probably similar to that in Powell township; it is related to a shear zone, which seems to form more readily along the south Timiskaming-Keewatin contact than the north, thus indicating that movement in general must have been from south to north; it also appears to be related to the intrusion of syenite porphyry in or near this shear zone. The relation of the carbonate schist to the syenite porphyry is not so clear in Eby township as in Powell; on the Lucky-Kirkland property and along the Ferguson highway there does appear to be a concentration of porphyry dikes in or near the carbonate schist band, but south of Kenogami lake few dikes have been found.

Timiskaming

The Timiskaming sediments are more extensively developed in Powell and Cairo townships than elsewhere in the Matachewan-Kenogami area. Here they are found in two definite synclines which extend from Mistinikon lake on the west to the Montreal river or Matachewan lake on the east. The synclines are each approximately one mile in width from north to south and are separated by an anticline of Keewatin rocks about one and a half miles in width. The synclines are interrupted at the two lakes by strong faults, which strike north and south. West of the Mistinikon lake fault the northern syncline has been thrown to the south about 3,000 feet, and the southern syncline is hidden under the Cobalt conglomerate. About half a mile west of Mistinikon lake the sediments are broken into by a stock of granite and do not appear again until Midlothian township is reached, a distance of 12 miles. East of the Montreal river and Matachewan lake fault the two synclines join to form one broad band of sediments, which is terminated by the syenite porphyry stock. A remnant of Timiskaming greywacké occurs on St. Paul lake in Cairo township and four discontinuous bands of conglomerate were located farther east, one in the northern part of Flavelle township and three in the southern part of Holmes. In Eby township immediately east of the Cobalt formation Timiskaming conglomerates appear again and continue as a band about half a mile wide along the south side of Kenogami lake and along the Ferguson highway to the Blanche river. Eastward the band gradually widens into the broad syncline of the Kirkland Lake area. Since the Timiskaming sediments are found on either side of the ridge of Cobalt series in Holmes and Burt townships, it follows that it is probably present along its regional strike under the Cobalt in these townships.

Southern Syncline of Powell and Cairo Townships

In the eastern part of the southern syncline, between the Montreal river and the Ashley road, the beds consist, for the whole width of the syncline, of conglomerates and conglomeratic quartzites and greywackés. A short distance west of the Ashley road, however, distinctly finer-grained beds, such as cherty quartzite, chert, slate, and banded argillite and chert make their appearance in the middle of the syncline and continue west to Mistinikon lake. This dis-

tribution of coarse and fine sediments forms the strongest evidence for the determination of the structure of the band as a syncline, but corroborative evidence is supplied by the occurrence of greenstone boulders in the basal conglomerates at certain localities on both sides of the syncline. Evidence afforded by volcanic flows, although indecisive, points to the tops of the flows facing north on the south side of the syncline and to the south on the north side.

The conglomerates, conglomeratic quartzites, and greywackés are massive-bedded and grey and greenish-grey in colour. Quite a common type of rock is a medium- to coarse-grained quartzite or greywacké with lenses of conglomerate, the lenses varying in width from a mere line of compressed pebbles to distinct lenses several feet in width. The pebbles in the conglomerate are subangular to rounded, but are sometimes compressed; in certain places all three shapes are mixed together. On the whole the pebbles are not large; in some of the basal conglomerates near the sides of the syncline they reach 4 to 6 inches, but generally they are 1 to 2 inches. Pebbles noticed were of decayed grey granite, jasper, quartz, gritty quartzite, grey and black chert, andesite, and rhyolite; the matrix usually consists of quartzose or chloritic greywacké.

The quartzites vary in occurrence from massive beds up to 2 feet in width, of coarse-grained material, to thin beds of cherty material. The colour is usually light-grey or greenish-grey, but some of the cherty material is black. Toward the western end of the syncline is found a distinctive type of sediment composed of banded quartzite and argillite, the bands of quartzite being on the average one foot in width and those of argillite two inches.

Northern Syncline of Powell and Cairo Townships

The sediments of the northern band are almost all fine-grained. Types consisting of alternating bands of quartzite and argillite or chert, greywacké, and slate are prominent along the Ashley road, and on both sides of Mistinikon lake. Quartzites are well exposed on Matachewan lake between Old Woman rapids and Fort Matachewan. These fine-grained sediments are very similar to those of the western part of the southern syncline, and there is little doubt that at one time they were continuous with them.

Conglomerates are only occasionally seen, the best locality being on the northern end of the peninsula at Old Woman rapids. Here, they are basal in type with boulders, up to 6 inches in diameter, of rounded, subangular, and compressed shape; the lowest beds immediately overlying the Keewatin consist mainly of reworked greenstone.

There is a remarkable thinning of the conglomerates in a very short distance from south to north. In the southern syncline they are 3,000 feet thick, but in the northern syncline the greatest thickness observed, at Old Woman rapids, is about 1,000 feet; they are much thinner to the west and were not seen at all along the northern side of the syncline. They thin, therefore, from 3,000 to 1,000 feet in a distance of one and a half miles. The increasing thickness westward of the fine-grained sediments in the middle of the southern syncline may be due to a progressive change in sedimentation from coarse to fine, or it may be caused by a westward plunge of the syncline.

The determination of the synclinal structure in the northern band of sediments is based chiefly on the study of grain sizes. Along the Ashley road there are numerous outcrops of banded sediments. Good bedding planes are exhibited, and within the bed the material grades very gradually and evenly from a rather coarse quartzite on one side, presumably the bottom of the bed, to an argillite

or chert on the other side, the top of the bed. Many such determinations were made, and it was found that in the northern 2,000 feet the bottom of the beds was toward the north, whereas in the southern 3,000 feet the bottom was toward the south. Assuming that the structure is a simple syncline and that the dips are vertical, which is the rule, the thickness of these sediments is in the neighbourhood of 2,500 or 3,000 feet.



Timiskaming conglomerate in railway cut south of Kenogami station.

Flavelle, Holmes, and Eby Townships

Three narrow bands of Timiskaming conglomerate were found in Holmes township, two northwest of the lake (locally known as Galer) north of Holmes lake, and the third near Holmes creek, one and a half miles east of Galer lake. Another band occurs a quarter of a mile west of Middleton lake in Flavelle township. In all these bands the beds consist of a light-grey to dark-green or black fine-grained material, with numerous well-packed, poorly sorted angular to rounded pebbles and boulders, up to one foot in length. The pebbles are of greenstone schist, rhyolite, chert, vein quartz, and grey granitic material. The strike of the beds is from east to northeast, and shearing is well developed, in places intense, with the strike usually parallel to the strike of the beds; the dip in most cases is almost vertical. Only at Galer lake was the relation of the

Timiskaming to other formations at all clear. Here the south contact with Keewatin agglomerates, the only contact which could be clearly seen, was transitional.

In Eby township the Timiskaming sediments form a band about half a mile wide extending east-northeast from the ridge of Cobalt formation along the south side of Kenogami lake to the Blanche river at the east boundary of the township. From the Blanche river it gradually widens into the broad syncline of the Kirkland Lake area. The formation in Eby township is largely conglomerate, although finer-grained rocks, such as greywackés or quartzitic arkoses, were seen in some localities. The best exposures are along the Ferguson highway and in the railway cut, a quarter to half a mile south of Kenogami station. South of Kenogami lake drift is rather heavy and exposures are scattered and small in extent.

Near the junction of the Ferguson highway and the gravel road running south to the Finnish settlement, there is a tabular mass of feldspar porphyry in the conglomerate. This mass strikes N. 85° E. and is about 10 feet wide. It consists of light- to dark-grey orthoclase and plagioclase phenocrysts up to an eighth of an inch in diameter, with augite as the ferromagnesian mineral, in a dark-brown groundmass of variable grain size consisting of the same minerals as the phenocrysts; quartz eyes are visible in some places. Several features suggest that this porphyry is older than the conglomerate. Although the contact of the porphyry and the conglomerate is sharp there are no chilled edges in the porphyry; pebbles of the porphyry were found in the conglomerate, and the porphyry outcrops topographically lower than the conglomerate in such a way as to suggest that it had never cut through it.

Relationship of the Timiskaming to the Keewatin

The Timiskaming of the Matachewan area is separated from the underlying Keewatin by an erosional disconformity at least. This is shown by the fact that the coarsest conglomerates in most places immediately overlie the Keewatin, and also by the fact that the conglomerates containing greenstone pebbles and boulders, or conglomerates made up of reworked greenstone, were found immediately overlying the Keewatin. Transitional stages with alternating tuffs or flows and sediments, such as are found in the Swayze area to the west, do not occur, with the possible exception of the locality northwest of Galer lake previously mentioned.

Some evidence was obtained in Powell township suggesting an angular unconformity between the Timiskaming and the Keewatin. In the volcanics between the two synclines in the region between the Ashley road and Mistinikon lake, spherulitic lava was found in four places over a distance of 8,000 feet. These localities line up in a direction of E. 20° S. Since spherulitic material is otherwise of rare occurrence in Powell township, it is possible that the four occurrences belong to the same bed. If so, its strike does not conform to the strike of the northern syncline but makes an angle of 30 degrees with it. More work, however, must be done to determine whether the spherulitic material does actually belong to the same bed. In general the strike and dip of the Timiskaming appears to conform fairly closely with that of the Keewatin.

Characteristic Features of the Timiskaming of the Matachewan Area

The Timiskaming of the Matachewan area differs from that of Kirkland Lake and Larder Lake to the east and Swayze to the west in its lack of volcanic

constituents, either flows or tuffs, and in the greater thickness of quartzite and fine-grained banded beds. In these features it more closely resembles the Timiskaming of the Porcupine area.

Algoman

Diorite

In the Matachewan-Kenogami area there are several bosses of basic rock, which, although of uncertain age relationship, are grouped together because of their general similarity. In the case of the occurrences in Powell and Cairo townships some evidence was obtained pointing to an early Algoman age (pos-



Photomicrograph of diorite, northeastern part of Flavelle township, showing abundant hornblende in a groundmass of altered feldspar. (×90.)

sibly Haileyburian of some writers), but the rocks in the eastern part of the area occur as isolated bosses and differ in character among themselves as well as from that of the western part of the area.

Powell and Cairo Townships.—On Mistinikon lake in the southern part of Powell township, and in Cairo township in several outcrops centring about Montpetit's house at mileage 20 on the Ashley road, the rocks, when least altered, consist of coarse-grained hornblende and plagioclase and may be termed basic diorite, but they have in large part been altered irregularly to serpentine, chlorite, and carbonate. The serpentine rock and the diorite are parts of the same intrusive mass, but it is possible that the former was originally a more basic differentiate, such as pyroxenite. On Mistinikon lake the basic intrusive cuts the Timiskaming sediments but is itself sheared in a direction parallel to the strike of the sediments and is possibly older than the granites. In Cairo township

the bosses cut greenstone, and at least one of them is intruded by a small granite dike. The Cairo bosses have been sheared much less severely than those in Powell.

Eby Township.—At the northeastern corner of Eby township, south of the Ferguson highway, a mass of diorite occupies an area of one square mile. The diorite is usually composed of hornblende and dark feldspar, but it is variable in composition and texture. In places quartz eyes are present. The rock may be fine-grained or coarse-grained, and in places it is porphyritic, with hornblende phenocrysts up to half an inch in diameter. Much of it, especially the finer-grained types, shows distinct ophitic structure. The various types usually grade



Photomicrograph of granite from the batholith in Baden and Alma townships showing orthoclase, plagioclase, quartz, and hornblende. (×90.)

into one another, but in places dikelets of one type of diorite cut masses of other types. South and southwest of the main mass of diorite there are subsidiary offsetting masses, apparently dikes, some of which are sheared. Whether the diorite is post-Timiskaming or not could not be definitely determined.

Holmes and Flavelle Townships.—In the southeastern part of Holmes township and the northeastern part of Flavelle township, there is a boss of greenish-grey, medium-grained diorite composed of about equal proportions of white feldspar and a dark-green ferromagnesian mineral, which in places can be recognized as hornblende. Thin sections show extensive alteration, both of the hornblende and the feldspar; the hornblende has frayed out and become fibrous, and the feldspar has been altered to epidote and kaolin. Some of the better preserved crystals of feldspar were determined to be albite. The dimensions of the boss are not known, as on the northwest side it is uncomformably overlain by the Cobalt formation, and on the east side it is bounded by the sand plain of

Englehart river. Little is actually known of its age relationships; it cuts Keewatin greenstone, and inclusions of the greenstone are found in it in various places; it is cut by Matachewan diabase dikes, and by at least one feldspar porphyry dike.

Granite and Granite Porphyry

The Keewatin trough of the Matachewan-Kenogami area is bounded to the north and to the south by granite batholiths, the intrusion of which has caused the greater part of the folding of the Keewatin volcanics and Timiskaming sediments. The granite at most localities is much the same, being a medium-



Photomicrograph of a basic dioritic rock which is a phase of the granite stock in Bannockburn and Powell townships, showing pyroxene and altered feldspar. (×90.)

grained hornblende type of grey, red, or brownish colour. Under the microscope it is seen to consist of orthoclase, albite, microcline, and plentiful quartz. Accessory minerals include apatite, zircon, titanite, magnetite, and pyroxene. In some places, such as in the long tongue that extends through the southern parts of Eby and Burt townships, the granite tends to become porphyritic. In the southern townships, Cairo, Flavelle, Gross, and Blain, gneissic structure is common; and near the contact with the Keewatin and sometimes for considerable distances into the batholiths various marginal features are seen: injection gneiss, inclusions of greenstone, *lit par lit* injection, and syenitic or dioritic phases of the granite. To the north these marginal features are not so well marked and gneissic structure is rare, but in some places there are basic phases and in others the adjacent greenstone has been granitized to some extent and rather severely folded and crumpled. Occasionally, also, the granite in the northwestern part of Holmes township and the northeastern part of Alma shows porphyritic structure and is cut by "aplite" dikes. In the Indian Reserve there are extensive

phases of hornblende and quartz hornblende diorite, which are considered to be early differentiates of the granite. In the northern part of Baden township the granite tends to be finer-grained and darker than elsewhere.[1]

In addition to the batholiths there are isolated bosses and dikes of granite and granite porphyry in widely scattered parts of the area. The largest is located in the west central part of Powell township and extends over the boundary into Bannockburn; this granite is characterized by its small content of quartz, usually not over 5 per cent.

In the southern part of Powell township there is a series of small bosses and dikes of porphyry, which is of interest on account of its proximity to the Young-



Photomicrograph of typical porphyry characteristic of granite apophyses. It is made up chiefly of altered plagioclase and orthoclase. (Crossed nicols, ×90.)

Davidson and Matachewan Consolidated ore deposits. The porphyry is characterized by its unusually high content of albite. When map No. 44a of Powell and Cairo townships, which accompanies this report, was prepared, the porphyry was mapped separately as granitic and monzonitic porphyry, but on the map of the whole area, No. 44b, which was prepared later, it is included with the granites. The dikes and bosses outcrop on claims Nos. 5,371 and 5,383 of the Young-Davidson group, on claim No. 5,406 of the Matachewan Consolidated group, and on other claims as far east as Hollinger lake. The porphyry is grey or red in colour and is often traversed by a network of quartz veins. In thin sections the feldspar phenocrysts were determined to be albite and orthoclase in the ratio

[1]On map No. 44b, the area at the north boundary of Baden township between Matachewan and Nokomis lakes, lying between the two masses of granite and along the west shore of Matachewan lake south for a distance of two miles, should have been shown without colour. This area is covered with a sand plain, and nothing is known of the underlying rocks. It is probable, however, that the two masses of granite come together.

of 4 to 1. Quartz forms phenocrysts in some masses, but is present only in the groundmass in others. The ferromagnesian mineral is hornblende.

On claims Nos. 5,371, 5,383, and 5,406, the porphyry has been heavily sheared, the direction of the shearing conforming to that of the greenstone which it intrudes. It has also been highly altered with the development of much calcite and secondary quartz. Farther to the east the porphyry in some of the dikes has been sheared and has undergone some silicification and carbonatization, but in others it has not been sheared and has been only slightly altered. A distinct gradation in alteration was noticed from the highly altered material of claim No. 5,406 to quite fresh-looking types. The schistose character, so marked in the bosses and dikes near the Matachewan Consolidated ore bodies, suggests that they were of earlier age than the syenite porphyry with which the ore bodies are related, and that they were sheared by the intrusion of the latter porphyry. The large amount of calcite and secondary quartz in the dikes may be due to the diffusion of the ore solutions subsequent to the intrusion of the syenite porphyry. The dikes farther east probably owe their fresh state to the accident of being located farther away from the locus of ore deposition.

Syenite

Under the heading of syenite are grouped certain rocks which resemble and are probably close in age to the granites, but which are sufficiently different to be described and mapped separately. Two stocks are referred to this group; one is located in the central part of Holmes township, and the other on the boundary between Eby and Otto townships.

In the middle of Holmes township the syenite is of uniform, medium-grained texture and light-pink to light-brown in colour. Recognizable minerals in the hand specimen are orthoclase and hornblende, with occasionally a little biotite. At one point in the middle of the stock the rock contains enough quartz to be called a granite. This stock occupies an area of three square miles on the west side of the Englehart sand plain, but the same type of rock has been recognized three miles to the northeast on the other side of the sand plain; hence the total area of the stock would appear to be more nearly 12 square miles.

The profile of this stock must be rather flat, since around the margin there are many dikelets of pink syenite in the greenstone and tuffs, and much *lit par lit* injection. Well-marked marginal facies of basic syenite and hornblende diorite are also present.

Along the eastern boundary of Eby township syenites are found which represent the western part of a large Algoman syenite stock mapped by Cooke in Otto township. Exposures of this stock examined in Eby township were of grey or pink gneissic syenite, or were of finely banded and highly metamorphosed injection gneiss. There were, however, some exposures of good pink medium-grained syenite. Ferromagnesian minerals are fine-grained and difficult to distinguish in a hand specimen, but Cooke states that they usually include augite, green and brown biotite, magnetite, and zircon.

Syenite Porphyry

Intrusion of syenite porphyry into the Keewatin and Timiskaming is very general throughout the Matachewan area. Intrusive masses vary from narrow dikes to large stocks. The largest single mass lies in the northeastern part of Cairo township and extends into Holmes, Flavelle, and Alma; it is approximately 25 square miles in area. The most common type of rock is a hornblende

syenite, which is usually porphyritic; the colour varies from red to grey and brown, and rarely green. The feldspar is orthoclase, with occasionally a little albite; basicity varies with varying amounts of hornblende or biotite. The percentage of quartz is usually low, but in the southwestern part of Holmes township some of the rock approaches a granite in composition. Accessory minerals include magnetite and apatite. In the western part of the stock, red and grey colours predominate and porphyritic structure is usual, whereas on the eastern side, in Flavelle and Holmes townships, brown colours are more common and porphyritic structure is less evident.



Photomicrograph of syenite porphyry, Matachewan area, showing typical orthoclase and plagioclase crystals in a fine-grained groundmass of quartz, feldspar, biotite, and hornblende. (Crossed nicols, ×90.)

The most important intrusion in the Matachewan area, from an economic viewpoint, is the syenite porphyry that has come up between the Timiskaming sediments and the Keewatin volcanics along the south side of the southern Timiskaming syncline, in Powell township, on the Young-Davidson and Matachewan Consolidated properties. This intrusion is described in detail in the accounts of these properties.[1]

There are two other bosses of interest in Powell township. The first appears along the Ashley road, west of Log lake. This mass is about 2,000 feet long and 700 feet wide, but its margins are hidden under drift. The second lies just west of the Ashley road, 1,000 feet south of Ryan lake; it appears to be about the same size as the other but was not studied in detail. In both bosses the rock is mainly red hornblende syenite porphyry, but in the boss near Log lake it grades into a granite.

[1]See pages 32, 33, 36, 37.

Throughout the Matachewan-Kenogami area there are numerous dikes of porphyry of varied type. In Powell and Cairo townships many of them are red hornblende syenite porphyry, very similar to the average type of rock in the large stock in the northeastern part of Cairo township.

Numerous dikes of syenite traverse the Keewatin volcanics of Baden township. The syenite differs from that of Powell township in being finer-grained and less pronouncedly porphyritic; it is pink in colour rather than red or grey. The most extensive series in Baden township occurs on the Arbade group of claims, where about 10 subparallel dikes were counted in a width across the strike of



Photomicrograph of syenite porphyry from the Young-Davidson mine, showing typical large lath-shaped orthoclase crystals. (Crossed nicols, ×90.)

400 feet; they cut Keewatin tuff and can be followed for a length of one and a half miles. They strike in a northwest-southeast direction.

In the eastern part of the area red feldspar porphyry dikes are found in the southwestern corner of Eby township cutting granite porphyry dikes and greenstone, and several dikes of feldspar porphyry of red, grey, and brown shades, one of them up to 40 feet wide, are found in the northeastern corner of Eby township on the shores of the southeast bay of Kenogami lake, on the Lucky-Kirkland property, and south of the Ferguson highway.

Syenites of basic composition are common in Powell and Cairo townships. Mineralogically they differ very little from the syenite porphyries. The feldspar is mostly orthoclase, and there is a greater proportion of basic minerals in them, but these minerals were the same as in the syenite porphyry, i.e. biotite, hornblende, and magnetite. In most cases the rock was proved to be merely a basic marginal phase of the ordinary red syenite porphyry owing to the latter having assimilated a greater portion of the intruded greenstone.

The syenite porphyry dikes vary greatly in size; probably the biggest is that which occurs on the Bloom lake group of claims in the northern part of Powell township. It is partly covered by drift, but its length is estimated at 6,000 feet, and its width at 100 to 150 feet. The dikes strike in various directions, but there is a tendency toward parallelism with the strike of the intruded rocks; this was particularly noticeable in the southeastern part of Powell township and the southwestern part of Cairo. Instances were seen on the banks of the Montreal river, north of Matachewan townsite, of dikes of porphyry parallel both on a horizontal and vertical plane to the shearing of the greenstones.

With the exception of some of the basic types, all the syenites and syenite porphyries described above have the same mineralogical constitution, with the minerals in the same proportion. Chemically, also, they appear to be closely allied, with the potash content higher than the soda, in which they differ from all other igneous types in the area, which have a higher soda than potash content.

Some instances were found of a more acid type cutting a more basic type, but many more examples were found of slightly different types grading into one another with no definite line between them. It is concluded that these syenite porphyries all belong to one period of igneous activity.

They have no exact counterpart in the Kirkland Lake area, but the red syenites of the central ore zone resemble them somewhat in having the same mineral constituents and the same high potash content. The Kirkland Lake syenite, however, is generally finer-grained and less porphyritic, and contains a higher percentage of ferromagnesian minerals than the ore-bearing types of porphyry in Powell township.

Evidence regarding the relationship of the syenite porphyries with the granite is not complete, but it is believed that the porphyry is younger. Near the southwest corner of Eby township a feldspar porphyry dike was found cutting granite; this locality, however, is rather far removed from the area in Powell township where the typical syenite porphyry is found. In the northeast part of Alma township, J. B. Webb and A. W. Derby report[1] finding a dike of typical red syenite porphyry, evidently an offshoot of the large porphyry stock, cutting grey granite. Reasons have already been given[2] for believing that the sheared granite porphyry on claims Nos. 5,371, 5,383, and 5,406 of Powell township, which is included with the granite, is older than the syenite porphyry. The general field relationships also indicate a somewhat later age for the porphyry. Most of the granite is of batholithic dimensions and is confined to the north and south sides of the Keewatin trough; its intrusion probably formed the close folds of the trough. The porphyry on the other hand, even the large stock in the northeastern part of Cairo township is well within the trough and probably came up after the folding was fairly well completed. The shape and distribution of many of the masses appear also to have been predetermined to some extent by the structure of the intruded volcanics and sediments.

Lamprophyre

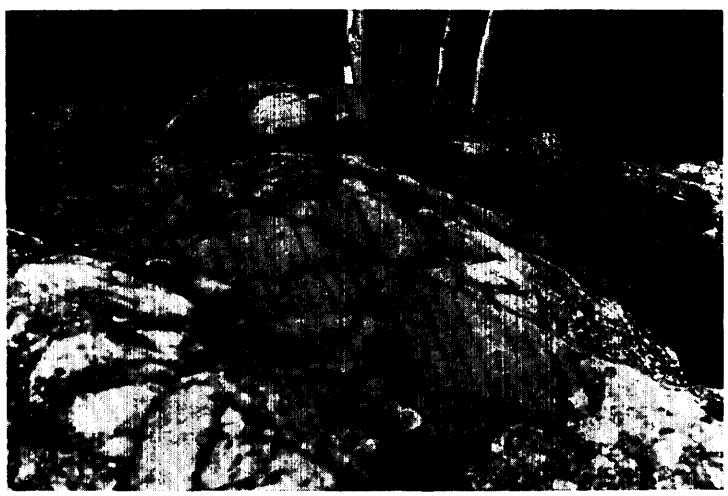
A few narrow lamprophyre dikes occur at widely scattered localities in the area. Most of them are of the mica type (minette) with phenocrysts of biotite in a groundmass of feldspar; others are of the vogesite type with laths of hornblende, apparently altered to chlorite, in a groundmass of feldspar. In some of the dikes in Powell township the feldspar was determined to be orthoclase,

[1]Personal communication.
[2]See page 21.

and the rock appears to be merely a differentiate of the syenite porphyry, still more basic than the basic syenite. In others the relationship to the other igneous rocks is not known. Some of the dikes cut the Keewatin and others the Timiskaming, but none was found cutting igneous rocks. The strike may be in any direction and does not bear any relation to the strike of the intruded rocks.

Matachewan

The name "Matachewan" was first used by Miller[1] for certain diabase dikes that cut the Algoman and earlier rocks but are overlain unconformably by the Cobalt conglomerate, because dikes of such relationships were first recognized in the Matachewan area by Burrows. These dikes have since been found in many parts of the gold region of northeastern Ontario and northwestern Quebec.



Cobalt conglomerate lying unconformably upon a diabase dike of Matachewan age, claim No. 5,383, Matachewan-Ashley highway.

They occur in remarkable profusion in the Matachewan area, and the name would, therefore, appear to be well chosen and is here retained. They cut cleanly through all the Algoman intrusives, would appear to be post-ore, and are not displaced by the great north-south faults of Matachewan and Mistinikon lakes, but are overlain with a great unconformity by the Cobalt conglomerate. They really represent the last manifestation of igneous activity in the Algoman. Excellent examples of the unconformable relations with the Cobalt can be seen on the Young-Davidson property and along the north edge of the Cobalt conglomerate westward to Mistinikon lake.

The rock shows the ophitic structure typical of diabase, with laths of plagioclase surrounded by irregular grains of augite; the feldspars are sericitized and kaolinized, and some quartz is usually, though not always present. The dia-

[1]Cyril W. Knight, "Cobalt and South Lorrain Silver Areas," Ont. Dept. Mines, Vol. XXXI, pt. 2, 1922 (1924), p. 351.
W. G. Miller, "The Matachewan Series and Its pre-Cambrian Relations," Can. Min. Jour., Vol. 44, 1923, p. 299.

base is characterized by the presence of numerous phenocrysts of labradorite feldspar, which are sometimes 2 to 3 inches in diameter and exhibit a waxy lustre due to kaolinization. These phenocrysts are not always developed in the diabase, but there is scarcely a dike which does not show them at one point or another. Magnetite is the chief accessory mineral, and in one dike on the west side of Hollinger lake in Powell township it occurs in sufficient quantities to affect the compass.

One phase of the diabase is more acidic; in the hand specimen it shows a considerable development of reddish feldspar, and under the microscope a large percentage of feldspar and quartz in micrographic intergrowth with some



Porphyritic diabase (Matachewan), about one mile west of Matachewan townsite.

separate grains of quartz, the other minerals being augite and magnetite as in ordinary diabase. Usually the more acidic type occurs as segregations in ordinary diabase, but in a dike one mile southeast of Fort Matachewan it was found cutting the more basic type. It is doubtless a residual part of the same magma. On the property of Hugh Kells, on claim No. 7,388, Cairo township, there is a dike of gabbro with serpentinized olivine. It does not occur near the Cobalt conglomerate, hence its age relationships are not known; it strikes in the same direction as the Matachewan dikes.

The Matachewan diabase is not all of exactly the same age. In many places a fine-grained jointed type cuts the coarser-grained massive type, and some examples were seen of porphyritic diabase cutting non-porphyritic diabase with fairly definite contacts.

As will be seen by the map the dikes are very numerous and occur at fairly regular intervals across Cairo and Powell townships as far west as Mistinikon lake, but from this lake to the western boundary of the township only one dike is known, and in Bannockburn comparatively few occur. Between the east boundary of Powell township and Mistinikon lake, a distance of 4 miles, there were counted 27 dikes measuring 50 feet or more in width; there are probably several more smaller ones. They are also very numerous in Alma, Holmes, and Flavelle townships, but east of the Englehart sand plain they occur at much wider intervals.

The dikes are nearly all subparallel and strike generally about north and south. Between the Ashley road and Mistinikon lake the strike is usually from north to N. 10° W., whereas east of the Ashley road and in Cairo township it is from N. 5° E. to N. 25° E. No attempt was made to follow any single dike throughout its length, but one dike, which incidentally reaches a width of 800 feet west of Log lake, appears to extend from the Cobalt conglomerate northward across the township and for at least 2 miles into Baden township, a distance of 7 miles. The dikes broaden and narrow and change in strike, and some of them branch; many large inclusions of greenstone and sediments were seen. The contacts with the rock they intrude are in most cases clear-cut with chilled edges, and the dikes are finer-grained on the sides than in the middle.

The parallelism of the dikes with the north-south tension faults of Matachewan and Mistinikon lakes is worth noting. Some examples of diabase dikes intruding along such faults were seen, and it is quite likely that there are many others, although evidence is now hard to obtain owing to the difficulty of locating faults of small displacement. It seems a natural supposition that the striking feature of the parallelism of the dikes should be predetermined by a fracture or fault pattern. The dikes are probably related to cross-faults formed by tension. The folding of the great series of lavas and sediments would cause compression in an east-west direction owing to a tendency toward some elongation in this direction which was probably restricted. As the intruded igneous rocks cooled, tensional stresses were set up, which resulted in north-south faults, normal to the direction of elongation, which apparently extended to depth and tapped the still molten basaltic magma.

Cobalt Series

The Cobalt series outcrops extensively over the southern third of Powell township, and a long narrow tongue extends northeastward through the central part of Flavelle, across the southeastern corner of Holmes, through Burt, and northward through Bompas and Lee. An offshoot crosses Kenogami lake. In Burt township this ridge reaches a width of 4 miles.

A close study was not made of this formation, since it is of little economic importance. In Powell township the stratigraphic succession appeared to be as follows: poorly sorted basal conglomerates, with some greywackés and, rarely, reddish arkoses. In Burt township, fine-grained slaty rock, with here and there an included boulder or pebble, appears to occupy the lower elevations, succeeded upward by medium-grained greywacké, also containing scattered pebbles in places, with pink-weathering to impure arkose at the highest elevations.

The attitude of the series is in marked contrast to underlying formations, being in general much more nearly horizontal with gently undulating rolls.

Along the south side of Davidson creek dips are from 5 to 15 degrees south or southeast, and there are successive minor ridges with cliff-like northern sides and gently sloping southern sides. The Cobalt lies with marked unconformity upon older formations, an excellent example of which can be seen on the Matachewan-Ashley road on claim No. 5,383 opposite the old Young-Davidson cookhouse. The Cobalt can be recognized from long distances, owing to its rugged topography. Collins[1] has divided the Cobalt series into the Gowganda and the Lorrain formations. The Gowganda formation includes the heavy basal conglomerates, greywackés, arkoses, and slate conglomerate of the series, and the Lorrain formation is composed principally of quartzites. The part of the series in the Matachewan-Kenogami area is the lower Gowganda formation.

Keweenawan

At least one diabase dike was found cutting the Cobalt conglomerate which makes it Keweenawan in age. This dike can be seen from the Ashley road a quarter of a mile west of Moyneur's hotel. The rock is not very different from that of the Matachewan diabase except possibly in containing a somewhat lower percentage of augite. For the most part it is coarser-grained. The feldspars are extensively kaolinized; the chief accessory mineral is ilmenite altered to leucoxene. None of the large feldspar phenocrysts, so characteristic of the Matachewan dikes, were seen.

The strike of the dike is approximately northeast in contrast to the nearly north strike of the Matachewan dikes. It was followed northeast to the high west bank of the Montreal river, but below the bank it was lost in talus and could not be picked up again across the river. It averages 150 feet in width.

STRUCTURAL GEOLOGY

Folding

The structure in the Matachewan-Kenogami area, simply expressed, is that of a broad northeastward-trending syncline or synclinorium of Keewatin rocks bounded by Algoman batholiths. The axes of some of the synclines are marked by Timiskaming sediments. The Keewatin and Timiskaming formations have been so closely folded that the dips approach the vertical. Shearing is general throughout the area; it usually, though not always, parallels the bedding, and the strike of the beds and the schistosity, although variable and somewhat erratic, shows a strong tendency to an east-northeast to northeast direction.

The best example of folding was obtained in Powell and Cairo townships where, as outlined previously,[2] there are two well-developed synclines marked by Timiskaming sediments extending from west to east across the townships, each of the synclines being about one mile in width from north to south and separated by an anticline of Keewatin greenstone 1½ miles wide. It is probable that further folds occur in Baden and Alma townships, although evidence is fragmentary and inconclusive, chiefly due to the fact that no Timiskaming sediments occur in these townships and criteria based on the attitude of volcanic flows is indefinite.

In the eastern part of the area evidence concerning folding is fragmentary.

[1]W. H. Collins, Geol. Surv. Can., Mem. 95, 1917, pp. 63-73.
[2]See pages 13–15

In the southern part of Holmes township and the northern part of Flavelle the volcanic flows appear to face northward, and Cooke[1] states that a study of grain sizes in the flows in the southern part of Burt township indicates that here also the flows face northward. To the north no evidence as to the attitude of the flows was found by the writer's party, although Cooke[2] states that the banded tuffs on the northern boundary of Holmes township, about one and a quarter miles east of Englehart river dip toward the south, and that the flows around the Burt-Dunmore corner face the south.

There is plenty of definite sedimentary evidence to show that the beds along the north side of the Timiskaming band in Eby township face the south; but on the south side structure is obscured by the carbonate zone, and in the adjacent volcanic flows what little evidence was collected was conflicting. The structure of the narrow discontinuous bands of Timiskaming conglomerate in Holmes and Flavelle townships is obscure.

In a broad way, therefore, it would appear that the structure in the eastern part of the Matachewan-Kenogami area is synclinal, but if secondary folds were ever present, no evidence remains to indicate them.

Faulting

The Montreal River and Mistinikon Lake Faults

Two major faults were found in the area; they trend north and south and are later than the folding and shearing. One of them follows the valley of the Montreal river and Matachewan lake, and the other the valley of Mistinikon lake. The Montreal river fault extends from the Cobalt conglomerate at Moyneur's bridge northward to Old Woman rapids, where it crosses the peninsula and swings to the east side of the lake. Between Fort Matachewan and Narrow lake it is lost in the greenstone, but there is a north-south fault along Narrow lake, which is probably an extension of the big fault. No attempt was made to follow the fault into Alma township. The fault was worked out mainly on the basis of the distribution of the formations; the fault line itself cannot be definitely seen, although sharp scarps at Old Woman rapids appear to mark its position, as do certain lenses of solid sulphides, mainly pyrite, at Old Woman rapids and at a point three-quarters of a mile to the north. The fault displaces syenite porphyry dikes and also the zone of carbonate schist at the south side of the southern Timiskaming syncline, but Matachewan diabase dikes appear to cross it without displacement. Hence, the fault is late Algoman in age, post-porphyry and probably post-ore, but pre-Matachewan. The fault is a complicated one. It is possible that it is a thrust fault, but in this and neighbouring areas faults with north-south strike, i.e. normal to the axes of folds and to the direction of elongation, have generally been assumed to be normal (tension) faults. If the Matachewan fault is a normal fault, then, judging by the distribution of the rocks, the east side must have been thrown almost vertically downward; there may have been a lateral component, but this is difficult to prove. The apparent displacement of the southern Timiskaming syncline to the north on the east side of the fault could have been brought about by a vertical throw, since this syncline is overturned with dips of 70 degrees or less to the south. Just what happened to cause the southward displacement of the northern syncline on the east side of the fault is not known; there may

[1]H. C. Cooke, Geol. Surv. Can., Mem. 131, 1922, p. 9.
[2]Ibid.

have been a thrust fault to the south of greenstones over sediments, or at higher elevations (before erosion) the northern syncline may have been overturned towards the north.

The Mistinikon lake fault is simpler. On it the northern syncline of sediments has been displaced about 3,000 feet to the south on the west side of the fault, and the southern syncline is probably hidden on the west side under Cobalt conglomerate. There may also have been a vertical component. This fault has not been traced north of the northern band of sediments.

Other Faults[1]

Other faults of similar character are indicated by topographic features, such as that along Browning and Cameron lakes. The faults that displace the veins in the Ashley mine have the same strike and appear to be of about the same age; the throw is nearly vertical. A study of the distribution of the rocks on claims Nos. 5,372 and 5,375 of the Young-Davidson group suggests a fault along the most westerly of the three diabase dikes that cross the claims. West of the dike the porphyry intrusion is cut up by a number of bands of sediments and schist, whereas east of the dike the porphyry is apparently a solid mass. Moreover, the boundaries of the porphyry do not match on opposite sides of the dikes. The rocks on the west side of the fault are apparently downthrown vertically.

Rickaby found little evidence of major north-south faults in the Bannockburn area, although he points out that the topography suggests their existence.[2] Faults of this type have been found by him, however, in the Swayze area,[3] and by Laird[4] in the Opeepeesway area. The strike is in general northward and the east side is always displaced to the north; the faults are thought to be post-Algoman, but their relation to the Matachewan diabase dikes is not known.

In the Kirkland Lake area a number of north or northeast cross-faults have been found which, as a rule, though not always, displace the veins to the north on the east side. They have also displaced the diabase dikes, which in the Kirkland Lake area are pre-ore rather than post-ore, as in the Matachewan area.

Faults parallelling the strike of the beds, with the exception of a few of very minor displacement, are rarely found. Perhaps the only ones are those that occur on the Lucky-Kirkland property in the northeastern part of Eby township. Here they strike east-northeast parallel to the Timiskaming sediments in which they occur; they are apparently normal faults with the south the upthrown side. Movement along them, however, as judged by striations on slickensided surfaces, appears to have been compound. They can be clearly seen along the railway cuts north of the Lucky-Kirkland mine.

To sum up, it is believed that during Algoman times compressive stresses were active from the south, which caused folding, shearing, and minor faulting in an easterly direction, and that late in this period normal tension faults (at right angles to the shearing) developed. Any movement prior to the Algoman is masked by the intensity of movement in this period. After Algoman time, movement must have been slight, judging by the gentle dips in the Cobalt series.

[1]On map No. 44b, at the property of the Arbade Gold Mines (No. 19) in Baden township, the fault shown running from claim No. 6,829 southeastward to a small lake does not exist. Instead there should have been shown a winding creek.

[2]H. C. Rickaby, Ont. Dept. Mines, Vol. XLI, pt. 2, 1932, pp. 6, 7.

[3]Ibid, pt. 3, 1932, p. 45.

[4]H. C. Laird, report in preparation.

ECONOMIC GEOLOGY

Gold

POWELL AND CAIRO TOWNSHIPS

Young-Davidson Mines, Limited

The Young-Davidson property, which has been taken over for operation by the Hollinger Consolidated Gold Mines, Limited, lies in the southern part of Powell township on the Ashley road, 2 miles west of the Matachewan townsite. It includes five claims, Nos. 5,371, 5,372, 5,374, 5,375, and 5,383. The ore body on which most of the work has been done lies in the northwest corner of claim No. 5,372.

History.—The early history of the property has already been described.[1] Since 1916, the year it was staked, several attempts have been made to develop



View looking north over Davidson creek at the Young-Davidson mill. To the left are seen the old buildings; in the centre, an electric shovel eating into weathered porphyry ore; to the left of the mill, the crusher-house in course of erection. The buildings in the right background are on the property of the Matachewan Consolidated Mines.

this property, and in the years 1923 to 1925 it was under option to the Porcupine Goldfields Development and Finance Company, Limited, who did a considerable amount of drilling, shaft-sinking, and drifting. These attempts proved abortive, however, owing to the low grade of the ore, until with the recent rise in the price of gold the Hollinger Consolidated Gold Mines, Limited, began operations on the property under an option with the Young-Davidson Mines, Limited. This work consisted of extensive trenching through the overburden and oxidized surface rock and extensive sampling. Having satisfied themselves as to the tonnage and tenor of the ore the Hollinger Company late in the summer of 1933 began preparations for the erection of a mill. In September, 1934, the mill was completed and production was commenced. At present ore is being recovered by an electric shovel in an open pit, a very low-cost operation made possible by the large size of the ore body, which is 500 feet by 300 feet. The method of milling chosen was that of all-cyanidation. Pro-

[1]See pages 1, 2.

duction is now at the rate of about 600 tons per day, but this tonnage could be increased by comparatively small additions to equipment. Mill heads are reported to be about what was expected from sampling, i.e. 0.10 ounces. The large size of the ore body and the amenability of the ore to cheap methods of milling should result in low operating costs. The mine is also favoured by low power costs and easy accessibility.

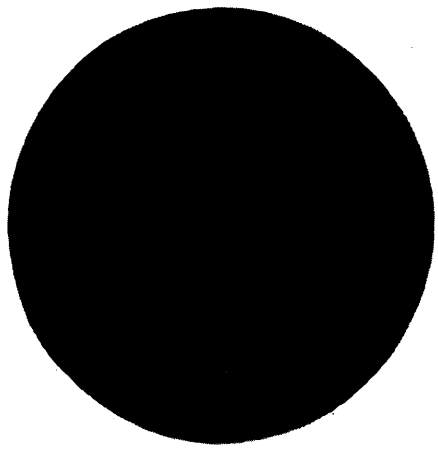
Geology.—The ore occurs in an intrusion of syenite porphyry that lies along the south contact of the southern syncline of the Timiskaming sediments with the Keewatin volcanics. The intrusion extends from the west boundary of claim No. 5,372 eastward across claims Nos. 5,372 and 5,375 and for 700 feet into claim No. 5,379 (Matachewan Consolidated Mines, Limited), where it narrows and splits into a number of dikes. The total length of the porphyry intrusion, exclusive of the dikes, is about 3,300 feet, and the maximum width is 700 feet. The regional strike of the sediments to the north of the porphyry is east to N. 60° E. and the dip of the sediments and porphyry intrusion is 75° S. The Keewatin south of the porphyry is heavily altered, sheared, and contorted.

There are three main types of porphyry in the intrusive mass: a cherry-red, coarsely crystalline type, in which the porphyritic texture is not generally seen; a grey, more compact type, with more distinct phenocrysts; and a fine-grained, dense, dark-brown type, with a tendency towards smaller phenocrysts. Under the microscope all these types look much alike. In all three the main constituent is orthoclase; a minor amount of albite may be present; hornblende is relatively small in amount and is somewhat more plentiful in the darker phases. A little quartz is sometimes present, but it is thought to be secondary, and calcite is present in quite large amounts. Accessory minerals are magnetite, pyrite, apatite, titanite, and zircon. Since no sharp boundaries were seen between the various types, they are considered to be differentiates of the same magma. The dark-brown type is probably a marginal phase, such as is found at the boundaries of the boss, and grades into the grey porphyry. The cherry-red type is probably a slightly later differentiate, since it is found in the central part of the stock and in a few places appears to make rather abrupt contact against the grey. It was noted that the grey porphyry shows alteration to red along quartz veins, and there is, therefore, some possibility that the cherry-red rock has formed by alteration from the grey porphyry by the action of ore-bearing solutions.

A characteristic feature of the cherry-red type is that it oxidizes readily. In order to sample fresh rock it was found necessary to dig some of the trenches to a depth of 20 feet, mostly through oxidized porphyry. Since this oxidized material shows undisturbed the system of subparallel quartz veins characteristic of the deposit and is overlain by boulder clay, the oxidation is evidently pre-glacial.

Recent work has shown that the ore is found only in the cherry-red porphyry, probably because it is more brittle and has fractured more readily, allowing freer access to the gold-bearing solutions. The gold has been brought in by a branching system of quartz veins, which are seldom over one inch wide. The veins and stringers fill fractures which dip flatly, seldom over 50 degrees and usually much less, to the northeast, but there are others which dip to the northwest and north. Shear planes are also present, but they seldom carry quartz and do not appear to be related to the gold deposition; they strike in

various directions, and most of them are vertical or nearly so. Mineralization in the ore body is chiefly coarse pyrite, with some chalcopyrite, magnetite, and hematite. Carbonate occurs in considerable quantity both in the fractures and replacing the porphyry. Most of it seems to have been introduced before the quartz, but Thomson shows that some of it was later than the quartz.[1] Some orthoclase, tourmaline, and barite were also observed. The gold, a good deal of which is native, was nearly always in the quartz, although some of it is in the porphyry, not very close to visible quartz. This gold has probably been brought in along miscroscopic fractures. The gold is often found as coatings on pyrite, and the pyrite itself is auriferous.



Photomicrograph of a polished section of Young-Davidson ore (×160). The light-grey veining material is gold; the dark-grey is pyrite; and the black is gangue.

J. Ellis Thomson, who examined polished sections of the ore submitted by the writer, reports as follows:—

> The chief metallic mineral in this section is pyrite, but it contains also considerable native gold, as well as minor quantities of magnetite These metallic minerals, which are associated with a mixed quartz carbonate gangue, occur in the following forms: pyrite, as isolated crystals or small crystal aggregates, scattered through the gangue material; magnetite, as big grains in the gangue; native gold, as vein-like or bleb-like forms, chiefly in the gangue and to a lesser extent cutting the larger pyrite crystals [see photomicrograph above]. The order of deposition appears to have been: (1) pyrite and magnetite, (2) quartz, (3) carbonate, (4) native gold.

Ore Bodies.—Intensive development work has been carried on in the northwest quarter of claim No. 5,372, formerly by underground work, which is now flooded, and recently by deep trenches. Very extensive sampling, both underground and in the trenches, has shown the existence of a block of low-grade ore extending with certainty to a depth of 200 feet, the depth of the lower level of the underground workings. This block has an irregular surface outline, but its approximate dimensions are 500 by 300 feet, although No. 6 trench, which was cut the width of the ore body, was in ore for 400 feet with consistent gold values.

[1]See report by J. Ellis Thomson on this page.

It is possible that ore-bearing porphyry may be found under the Cobalt conglomerate to the west and northwest, although sediments and schists were found between the porphyry and the conglomerate in these directions. The contact between the Timiskaming and the Keewatin along which the ore bodies are aligned may continue its westward strike under the Cobalt or it may bend northwestward to agree with the northwest flexure of the contact on the opposite side of the Timiskaming syncline. In this case the Timiskaming-Keewatin contact would be found only a short distance south of the edge of the Cobalt.



Trench-sampling by the Hollinger Consolidated Gold Mines in the summer of 1933 on the Young-Davidson property. Some of the trenches were dug 25 feet deep to get below the oxidized zone.

A considerable amount of diamond-drilling done in the earlier days of the property indicated good values in the porphyry at some distance from the proved ore body, but the holes were drilled at considerable intervals, and not much attention is now paid to the results.

In the central part of claim No. 5,372 as far east as the first diabase dike that crosses the porphyry,[1] the porphyry intrusion is broken up by bands of sediment and schist. In places the rock is of a hybrid type, half way between sediments and porphyry, representing apparently a marginal phase of the por-

[1]An apparent fault along this dike is discussed on page 30.

phyry. These rocks do not make ore. In the western part of claim No. 5,375 no inclusions of sediment or schist were found, but the porphyry is mostly a dense dark type, which does not appear favourable for gold deposition. In the eastern part of claim No. 5,375 and extending into claim No. 5,379 (Matachewan Consolidated), porphyry of the same rich red variety as the proved ore body occurs, and similar gold values were obtained on sampling. Insufficient work has been done to determine its dimensions, but there would appear to be a block at least 400 feet long and 200 feet wide (including both properties).



Quartz stockwork on the Young-Davidson property. This is the site of the original discovery by Jake Davidson, and the photograph shows his early shelter.

Scattered values have been obtained from the altered volcanics adjacent to the south flank of the porphyry. Along the south boundary of claim No. 5,372 there is a stockwork of quartz in rusty carbonatized greenstone, with a considerable development of green mica. It is partly hidden under drift, but it would appear to be lenticular in shape and over 50 feet wide; some gold values were obtained in it, although it is sparsely mineralized. It was in this quartz that Jake Davidson made his original discovery in 1916. Farther east, on claim No. 5,375, flanking the porphyry, there is a zone of carbonate schist. A width across the strike of 100 feet of the schist shows in a trench, and pyritized light-grey schist with a small dike of porphyry was uncovered by a pit 100 feet southwest of the trench. This zone of carbonate and pyritized schist is very similar to the one that carries the ore bodies on the Matachewan Consolidated claims.

Comparison with Kirkland Lake Ore Bodies.—The geology of the ore deposits of the Kirkland Lake camp is similar to that of the Young-Davidson in some respects. The area is related to a somewhat similar porphyry and is concentrated along a zone of marked structural weakness; in the case of the Young-Davidson, along the contact between the Timiskaming and the Keewatin, and in the case of the Kirkland Lake, within the Timiskaming. The Kirkland Lake ore differs, however, in that it is largely confined to a more definite fault zone and is, therefore, more concentrated and higher in grade. The tourmaline, feldspar, and more coarsely crystalline pyrite, together with the absence of the lower-temperature suite of minerals found at Kirkland Lake, indicate that the Young-Davidson (and the Matachewan Consolidated) ore bodies were formed at higher temperatures than those of Kirkland Lake.

Matachewan Consolidated Mines, Limited

Matachewan Consolidated Mines, Limited, was incorporated on July 10, 1933, with a capital of 3,000,000 shares of no par value, to supersede Matachewan Canadian Gold, Limited; it is controlled by Ventures, Limited, and Sudbury Basin Mines, Limited. The property consists of 20 claims adjoining the Young-Davidson on the west and extending eastward to within a quarter of a mile of the Montreal river. Claims Nos. 5,379 and 5,380, at the west end near the Young-Davidson, are the most important at the present time.

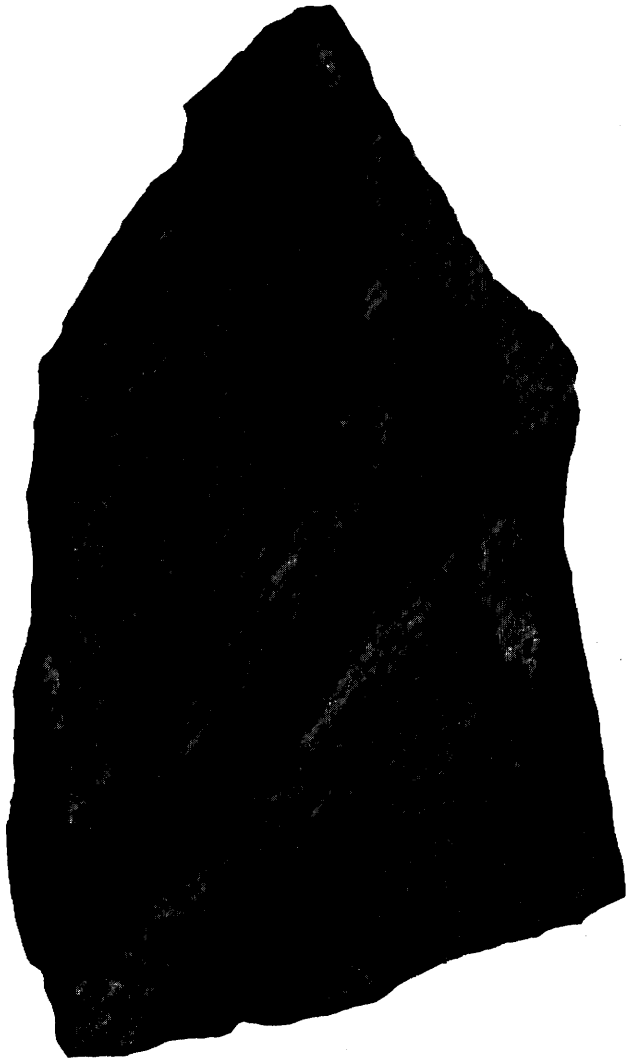
History.—Mine development, under the present management, began in May, 1933. It consisted in dewatering formerly existing underground workings, which consisted of a shaft and about 800 feet of drifting and crosscutting on one level at 160 feet; extending the drifting; drilling from the 160-foot level, mostly horizontal, closely spaced holes; and extensive sampling, both on surface and underground. At the end of July, 1934, ore reserves were estimated at 122,172 tons at \$6.92[1]; this ore was revealed at one level only. Construction of a 100-ton cyanide mill began on August 1, and the mill was in production at the end of October. The plant is such that production can be doubled with a small amount of additional equipment. A new 3-compartment shaft was started in July, 1935.

Geology.—The ore on the Matachewan Consolidated claims differs greatly from that of the Young-Davidson. Whereas on the latter property the quartz veins, which brought in the gold, are found in the syenite porphyry intrusion, on the Matachewan Consolidated they are found in altered Keewatin volcanics off the south flank of the intrusion. In both cases, however, the quartz is believed to be the end phase of the same porphyry magma. Another difference is that on the Young-Davidson the ore bodies are few and large with consistent but low gold values, whereas on the Matachewan Consolidated there are many much smaller ore bodies of variable size and of variable though higher values.

Near the centre of claim No. 5,379 the large intrusive mass of syenite porphyry, which extends eastward across the boundary from claim No. 5,375 of the Young-Davidson, plunges to the east, so that the surface effect is the splitting up of the intrusion into a number of separate dikes and apophyses. Insufficient work has been done to show the number of dikes or just how they behave; they appear to be irregular and discontinuous, and early drilling indicated that at least some of them grow rapidly wider at depth. They vary in

[1]The values reported for this property are all calculated on gold at \$35.00 per ounce.

width up to 25 feet, or more, and most of them strike N. 60° E., or parallel to the strike of the sediments and schists. A few dikes have intruded the sediments and have altered them to a reddish hybrid rock, but have caused very little mineralization.



Specimen (natural size) of typical ore from the chute at the west end of the 160-foot level, Matachewan Consolidated mine. The ore is altered pyritized basalt with quartz stringers.

Other dikes are found along the contact of the Timiskaming and Keewatin, and in the Keewatin for 200 feet or more south of the contact. The Keewatin for this width of 200 feet has been altered by the porphyry to a light-green carbonate schist, which weathers to a dark rusty green at the surface, but there are patches of less altered rock, resembling tuff in some places, flows in others.

Green mica, either mariposite or fuchsite, is a common accompanying mineral. Bands of distinctive light-grey, pyritized schist are found at scattered localities in the green carbonate schist, and the light-grey schist also constitutes an irregular discontinuous zone near the outside (south) limit of the alteration. South of this zone the alteration fades out gradually, the rock becoming a dark-green basaltic schist. The light-grey schist, however, is not confined to the carbonate schist zone, since in the vicinity of No. 2 shaft, lenses of it appear in dark-green basaltic schist. Most of the ore bodies are found in the light-grey schist.

The light-grey pyritized schist has been formed by the intrusion of veins and stringers of quartz, and is a distinctly later development than the green carbonate schist. In many cases it can be seen that the alteration to light-grey material is more intense next a vein of quartz, gradually dying out away from the vein. Burrows[1] reports that a sample of the green schist from trench 125 contained 30.4 per cent. of carbonate of lime, magnesia, and iron. An analysis of the green schist from a trench northwest of shaft No. 1 follows:—

	Per cent.
Silica	69.42
Alumina	13.64
Ferric oxide	1.76
Ferrous oxide	.79
Lime	2.37
Magnesia	1.30
Potash	1.73
Soda	4.29
Oxide of titanium	.20
Phosphorus pentoxide	.10
Water	1.19
Carbon dioxide	3.33
Sulphide of iron	.26
	100.38

This analysis indicates that some silicification as well as carbonatization has taken place.

Analyses of the light-grey pyritized schist follow:—

	No. 1	No. 2	No. 3	No. 4
	per cent.	per cent.	per cent.	per cent.
Silica	44.02	37.78	33.62	31.14
Alumina	14.23	14.68	20.68	15.44
Ferric oxide	.03	1.44	.86	2.30
Ferrous oxide	2.18	2.50	3.22	3.37
Lime	5.04	7.45	11.48	10.92
Magnesia	2.84	2.90	.88	6.25
Potash	1.89	.25	.32	1.42
Soda	4.18	5.27	5.42	3.90
Oxide of titanium	1.40	.....	.....	.....
Phosphorus pentoxide	.14	.....	.....	.....
Water	1.20	2.00	1.46	1.35
Carbon dioxide	8.41	6.95	9.00	10.94
Sulpide of iron (FeS_2)	14.21	18.75	12.94	12.96

Sample No. 1—From the ore shoot at east end of drift, supplied by T. H. Wells.
Sample No. 2—Burrows, "a light-grey rock."[2]
Sample No. 3—Burrows, "a somewhat darker rock, altered from basalt . . . trench 825, southwest of No. 2 shaft."[3]
Sample No. 4—Burrows, "a light-greenish rock containing considerable iron pyrites, from an ore zone in trench 125."[4]

[1]A. G. Burrows, Ont. Dept. Mines, Vol. XXIX, pt. 3, 1920, p. 59.
[2]Ibid, p. 60.
[3]Ibid.
[4]Ibid.

These analyses show that the alteration is one of carbonatization, pyritization, and possibly some albitization.

In this connection, E. L. Bruce[1] says of the geology of Red Lake:—

> The intruded rocks [Keewatin] have suffered very severe alteration, especially near those quartz porphyry tongues which plunge beneath the older rock. In such places the greenstones have been extensively altered to ankeritic material. Calculations show that this probably took place with decrease of volume, and fractures developed which were later filled with stockworks of quartz. Metamorphic effects upon the sediments are much less marked.

Such may be the origin of the light-grey schist lenses, with their system of quartz veins, on the Matachewan Consolidated property.

The wide belt of alteration in the Keewatin is only part of a belt that is described elsewhere as following the south side of the southern Timiskaming syncline for several miles through the southern parts of Powell and Cairo townships. It appears that the softer volcanics were squeezed against the hard massive Timiskaming conglomerates by movements from the south, thus forming a wide shear zone, which could be altered with ease by the porphyry. The volcanics nearest the sediments may also have been largely tuffs with more open texture than the basalts and sediments, and hence more easily sheared or altered.

On the Matachewan Consolidated property the sediments, schists, and porphyry dikes all dip to the south at an angle of approximately 70 degrees. They are cut by the later Matachewan diabase dikes, which strike north-northeast.

On the map it will be noticed that in the vicinity of No. 1 shaft, there is a rather sharp northeast flexure of the Timiskaming-Keewatin contact and of the accompanying belt of carbonate schist. Just what significance, if any, this has, is not known. It was at first thought that north-south faults might be present, but none of more than minor displacement have been proved. The quartz veins, as seen underground in the drift, have undergone minor fracturing; in trench No. 13 a post-porphyry fault striking about north, but probably of minor displacement, was proved, and in trench No. 20 there is a north-south striking pre-ore fracture.

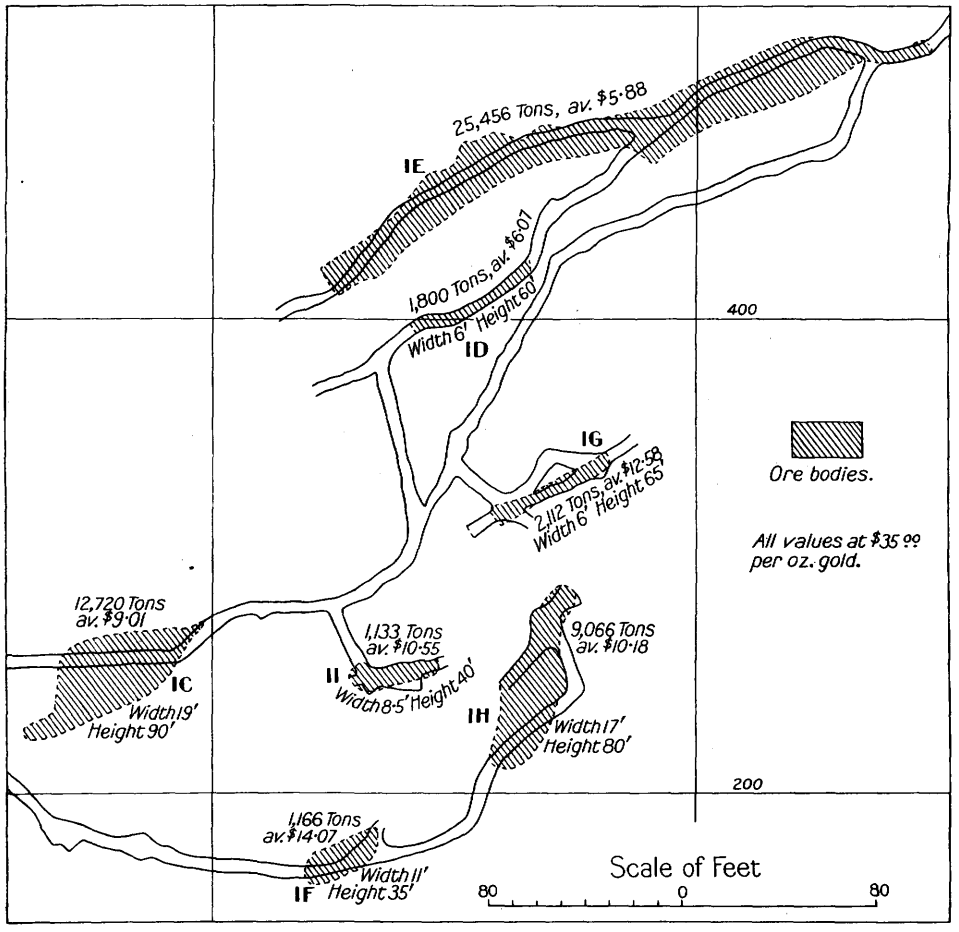
Description of Ore Bodies.—The highest-grade ore bodies so far found lie near No. 2 shaft at the east end of the developed ground. They are lenticular in shape, both horizontally and vertically, and vary considerably in size, shape, and average values. They were found by drilling horizontal holes from the 160-foot level and were later blocked out by further drifting and drilling. Similar ore lenses have long been proved to occur at the surface above them, but there has been some difficulty in correlating them with those found underground. Drift lengths of the 7 ore shoots on the 160-foot level vary from 40 to 260 feet; their average width is 12 feet; and average values for the individual shoots range from $5.88 for the biggest one to $14.07 for one of the smaller shoots, and the average for all 7 shoots is $7.91.[2] These bodies consist of lenses of light-grey pyritized schist lying in basalt south of the zone of carbonate schist. The gold values occur in and adjacent to narrow veins and stringers of quartz, which cut the light-grey schist. Mineralization consists almost entirely of pyrite, although chalcopyrite, tourmaline, and scheelite have been observed. Better values are obtained where the pyrite is coarse. The schist

[1] "Mineral Deposits of the Canadian Shield," Macmillan Co. of Can., 1933, p. 372.

[2] The lower value of the large ore body west of No. 1 shaft, a description of which follows, brings the average of the total reserves down to the figure quoted previously, $6.92.

in the walls of the vein may assay as high or higher than the vein itself. There is usually very little pyrite in the vein, but coarse cubic pyrite is plentiful in the schist next it, gradually becoming less abundant and finer away from the vein. Native gold is often found in the quartz stringers cutting the light-grey schist as well as in the schist itself; the pyrite is also auriferous.

Smaller and lower-grade lenses of ore occur north of No. 1 shaft, in trench No. 10, in the southern part of trench No. 11, and on the west end of the drift

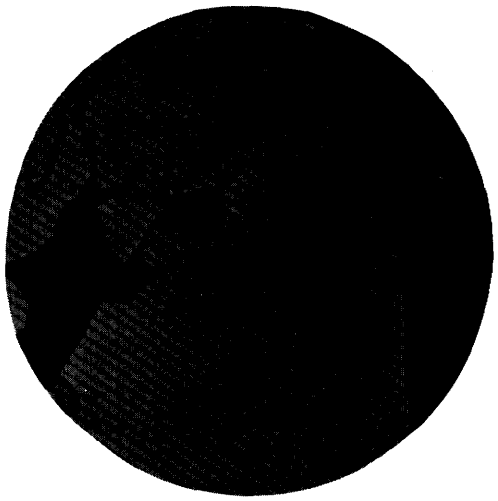


Plan of the 160-foot level east, Matachewan Consolidated mine, showing the ore bodies.

at the 160-foot level in the light-grey schist belt along the south edge of the carbonated schist zone. These low-grade ore bodies differ from the eastern higher-grade ore bodies in having fewer quartz veins and in having between the veins, in places, areas of more or less unaltered basalt; the light-grey, pyritized schist itself is of a lighter colour; the quartz veins strike more or less regularly east-west and dip from 15° to 45° N. The quartz itself is softer and has more included calcite than that to the east; mineralization is also less thorough, and the pyrite is somewhat finer. To the east the light-grey schist is

more solid and somewhat darker, and the quartz is more irregular and more massed.

The largest ore body on the property occurs northwest of shaft No. 1; it can be seen in trenches Nos. 9 to 14 and has been penetrated in drill-holes south of the west end of the drift. The ore reserve in this western, or "dike," zone was estimated at 68,719 tons at $6.15. In a 60-foot width and an almost 200-foot length many lenses of better-grade ore are obtained. At present, a 30-foot width is being stoped. A study of the possibility of a profitable operation in mining the whole zone on a low-cost, high-tonnage basis is being made. The gold values are connected with quartz stringers in what has been called "grey porphyry" as well as with quartz stringers in carbonate schist. Mineralization is similar to that of the ore bodies in the vicinity of No. 2 shaft. The "grey porphyry," which is yellowish to white in colour, is sometimes in separate



Photomicrograph of a polished section of Matachewan Consolidated ore showing gold (au) in fractures in the pyrite (py). (×160.)

dikes, but can also be seen grading into the ordinary type of red syenite porphyry. The microscope indicates that the grey porphyry is not a distinct type of porphyry but merely a replacement of the red syenite porphyry by quartz, albite, and calcite.

Isolated gold values, some of which are high, have been obtained from numerous places outside the ore bodies described, but the difficulty has been to line them up into sizeable ore bodies; they have been found along a pre-ore fracture in carbonate schist in trench No. 20; and they have been found in isolated quartz and pegmatitic quartz veins, and for a few feet into the walls of the veins in trench No. 26 and in the drift.

Professor Thomson, who examined polished sections of the ore submitted by the writer, reports as follows:—

Five specimens were submitted for examination. From these, three were selected, polished, and examined under the microscope. These three specimens were labelled as follows: (1) M.C. 1, from shoot No. 1-C, east end of the 160-foot level; (2) M.C. 2, silicified schist type, from the shoot on the west end of the 160-foot level; and (3) M.C. 3, carbonated schist type

from zone No. 1-A ("dike zone"). The description of these three sections is given in composite form in the following paragraph:—

The chief metallic mineral in all three sections is pyrite, but in M.C. 3 native gold is also present in considerable quantity. Gold is a minor constituent in M.C. 1 and is lacking in M.C. 2. Chalcopyrite, magnetite, and limonite are minor constituents. These metallic minerals are associated with a mixed quartz and carbonate gangue. Pyrite occurs in crystals of cubic habit, sometimes showing a rough cubic cleavage, disseminated through the gangue material; native gold and chalcopyrite, as small blebs or short veinlets in the quartz gangue or in the larger pyrite crystals [see photomicrograph on page 41]. Magnetite appears as occasional grains scattered through the gangue material; limonite, as aggregations of tiny granules surrounding some of the quartz grains. The order of mineral deposition appears to have been: (1) pyrite; (2) magnetite; (3) quartz; (4) carbonate, native gold, chalcopyrite; (5) limonite.

The ordinary type of red hornblende syenite porphyry when it occurs as dikes carries very low values, but an ore body of some importance occurs at the east end of the large syenite porphyry intrusion. It lies partly on claim No. 5,375 and has been described in the section on the Young-Davidson mine.[1] The ore is similar to that in the ore body in the northeast corner of claim No. 5,372 and, where sampled, appears to carry similar values.

There is no apparent geological reason why values should not go to depth. As a matter of fact, the ore shoots on the Matachewan Consolidated property are higher in horizon relative to the igneous intrusions than are those on the Young-Davidson. At depth the different porphyry dikes may coalesce to form one large intrusion, and conditions may become increasingly like those on the Young-Davidson property.

Bloom Lake Consolidated Mines, Limited

Bloom Lake Consolidated Mines, Limited, has three groups of claims in Powell and Cairo townships, with a considerable amount of work done on all of them.

Otisse Lake Group.—The first group consists of three claims, Nos. 5,513, 5,514, and 5,421, lying around the south end of Otisse lake and directly north of the most important claims of the Matachewan Consolidated group in Powell township. The rocks in the Otisse Lake group consist of Timiskaming conglomerates and greywackés, intruded by dikes and bosses of red syenite porphyry and Matachewan diabase dikes. The sediments, however, have been affected by the porphyry intrusion to a less extent than the greenstones to the south, alteration and mineralization being less evident. The contact between the Timiskaming and Keewatin formations, which is the most marked belt of mineralization in the townships, lies very close to the south boundary of claims Nos. 5,513 and 5,514 and probably enters the claims in places. At the time of writing, diamond-drilling is being done to locate this boundary.

North Powell Group.—A group of 8 claims, Nos. 6,440, 6,441, 6,667, 6,194, 6,294, 6,618, 6,231, and 6,140, lies in the northern part of Powell township, one mile northeast of the Matachewan-Ashley highway. The rocks consist of greenstone and a variety of Algoman dikes, chiefly red syenite porphyry, which intrude it. The contact with the Timiskaming sediments passes through the two southern claims. A lens-like vein of quartz of some interest occurs on the property. This vein can be followed for 500 feet, striking in an east-west direction and dipping vertically. Its greatest width is 40 feet, but it tapers off at both ends. It is well mineralized with pyrite, and is reported to have yielded

[1]See page 32.

on assay some low values in gold. It intrudes greenstone but is close to the contact with the sediments. Narrow dikes of granite porphyry and feldspar porphyry parallel it along its south wall. A shallow pit was sunk on it at one point, and some diamond-drilling was done. It is reported, however, that in drilling, unsuspected diabase dikes were entered and the vein was never reached.

Cairo Group.—A third group, of ten claims, surrounds Morrison lake in the eastern part of Cairo township. The contact between the large syenite porphyry stock and the Keewatin crosses the group in an easterly direction. Values in gold are reported to have been obtained along this contact, where in places there is strong shearing with silicification and carbonatization.

O'Connell Gold Mines, Limited

O'Connell Gold Mines, Limited, holds 4 claims in Powell and Cairo townships. Claims Nos. 5,651 and 5,389 lie in a Timiskaming sedimentary band east of Otisse lake and north of the eastern part of the Matachewan Consolidated group. Claims Nos. 5,387 and 5,390 lie between the highway and Hollinger lake in greenstone. Development work, consisting of trenching and shaft-sinking, is proceeding on claim No. 5,651. The rocks are similar to those of the Bloom Lake group to the west, largely Timiskaming conglomerates or greywackés intruded by syenite porphyry and Matachewan diabase dikes. A shaft is being sunk to explore a quartz vein, from which values have been reported by the company; this shaft had reached a depth of 75 feet in July, 1934. The vein reaches a width of 1.4 feet and is mineralized with chalcopyrite, pyrite, and tourmaline. It is vertical and strikes northeast, parallel to the schistosity in the soft, grey altered greywackés, which form the country rock. The vein could be followed only a short distance, owing to the fact that it has been faulted.

Matachewan Townsite Mines

Matachewan Townsite Mines, under the direction of A. P. Dunbar, has done a considerable amount of surface trenching on a large group of claims east of Old Woman rapids on the Montreal river. The geology resembles that of the Bloom Lake group south of Otisse lake and the northern O'Connell claims, the rocks consisting of Timiskaming conglomerate and greywackés, intruded by numerous dikes of red syenite porphyry.

Matachewan Pioneer Syndicate

The Matachewan Pioneer Syndicate is developing a group of claims on the highway, half a mile east of Matachewan townsite. Good values were reported to have been found here many years ago by the original stakers. The rocks are greenstones, traversed by bands of iron formation. Much Cobalt conglomerate outcrops on the claims.

Margo Mines

A company known as the Margo Mines has been recently organized by W. C. Young to explore the possibilities in a large group of claims in the centre of Cairo township. The group lies in the southwestern part of a large stock

of syenite porphyry. Work so far has consisted of trenching and stripping; some quartz veins have been uncovered, which are reported to have yielded values in gold.

Other Claims

In the southeastern part of Cairo township in a strip of greenstone about 1½ miles wide lying between the stock of red syenite porphyry to the north and granite to the south, a large amount of work has been done on several groups of claims held under the names of J. B. Moyneur, Hugh Kells, Ed. Otisse, J. O'Brien, Frank Westcutt, and D. Miller. The greenstone in the area has been locally sheared and mineralized to a considerable degree and intruded by quartz veins and dikes of quartz porphyry, feldspar porphyry, and granite. Native gold has been found in a number of places.

BADEN TOWNSHIP

Baden Gold Mines

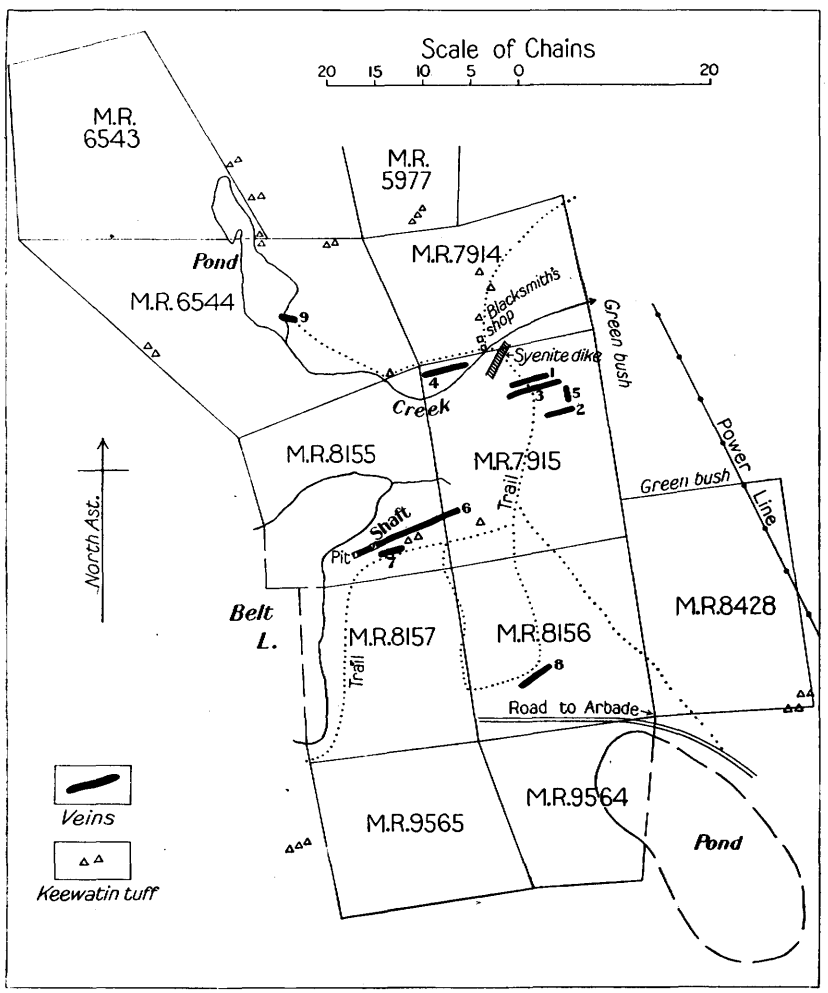
Baden Gold Mines holds a group of claims in the northern part of Baden township, east of the head of Matachewan lake, on which much active prospecting has been done. The late W. J. Shields, who was president of this syndicate, has been succeeded by A. P. Campbell; Harry Crawford is resident prospector. The property was reported on by Rickaby[1] in 1932. Nine quartz veins have been found, all of them similar in character, and most of them striking east-northeast, but a few at right angles to this direction. They are narrow, seldom over 12 to 18 inches wide, and occupy fissures in Keewatin tuff and agglomerate. Mineralization is chiefly pyrite and chalcopyrite, but some black tourmaline and pink calcite were noted in certain of the veins.

Tuffs and agglomerates are virtually the only rocks outcropping on the property. A narrow dike of red syenite striking N. 60° E. occurs on the northern boundary of claim No. 7,914; a narrow lamprophyre dike appears on the footwall of No. 5 vein, and a small dike of quartz diorite(?) parallels the shearing on the north side of No. 8 vein. On the east boundary of claim No. 6,543 there are outcrops of a reddish rock, which looked like quartz porphyry in the field but did not show sharp contacts with the tuff; under the microscope it was seen to consist of irregular grains of quartz and altered feldspar, with some grains showing micrographic structure; it is possibly an arkose.

No. 6 vein, on claim No. 8,155, is the most important; it has been uncovered by trenches and test pits for a length of 800 feet in an east-northeast direction; it dips steeply to the north. The quartz ranges in width on the surface from 1 to 14 inches, with the greatest width at the west end, but it is reported to widen to about 2 feet at the bottom of the 30-foot shaft, now flooded. Assays in gold of $1.00 to $48.00[2] and some native gold were reported by Mr. Crawford from the west end of the vein; at the east end a sample taken over 18 inches was reported to assay $3.50. The vein was drilled during the winter of 1933–34, but the small drill used had difficulty in penetrating the broken ground near the vein. It is reported that the three completed holes at the west end of the vein, which were approximately 100 feet apart, showed at a vertical depth of 100 feet widths of about 2 feet of quartz, carrying from 0.40 to 0.65 ounces per ton, and that in one hole the footwall rock averaged 0.30 ounces over 4 feet.

[1]H. C. Rickaby, Ont. Dept. Mines, Vol. XLI, pt. 2, 1932, pp. 22, 23.
[2]The values reported for this property are all calculated on the old price of gold, $20.67.

No. 7 vein parallels No. 6, being about 150 feet to the south; pits which had been sunk on it had filled in at the time of the writer's visit; an assay of $6.50 is reported to have been obtained across 6 feet. No. 4 vein has been uncovered for 150 feet; the quartz has widths up to 4 inches in a schisted zone reported to have been 4 feet in width. The vein strikes N. 85° E. and dips



Sketch map of the claims of Baden Gold Mines.

steeply to the south. Three channel samples over widths of 4 feet are reported to run from $3.80 to $4.80 per ton. Rickaby[1] reports that a grab sample taken here by him assayed $6.80. No. 8 vein consists of stringers of quartz in a sheared zone from 3 to 5 feet wide, striking east-northeast; values of $2.50 across 4 feet and some native gold are reported. No. 1 vein consists of 2 inches of quartz in about one foot of schist; it strikes N. 80° E. and dips 75° S.; it

[1]H. C. Rickaby, op. cit., p. 23.

has been uncovered for about 250 feet. A grab sample across 4 feet was reported to assay $1.60, and a grab sample collected from the dump by Rickaby[1] assayed $1.00. Nos. 2 and 3 veins are similar to No. 1 and strike in the same direction; gold has been panned from them, and some native gold has been found on No. 3. No. 5 vein, near No. 3, shows one foot of quartz dipping at about 45° W. and striking N. 15° W., or at about right angles to No. 3. Very little work has been done on No. 9 vein, which outcrops on the southeast shore of the small lake on claim No. 6,544.

Central Matachewan Mining Corporation, Limited

The Central Matachewan Mining Corporation, Limited, was actively engaged during the summer of 1934 in opening up a break, which had been discovered previously by W. J. Shields, on their group of claims lying immediately north of the Baden Gold Mines group. High values had been reported in oxidized material on this break, and in July, 1934, it was apparent that greater widths would be obtained here than on neighbouring properties. It was later reported that moderate values had been obtained over a considerable length. The break consists of a shear zone striking east-northeast across greenstone and fine-grained grey granite, a boss subsidiary to the bigger stock to the north; narrow lenses of quartz are found parallel to the schistosity.

The Central Matachewan Mining Corporation also owns several groups of claims in other parts of the Matachewan area, one of which lies south of the North Powell group of Bloom Lake Consolidated Mines. Here, some trenching has been done on a northeast-striking dike of syenite traversed by narrow quartz veins.

Thesaurus Gold Mines, Limited

The property of Thesaurus Gold Mines, Limited, is located at the head of Matachewan lake, across the lake to the northeast from that of Baden Gold Mines. The veins are similar to those of the Baden Gold Mines and strike in the same direction, east-northeast; they are probably an extension on strike of the same series. On Thesaurus ground, however, the fissure veins cut granite rather than tuff, but are near the contact with the tuff.

The chief rock outcropping on the property is granite intruded by Matachewan diabase dikes. Keewatin tuffs are found on the southeastern claims, and a small outlier of Cobalt conglomerate occurs on claim No. 5,901. A body, 60 feet wide, of peculiar, fresh-looking, yellowish-green rock with prominent quartz eyes was reported as having been cut in the crosscut at the 300-foot level; some of it can be seen lying on the dump. Under the microscope it is seen to consist of fresh phenocrysts of quartz and phenocrysts of orthoclase and plagioclase altering to sericite in a very fine groundmass of feldspar, quartz, sericite, and pyrite. It is a rhyolite porphyry or quartz porphyry and is probably intrusive into the granite. No rock like it occurs anywhere else in the area.

The principal veins are three in number, No. 1 on claim No. 5,868, the Discovery or Channel vein near the boundary of claims Nos. 5,871 and 5,872, and the Creek vein near the south boundary of claim No. 5,872. Underground work has been done on No. 1 vein, including a shaft to 308 feet and drifting and crosscutting of 100 feet on the 100-foot level and 230 feet on the 300-foot level. A plant, which appeared to be in good order, is still on the property, but no work had been done from 1924 until 1934, when the mine was pumped

[1]H. C. Rickaby, op. cit., p. 23.

out and resampled and some further drifting done. At the time of the writer's visit this work was just commencing, hence there was no opportunity of examining the property underground. Very good looking ore, with a considerable amount of native gold, which was reported to have been found in the mine, was shown to the writer, and some short sections of good widths have been reported. The chief difficulty appears to be the narrowness of the veins and the faulted ground, which have made it difficult to follow the veins for any appreciable distance.

Practically all the veins on the above three properties appear to belong to one system of fracturing and strike east-northeast to northeast. It is probable, also, that the gold has come from the grey porphyritic granite which outcrops in the vicinity, since the veins are all found near the contact between the granite and the Keewatin tuffs, either in the tuffs or in the granite.

French Property

The French property, which lies just northeast of the Arbade group, in the west central part of Baden township, is under option to Hollinger Consolidated Gold Mines, Limited, who drilled a vein on claim No. 8,193 in the summer of 1934. This vein, which is similar to those already described on the properties at the head of Matachewan lake, is a narrow quartz vein, striking northeast and cutting massive tuffs. Hollinger officials report that over a length of 90 feet and a width of 11 inches, values of $30.00[1] in gold per ton were found. The ore body was also located in drilling. At both ends of the 90-foot section the fracture continues farther, but little quartz and no values were found.

Arbade Gold Mines, Limited[2]

In the west central part of Baden township several dikes of fine-grained pink syenite, often porphyritic, intrude the Keewatin tuffs. In places the syenite is traversed by a stockwork of mineralized quartz veins, somewhat like the porphyry on the Young-Davidson property, and at such places assays of gold up to $3.00 have been reported. On the property of Arbade Gold Mines, Limited, a series of such dikes, striking northwest, can be followed for over one and a half miles. A section across the strike of the dikes just west of the shaft showed at least 10 of them, including some of basic syenite, in a width of 400 feet. On claim No. 6,686, formerly part of the Hurd group, and now under option to Arbade Gold Mines, a shaft has been sunk to 30 feet on one of these dikes. Native gold was found in the shaft, and assays up to $14.00[3] across 5-foot widths, also from the shaft, have been reported by C. A. Floyd, president of the company. The dike averages about 8 feet in width. Some systematic channel-sampling was done in the summer of 1934, but results have not yet been reported. Arno Mines, Limited, diamond-drilled this dike in 1931, but it is reported that they obtained only low values. A good set of camps is on the property, as well as a second-hand mining outfit, including a boiler, compressor, and hoist.

Theodore Kallies

On claims Nos. 5,902 and 5,903, about one mile northwest of Matachewan falls, Theodore Kallies has obtained gold values from scattered points. At one point in a network of quartz veinlets in sheared greenstone, he reports

[1]Gold at $20.67.
[2]See footnote (1) on page 30.
[3]Gold at $20.67.

$10.40[1] over 5 feet, and a grab sample taken by the writer yielded $5.40. In quartz veins in altered greenstone, 120 feet to the west, $4.00 is reported over a width of 17 feet; a grab sample taken by the writer yielded $4.00. One hundred and sixty feet farther to the northwest, in greenstone, is a lens of quartz, which runs east and west for a length of 100 feet with a maximum width of 20 feet. Low assays have been obtained from scattered points. Insufficient work has been done to show the relationship between the different finds or to determine the width and length of the values at any one place.

J. Quilty

On claims Nos. 7,318 and 7,319, south of the Arbade claims, J. Quilty has uncovered a 2-foot vein of brecciated quartz and silicified and granitized greenstone lying between walls of tuff and greenstone, from which Rickaby[2] obtained a grab sample assaying $11.40[3] in gold. Insufficient work has been done to show the length of the vein or the consistency of values.

Woman River Gold Mines, Limited

Woman River Gold Mines, Limited, holds a large group of claims in the southeastern corner of Baden township. Visible gold was discovered on claim No. 10,401 in May, 1934, over a length of 2 feet in a 6-inch quartz vein. This vein has not yet been broken into, but extensive surface work is proceeding on the discovery and other claims. The rocks consist of greenstone and several intrusions of granite and grey and red syenite and syenite porphyry. There are some zones of shearing with silicification and pyritization on the property.

McNEIL TOWNSHIP

McNeil Syndicate and Oliver Gold Syndicate

Gold was discovered in McNeil township in June, 1923, by three Indians, Isador, Micmack, and Tom Fox,[4] and in this and following years much staking and development work, including trenching and shaft- and pit-sinking took place. Gold is found chiefly in the native state, in quartz veins traversing dikes of fine-grained "felsite" and quartz porphyry. The quartz veins, up to 2 inches in width, strike transversely to the dikes and dip at about 60° E. In places they are irregularly spaced and nearly parallel, looking like steps in a ladder. They usually stop short at the walls of the dike, but there are a few which extend into the greenstone on either side. Many of the veins carry brown carbonate. Mineralization consists of coarse cubic pyrite; some cubes 1 inch square were seen in the "Eight Foot" dike. The pyrite is more abundant in the felsite near the quartz veins than in the veins themselves. The gold nearly always occurs near the pyrite, and there are several instances of gold occurring in cavities from which the pyrite has been oxidized; gold has also been seen in fractures in pyrite. The dikes themselves strike as a rule about east-northeast and dip 80° S. They are probably offshoots of the granite stock of Robertson township and the eastern part of McNeil. The country rocks are Keewatin volcanics, among which were seen good examples of spherulitic and amygda-

[1]The values reported for this property are all calculated on the old price of gold, $20.67 per ounce.

[2]H. C. Rickaby, op. cit., p. 24.

[3]Gold at $20.67.

[4]P. E. Hopkins, Notes on Gold in McNeil and Other Townships, Ont. Dept. Mines, Vol. XXXIII, pt. 3, 1924, p. 37.

loidal pillow lavas and brecciated flow tops. Insufficient time was available to work out the structure in the Keewatin.

Five gold-bearing dikes, ranging in width from 8 to 30 feet, have been found over six claims from north to south, four of them on claims held by the McNeil Syndicate, known locally as the Jowsey-Segsworth group, and the fifth on the claim of the Oliver Gold Syndicate. From north to south these dikes are known as the "Isador," the "Scotch" or "Forgan," the "Eight Foot," the "South," and the "Oliver." The Scotch dike is of quartz porphyry, whereas the material in the other dikes is more feldspathic. The Isador has been traced by outcrops and trenches along the strike into a similar dike called the "Micmack," and farther east again, on the east side of Tom Fox lake, there is another dike which may be part of the Isador. If these are all parts of one



Quartz stringers in the "South" dike, on the property of the McNeil Syndicate, McNeil township.

dike, it is nearly one mile long. A shaft 65 feet deep was sunk on the Isador dike in 1924, but values were low. In this same year a 60-foot shaft was sunk on the 8-foot dike, which disclosed an ore shoot extending from the surface to a depth of 35 feet; this shoot was reported to average $7.00[1] over 8 feet. At the bottom of the shaft another shoot was entered, which was considered to be the same shoot as the one found on the surface 40 feet west of the shaft. On the second shoot an 18-foot pit was sunk, which is reported to have shown native gold in every round. The ore shoots, therefore, appear to pitch at about 60° E.; they are separated by barren felsite without quartz.

In the dike on claim P. 9,849 of the Oliver group, there appears to be more quartz than in the others; certainly the quartz veins are more irregular in strike and dip. Native gold, usually fine, but sometimes coarse, has been found in this dike in several places. Gold has been found also in narrow short veins, striking north-south, between the 8-foot dike and the South dike. It was in one of these veins that gold was first discovered in the township; hence, it is known as the "Discovery" vein. These veins are too narrow to be of economic interest. On claim No. 19,410, held by K. S. Oliver, to the east of the camps

[1]The values reported for this property are all calculated on the old price of gold, $20.67 per ounce.

on Tom Fox lake, there is a zone 100 feet wide, striking north-south, of altered and sheared greenstone and tuff with considerable quartz. This zone is mineralized with pyrite and chalcopyrite. Native gold has been found and assays of $2.00 to $9.00 are reported on the west side of the shear zone.

Although visible gold and high assays have been obtained in the dikes, values are erratic; and it is thought that the only way to obtain any accurate idea of average values is to bulk-sample the most likely-looking places. During the winter of 1934–35, development work in the township included deepening of the shaft on the 8-foot dike, under the direction of D. G. Oliver. It is reported that interesting mineralization has been encountered. Trenching is also proceeding on the Oliver Gold Syndicate claims.

YARROW TOWNSHIP

Christie Properties

On claim No. 9,929, Yarrow township, near the east shore of Mistinikon lake, George Christie has uncovered an interesting zone of carbonate schist, with lenses of silicified schist and stringers of quartz. The carbonate schist is yellow or grey in colour and rusty-weathering, and the silicified schist is grey and rather cherty. The quartz stringers are of two types, a grey and a white, and are numerous enough in places to amount to a stockwork. Mineralization is chiefly cubic pyrite and is heavier in the silicified schist and quartz stringers than in the carbonate schist. This zone resembles the zone of alteration on the Young-Davidson property, resulting from the intrusion of syenite porphyry, and it is reported that porphyry was recently found just north of this carbonate schist on the Christie property. At the time of the writer's visit, in July, 1934, the only unaltered rocks seen in the vicinity of the showing were greenstones and Matachewan diabase dikes. The zone of alteration is over 100 feet wide and has been followed for about a quarter of a mile in a northeast direction. Values in gold have been reported by Mr. Christie, and the property is now held under option by New York interests represented by Nelson Bradley.

HOLMES TOWNSHIP

L. Brookbank

In the south half of lot 8, concession II of Holmes township, on claims held by L. Brookbank, there is an interesting gold-bearing syenite porphyry dike. Over a length of 700 feet, more than 20 trenches have been cut across it and one shallow shaft has been sunk. For this length of 700 feet the width averages about 14 feet; the strike is northeast, and the dip approximately vertical. At the northeast end the dike has been affected by some obscure movement, probably faulting; it has been thrown 200 feet to the north, with a considerable amount of drag, after which it tends to resume the same northeast trend. On the strike of the dike, 800 feet southwest across a swamp, similar porphyry, probably an extension of the same dike, has been picked up again. The porphyry varies in colour from place to place along the dike, reddish-grey grading into dark-grey and greyish-brown. It was noticed that the grey porphyry becomes red in the vicinity of the quartz veins, which suggests that the reddish-brown phase is probably an altered hydrothermal phase of the grey. Phenocrysts are laths of orthoclase, up to 1½ inches, often showing Carlsbad twinning. Hornblende is the common accessory mineral, but there is considerable secondary chlorite in places.

Quartz veins traverse the porphyry with irregular strike and dip, but the greater number are transverse to the strike of the dike. In some trenches they are numerous, making up one-third of the total mass of the rock; in others they are much less frequent. They are, for the most part, narrow, seldom over 4 inches wide, and tend to die out at the walls of the dike. The walls consist of heavily sheared basalt schist, which on the north side is syenitized for about one foot from the dike; in places the porphyry has intruded the basalt schist *lit par lit* fashion. Well slickensided walls of the dike, especially to the northwest side, and slickensiding and shearing in the dike itself, shows rather severe movement. Massive pyrite occurs in the quartz veins at several places, along with some chalcopyrite and galena. Calcite is also present in the quartz, and pyrite is disseminated in the porphyry. Native gold has been found in the dike, and some high assays were obtained. The Coniagas Mines, Limited, did drilling here some years ago, but with unsatisfactory results. In 1933, the property was optioned by the Agaura Explorations, Limited (a subsidiary of the United States Smelting, Refining and Mining Company), who channel-sampled the dikes in several places. The results were disappointing and indicated that values were spotty. Similar dikes occur in other localities in the southwestern part of Holmes township, and values in gold have been reported from some of them, as well as from the greenstone schist near by. It is hoped that further prospecting will uncover commercial ore bodies.

FLAVELLE TOWNSHIP

Allen-Coghill Claims

In the south half of lot 11, concession VI of Flavelle township, a quarter of a mile west of Wyley lake, a well mineralized quartz mass has been uncovered in a series of trenches, on claim No. 10,018, by Mat Allen, Bert Coghill, and associates. This lens-shaped quartz mass occurs in a fractured zone striking W. 30° S., at right angles to the contact of the Keewatin greenstone schist and the large syenite porphyry stock of northwest Flavelle and adjacent townships to the west and north. Good examples of slickensiding, which occur on the walls and in the syenite and schist inclusions, indicate that there has been considerable shearing along this zone. Drag-folding shows that the direction has been such that the rocks on the side south of the fracture have been moved to the west. The east end of the fractured zone is in greenstone, but the remainder of it is in grey syenite with narrow inclusions of greenstone or rhyolite along the line of fracture. The fracture has been traced for 1,500 feet, but the quantity of quartz and the type of mineralization varies considerably over this length. At the east end there is a lens of quartz about 130 feet long, which reaches a maximum width of about 17 feet, although the lens is irregular, with included masses of grey schist and sheared and altered pink syenitized schist. Most of the quartz is white, although in places it is smoky and black. Mineralization occurs chiefly as blebs and masses of fine and coarse pyrite and chalcopyrite. Some pink carbonate, glassy black tourmaline, and a little galena and purple fluorite are present.

For about 600 feet west of the west end of the quartz lens there is not much evidence of the fracture, but west of this again, narrow lenses of coarse white quartz occur, which are more sparsely mineralized with pyrite and chalcopyrite than the eastern lens, but have a greater amount of tourmaline and fluorite, and in places considerable amounts of pink to brown orthoclase. The high-temperature minerals, tourmaline, fluorite, and orthoclase, are more com-

mon in the west end of the fractured zone, where it traverses the syenite, than in the east end in the greenstone. The orthoclase was observed only in the west end. The east end would appear to be more favourable for the occurrence of gold than the west end. Unfortunately the fracture zone strikes into low swampy ground toward the east.

A little native gold was noted in the limonite-encrusted cracks in the quartz of the bigger lens at the east end of the main fracture, and some medium assays have been reported, but consistent values have so far been lacking.

Another fracture, upon which some work has been done, comes in from the east, striking N. 75° E., and either intersects or joins up with the first fracture. Narrow, poorly mineralized quartz lenses are found along it.

EBY TOWNSHIP

Lucky-Kirkland Gold Mines, Limited

The property of Lucky-Kirkland Gold Mines, Limited, formerly known as the Baldwin, has been intermittently active since 1911, when gold was first found on the property by a prospector, from whom the old company took its name. It is located on the north half of lot 2, concession VI, Eby township, between the Ferguson highway and the main line of the Temiskaming and Northern Ontario Railway, 2½ miles west of Swastika. Development has included a shaft of 400 feet, 90 feet of crosscutting, and 240 feet of drifting on the 100-foot level; 350 feet of crosscutting and 310 feet of drifting on the 200-foot level; 480 feet of crosscutting and 390 feet of drifting on the 300-foot level, and 200 feet of drifting on the bottom or 400-foot level. At the time of the writer's visit in August, 1934, the shaft at the 1st level had been dewatered, but no other work was being done. A. G. Burrows and P. E. Hopkins[1] in 1923 reported as follows:—

> The rocks are Keewatin basalt schists and Timiskaming sediments intruded by syenite and reddish feldspar porphyry dikes. In these rocks have been located several small gold-bearing veins, striking nearly east and west, with a mineralization somewhat similar to the Swastika and Kirkland Lake deposits. Extremely fine-grained gold was seen in quartz stringers on the surface and on the 100- and 200-foot levels.

S. L. McDonald, who was in charge of the property at the time of the writer's visit, reports that several short shoots have been found in the mine, especially on the 200- and 300-foot levels. Average values of individual ore shoots are reported to range from $1.40 to $36.00.[2] The most interesting one is reported to occur on the 300-foot level and to consist of quartz veins and carbonate schist; it is 7 feet wide but is cut off at both ends by cross-faulting, and the length is only 12 feet; an 11-ton sample is reported to have given an assay of $36.00. Other shoots occur in dikes of red syenite porphyry and light-pink fine-grained syenite. On the 100-foot level one narrow low-grade ore shoot was found and erratic gold values were obtained from other points, and on the 400-foot level, drifting had reached red syenite porphyry, which showed native gold.

Mr. McDonald reported also that the gold was all in the native state; mineralization consists of fine pyrite, molybdenite, and chalcopyrite. Molybdenite is found along the sides of the dike and in fractures in quartz; chal-

[1]Ont. Dept. Mines, Vol. XXXII, pt. 4, 1923, p. 52.

[2]The values reported for this property are all calculated on the old price of gold, $20.67 per ounce.

copyrite appears to be an ore indicator, since wherever it appears gold values appear also.

The shaft and underground workings are in Timiskaming sediments, chiefly greywackés, which strike east-northeast. The contact with the greenstone lies between the shaft and the Ferguson highway, and a zone of carbonate schist parallels the contact a short distance within the sediments. The greywackés in the vicinity of the shaft are intruded by dikes of red syenite porphyry and pink fine-grained syenite. Similar dikes outcrop in the railway cut just north of the shaft. The dikes parallel the strike of sediments and dip vertically. Faults are also found on the railway cut; they are normal faults, post-porphyry in age, and strike parallel to the strike of the sediments and dikes. Movement along them, as judged by striations on slickensided surfaces, appears to have been compound. Similar faults are reported to occur in the drifts.

NOTES FOR PROSPECTORS

The Keewatin greenstones and Timiskaming sediments extend eastward from the Matachewan area through the townships of Holmes, Flavelle, Burt, and Eby, to the Kirkland Lake area. Numerous stocks and dikes of igneous rocks of varied type, including red syenite porphyry, pink syenite, and dark-grey diorite, cut through the greenstones in various places, and coarse-grained granites are found on the flanks of the syncline. Such an assemblage of rocks constitutes in general good prospecting territory, especially when the territory lies between such important gold camps as Kirkland Lake and Matachewan. It should be noted, however, that this section of the area represents a lower horizon with respect to the granite batholiths than either Kirkland Lake or Matachewan, and in this respect is probably not so favourable for gold deposits.

Burt, Holmes and Flavelle Townships

Some parts of the territory appear more favourable than others. For instance, Burt township and the eastern half of Holmes are overlain by the Cobalt series and by the broad sand plain that flanks the Englehart river (south branch of the Blanche river), and prospecting is difficult, if not impossible. There are some stretches of greenstone along the north and south boundaries of Burt township on which some prospecting has been done, but this greenstone is largely granitized and is probably only a shallow covering over granite.

In the greenstone area in Holmes and Flavelle townships with its intrusions of syenite and syenite porphyry and remnants of Timiskaming conglomerate, prospecting would be worth while. A drawback to prospecting in this section has been the large amount of land held as veterans' patents. Access to Holmes township is by a trail leading northwest from mileage 20 on the Elk Lake–Matachewan highway.

Alma Township

Alma township to the north of Cairo and west of Holmes is very largely underlain by greenstones and tuffs. Some prospecting has been done in the township, particularly along the northern contact of the red syenite porphyry stock and the greenstone, where there are in places considerable widths of carbonate schist.

Eby Township

Some desultory prospecting has been done in Eby township, but it deserves more thorough work. Special attention should be paid to the Timiskaming

sediments and to the contact with the greenstones to the south. Some tracts of greenstones of fair size are obscured only by a thin covering of moss, which could be stripped with little labour. The greenstones in the southern half of the township are rather heavily drift-covered.

Barite

Two deposits of barite occur in the Matachewan area. These are the Biederman deposit, in Cairo township, and a deposit on Mistinikon lake in Yarrow. Both deposits were visited by the writer, but the old shafts and trenches are in poor condition and more could be seen of the veins fifteen years ago, when Burrows examined them, than now.

Biederman Deposit

The following description of the Biederman deposit is taken from Burrows' first report[1] on the Matachewan area in 1918:—

This claim (16,042) is situated on the west shore of Browning lake, in the north part of Cairo township. The country rock is a red syenite in which there is a barite vein with strike N. 65° W. and dip 80° N. The deposit can be observed about 100 feet from the shore of the lake where a shallow shaft has been sunk at a point where the vein has been concealed by drift to the east. Here there is a width of 15 feet, and the barite can be traced westerly for 100 feet, decreasing to a width of 7 feet. Beyond this there is drift followed by an exposure of barite about 30 feet in length and three feet wide at the east end, and two feet wide at the west end. The barite is for the most part quite white in colour and of good quality. At the shaft there are minor quantities of zinc blende, galena and specularite and a little fluorite, as impurities. The deposit also contains at this point some large inclusions of syenite. A sample across eight feet, on analysis contains 90.50 per cent. barium sulphate.

Yarrow Deposit

Burrows[2] reported on barite in Yarrow township in 1920, as follows:—

Several veins of barite have been located on a group of claims lying about three miles south of the north boundary of Yarrow township, on the west side of Mistinigon lake. The property, owned by the Ontario Barium, Limited, Toronto, includes four claims, G.G. 4,222, 4,223, 4,328, and 4,329. Most work has been done on a strong barite vein on claim 4,223. This outcrops on the shore of the lake and strikes north 74° west. It is 5 feet wide at the lake, while 60 feet from the lake it is 13 feet in width. By means of trenches it has been traced at least 430 feet up the slope of a drift-covered ridge. At the farthest exposure, which was made through six feet of sand and gravel, a shaft has been begun where the vein is 11 feet wide. There are a few strips of "horses" of greywacké-conglomerate running with the vein, which are quite narrow relatively to the width of the vein.

The barite varies in grain, some being coarsely crystallized with cleavage faces an inch in width. Other portions are fine-grained, resembling greatly in appearance sugary quartz. The difference in grain gives the deposit a somewhat banded structure in parts. In colour the barite varies from a white to a faint pinkish, but all the material grinds white. A selected sample of barite carried 98.25 per cent. barium sulphate, while a channel sample taken by M. B. R. Gordon, from the surface, contained 81.24 per cent. barium sulphate. A sample of fine-grained barite taken by the writer carried 94 per cent. barium sulphate. As far as could be observed the deposit is free from sulphide minerals.

Barite also occurs in a vein a few hundred feet to the north on claim 4,222 along the bed of a creek. Owing to the heavy overburden of gravel only a short part of the vein is exposed. Here the barite is separated into two bands, by a strip of greywacké, 7 feet 6 inches wide, the south barite band being 6 feet 4 inches and the north band 5 feet 10 inches. About 300 feet to the northwest there is a deep trench showing a strong barite vein that is probably part of that exposed in the creek. A sample of barite taken from the north vein by Mr. Gordon contained 77.14 per cent. barium sulphate.

As the claims are not surveyed, and the country is thickly wooded, the deposits have not been accurately located. From the amount of work done it is apparent that there is a large tonnage of high-grade barite. The country rock is greywacké and conglomerate of the Cobalt series. Granite outcrops on the east shore of Mistinigon lake.

[1]A. G. Burrows, Ont. Dept. Mines, Vol. XXVII, pt. 1, 1918, p. 237.
[2]Ont. Dept. Mines, Vol. XXIX, pt. 3, 1920, p. 64.

The Yarrow deposit is now controlled by Dr. H. Glendinning, of Toronto. In 1933, samples of the barite from the southern vein were submitted by Dr. Glendinning to the Ontario Research Foundation for tests. These tests showed, as quoted from the Foundation's report, that "In general the sample of barytes submitted, if ground without contamination, would produce a ground barytes of intermediate commercial grade."

Geology of the Martin-Bird Property in Hearst Township

By W. S. Dyer

Introduction

This property comprises nine claims just east of the south end of the southwest bay of Larder lake, and four miles south of Larder City. Transportation is by motor boat from the latter point. Development work began in 1933 and was continued until temporarily suspended in November, 1934. The work included several hundred feet of trenching and some diamond-drilling. In June, 1934, a mining plant capable of going to a depth of 250 feet was installed, and the shaft, which had been earlier sunk to 50 feet, was deepened to 125 feet, and some lateral work done. The directors of the syndicate are S. J. Bird, of Toronto; G. O'Meara, R. Armstrong, J. Martin, Sr., all of Kirkland Lake; and D. Lough, of Toronto. The writer is indebted to John Campbell, mine manager, for many courtesies extended to him and to members of his party while at the property.

General Geology

The rocks outcropping on the property are largely fine-grained, finely-banded greyish and greenish sediments, which are considered to be Timiskaming greywackés and slates, although they may include some tuffs. For the most part they stand vertically and strike N. 20° W. They are bounded on the west by Keewatin greenstones, including pillow lavas, and to the east they grade into thicker beds of quartzite and conglomerate. The sediments probably form the west limb of a syncline, but work was not continued far enough eastward to determine the character of the sediments.

Intruding sediments are dikes and bosses of porphyry and narrow dikes of lamprophyre, which are regarded as Algoman in age. The porphyry is of two chief types. The younger is a light-grey, white-weathering, fine-grained quartz-feldspar porphyry; two dikes were found, one 3 feet wide striking N. 25° E. in the northwest corner of claim No. 24,957, and the other somewhat wider, striking east and west in the southeastern part of claim No. 24,935 and extending into claim No. 25,024.

The second type of porphyry is variable in composition; it is dark-coloured when fresh, but tends to weather white; in some places it is dioritic without quartz and with prominent blades of hornblende; in others it is lighter-coloured with well-marked feldspar phenocrysts, and sometimes with quartz eyes visible in the hand specimen. Most of it may be termed diorite or diorite porphyry; other phases are more correctly termed feldspar or quartz-feldspar porphyry. These rocks are similar to the diorite porphyry that Cooke[1] described from the Larder Lake area. He ascribed the marked variation in composition to differentiation by gravitational influence, and believed that the large mass in McVittie township was originally a thick sheet or laccolith; he also believed that it was intruded prior to the folding of the Timiskaming.

[1]H. C. Cooke, Geol. Surv. Can., Mem. 131, 1922, pp. 43-45.

The diorite porphyry forms bosses along the boundaries of claims Nos. 24,958, 25,076, and 24,935, on the boundary of claims Nos. 24,957 and 25,072, and on the shores of Larder lake on claims Nos. 2,566 and 2,715. Dikes are found in several scattered localities and also in the ore zone, where they are highly altered, sheared, and intruded by quartz veins.

The lamprophyre dikes are micaceous in type. Most of them are sheared, heavily so in the ore zone, and are cut by the diorite porphyry. There must, however, be a series of younger dikes, since at least one dike, on claim No. 24,849, was found cutting the diorite porphyry; this appeared to be similar to the earlier dikes but was not so heavily sheared.

A dike of diabase, striking about west-southwest, occurs in the northern part of claim No. 24,849 and extends eastward into claim No. 25,072, where it cuts the younger quartz-feldspar porphyry. It is not known whether it is Matachewan or Keeweenawan in age. Cobalt conglomerate outcrops extensively to the west of Sharp creek.

Structure

The most striking structural feature on the property is a strong drag fold, the axis of which strikes N. 60° E. and extends through the middle of claim No. 23,717, the northwest corner of claim No. 24,957, and the southern part of claim No. 24,935. The axis of the fold is very marked; for a length of a mile along the strike, and for widths across the strike of about 200 feet, the beds strike uniformly N. 60° E., in contrast to the persistent regional strike of N. 20° W. Along the axis the beds are highly sheared and altered, the strike of the schistosity paralleling that of the beds.

The movement along the fold has been such that the rocks on the northwest side have been shifted to the northeast. The intensity of movement is indicated by the zone of brecciated sediments in the trenches southeast of the shaft. The distribution of the Timiskaming conglomerate on either side of the fold is interesting. To the south of the fold such conglomerates, striking N. 20° W. to N. 20° E. and dipping vertically, were found in the western part of claim No. 24,957, whereas to the north of the fold no conglomerates were found, although outcrops are not numerous enough to be sure they are absent. The conglomerates outcrop again, however, about 4,000 feet to the northeast on claims Nos. 25,080, 25,324, and 25,069. It is possible that, instead of a simple drag fold, the structure is a fault with the northwest side displaced to the northeast, a distance of 4,000 feet.

In the sheer zone along the axis of the drag fold there are several quartz veins striking for the most part parallel to the schistosity but dipping at a small angle from it; in the shaft the veins dip steeply northward, whereas the schistosity is vertical. The veins are not usually over 2 feet in width, and those that exceed this width are usually poorly mineralized and do not carry gold values.

The gold-bearing quartz veins are mineralized chiefly with pyrite, both coarse and fine, and usually have selvages of brown carbonate. The schist between the veins is often silicified and carbonatized, and mineralized with pyrite, and it has been shown that values in the walls are at least as high as in the veins. The gold-bearing schist can be distinguished from the barren schist by its high degree of alteration and by its bleached light-green colour, in contrast to the darker green or grey colour of the barren schist.

Description of Ore Bodies

Values in gold have been obtained at different points in the trenches in the shear zone on claim No. 23,717, and there are scattered occurrences of visible gold. The shaft was sunk on the largest ore body indicated by trenching; this ore body, averaging 32 feet in width over a length of 180 feet, was reported to show an average value of $2.52[1] per ton. The shaft passed through the ore body to a depth of 50 feet, at which depth the ore body dipped out of it to the north; the average value in the shaft was given as $4.60. At a depth of 125 feet crosscutting began; about 50 feet south of the shaft an ore body was entered, which was drifted upon for 60 feet each way from the crosscut. When work was temporarily suspended in November, both faces were reported to be in ore; the average width of the ore body being 7 feet, and the average value $5.00. At the bottom of the shaft an ore zone was cut, which gave an assay of $7.00 over a width of 4 feet, but this has not been drifted upon. Judging by the dip of the veins as seen in the shaft the surface ore body is represented in the crosscut by quartz veins, which were cut 50 feet north of the shaft but which at this point were barren. The ore body in the south crosscut apparently does not extend to the surface.

Two shallow holes were drilled at an early stage of development to intersect the ore body which had been outlined by trenching. Both holes were unsatisfactory, as a good deal of core was lost; the sludge from one hole was reported to have shown a value of $3.50 over 35 feet, and from the other $3.75 over 15 feet.

Conclusions

There is little doubt that the drag fold described above had a definite bearing on the segregation of the ore, since all the values were found along its axis. Further prospecting and development should be concentrated along the axis of this fold. Further search might reveal an extension of this structure, and it is conceivable that other similar structures might be located in the vicinity.

The origin of the ore is not known and little is known about the relations of the ore to the different igneous intrusions, except in the case of the diorite porphyry. That this porphyry antedates the ore, and the shearing along the axis of the drag fold, is proved by the occurrence of a number of dikes in the shear zone which are themselves sheared and cut by quartz veins. In trench "C," 600 feet southwest of the shaft, a 2-foot dike is cut by typical gold-bearing quartz veins. The dike and the veins are well mineralized with coarse cubic pyrite, and some samples are reported to have shown values in gold.

[1]The values reported for this property are all calculated on the old price of gold, $20.67 per ounce.

Notes on Some Properties in Lebel Township

By W. S. Dyer

Introduction

A few weeks were spent visiting properties east of Kirkland Lake for the purpose of witnessing the amount of development work now being done. The geology of Lebel township, which has been described in a general way by Hopkins[1] and Todd,[2] is complex, and many problems still remain unsolved. Several properties have been mapped by independent geologists, and a correlation of their work and further detailed work on structure might lead to important economic results. Further study of the various types of porphyry and their relation to each other and to the Timiskaming trachyte flows is needed. Some of the porphyries appear to exert a control on the ore deposits, and others do not.

Description of the Properties

Moffatt-Hall Mines, Limited

Among the rocks recognized on the Moffatt-Hall property are trachyte flows and tuffs, conglomerate and greywacké of Timiskaming age, and porphyries and diorites of varied type. The most extensively outcropping rock is a porphyry of greyish to brownish colour, heavily carbonated, and often showing quartz eyes. Intruding the porphyry as dikes is a later phase of darker feldspar porphyry. It is this porphyry that appears to exert a control on the ore deposits on the Moffatt-Hall and probably also on the Kirkland Gold Belt and Bidgood Kirkland properties. The porphyries may be Algoman in age, but this has not been proved. The idea has been expressed that at least some of the porphyry may be earlier in age than the Algoman and may be an intrusive manifestation of the Timiskaming trachyte flows. The diorites are dark in colour and usually fine-grained; they contain varying amounts of quartz and sometimes show prominent hornblende phenocrysts. The relationship of the diorites to the other rocks is not fully understood. They vary in characteristics from place to place, and sometimes exhibit what appears to be flow structure; they are cut by the later porphyries. It is possible that in part they are flows or sills.

On claim L.S. 4 values of commercial importance have been found in a vein that follows closely the east side of a narrow feldspar porphyry dike that intrudes quartz diorite. The ore consists of irregular patches of black quartz in a brownish fine-grained material, which appears to be altered and silicified country rock. The break strikes N. 30° E. and dips steeply northwest. Both walls of the break are marked by slip planes, but no displacement has been proved. A fault striking approximately east-west and dipping steeply south cuts off the vein about 80 feet south of the shaft. Widths average about 4 feet, and values are reported to run about $15.00.[3] Mineralization consists of heavy, fine pyrite and some chalcopyrite.

[1]P. E. Hopkins, Ont. Dept. Mines, Vol. XXXII, pt. 4, 1923, pp. 53-75.
[2]E. W. Todd, Ont. Dept. Mines, Vol. XXXVII, pt. 2, 1928, pp. 153-159.
[3]Gold at $35.00.

Porphyry dikes similar to the one that parallels the vein at the shaft are found farther to the east and south. They all strike in the same direction and may be parts of a single dike offset by faults. The dike that controls the ore deposition on the Kirkland Gold Belt property is also similar in character and lies approximately on the strike of those of the Moffatt-Hall. It might be worth while to map these dikes in detail and to prospect along their contacts with intruded rocks.

A shaft has been sunk to 525 feet, and levels have been established at the 150-, 300-, and 425-foot levels; about 300 feet of drifting has been done on each level. Approximately 50 tons of ore is being mined per day under lease arrangement between the Moffatt-Hall interests and H. Jardine, who is in charge of the operation. This ore is being treated at the new Bidgood Kirkland mill about half a mile to the north, to which point it is hauled in motor trucks. Considerable success is reported in following the ore shoots on the old levels, and it is reported that about 20,000 tons has been made available by development. It is expected that profits will be used to carry on fresh development.

Bidgood Kirkland Gold Mines, Limited[1]

The geology of this property has been described by E. W. Todd.[2] The rocks exposed at the surface are similar to those at the Moffatt-Hall, but the Timiskaming conglomerates, greywackés, and trachyte flows and tuffs are more extensive and the porphyries less so.

No. 1 shaft on claim No. 6,796 at the west end of the property has been sunk to a depth of 850 feet with a winze to 975 feet. Lateral work has cut ore bodies that are associated with a rock that Todd calls hornblende syenite. This is reddish in colour with prominent hornblende phenocrysts; on the surface it closely resembles some phases of the Timiskaming trachyte. In September, 1934, no work was being done at this shaft and it was being allowed to fill with water.

Shaft No. 2, on claim No. 9,882, has been sunk to 500 feet, and considerable lateral work has been done at the 125-, 375-, and 500-foot levels. Here, small bodies of ore occur adjacent to the contact between porphyry and diorite, which is an extension of the diorite mass from the Moffatt-Hall, in which the ore is found on that property. The fractured zones are from 3 to 6 feet wide, strike N. 50° E., and dip to the northwest at high angles. More or less quartz is found along the breaks in the form of irregular stringers through the crushed rock; mineralization is chiefly pyrite. Development work at present consists of a long exploration crosscut to the south of the shaft on the bottom or 500-foot level and diamond-drilling to the west of the west end of the 125-foot level to intersect a vein from which good values were obtained on surface. The mill is being kept busy treating Moffatt-Hall ore.

Kirkland Gold Belt Mines, Limited[3]

At the Kirkland Gold Belt property recent work has included the sinking of the shaft to 750 feet and the opening up of levels at 125, 250, 375, 500, 625, and

[1]In the *Northern Miner* of February 28, 1935, it was announced that an agreement had been arranged between the Premier Gold Mining Company, Limited, and the Bidgood Kirkland company whereby the Premier was to proceed with underground exploration and development at the latter property.

[2]Op. cit., pp. 155, 156.

[3]A new company named the Morris Kirkland Gold Mines, Limited, has been formed recently to take over the assets of Kirkland Gold Belt Mines, Limited.

750 feet. Here the break follows closely the northwest side of a feldspar porphyry dike, which is 20 feet wide and strikes about N. 40° E. The dike cuts across Timiskaming trachyte flows, conglomerates, and greywackés. The break consists of silicified material with numerous irregular quartz stringers; the vein minerals are pyrite, chalcopyrite, and galena. Widths of the ore shoots reach 7 feet. In September, 1934, it was reported that there was 21,675 tons above the 500-foot level, with average values on different levels ranging from $11.48 to $14.24.[1] Ore had also been found on the lower levels, but the tonnage had not been estimated.

Other Properties

Other properties in Lebel township on which active work was being done in September, 1934, included those of Lakeside-Kirkland Gold Mines, Limited (formerly Queen Lebel); Lebel Lode, Limited; Conroyal Gold Mines, Limited; and Glenora Gold Mines, Limited. At the Lakeside-Kirkland a crew of men were working on a crosscut, which had reached a length of 250 feet to the northwest of the southwest end of the old drift. Exploratory drilling was being done from the end of the crosscut. At the Lebel Lode a crew of 6 men were engaged in sinking an inclined test shaft along a vein from which good values had been reported on surface. Drilling was being done on the Conroyal property on claim L.S. 296, and some surface work was still being carried on by a crew of 5 men on the Glenora claims.

On the property of the Goodfish Mining Company, Limited, in Morrisette township, No. 1 shaft on the Costello vein was being pumped out with the object of resampling the more likely looking places, and doing further exploratory work. At No. 2 shaft drifting was proceeding eastward on the 200-foot level. The veins on the property are in Keewatin basic lavas to the north of the Timiskaming belt.

[1]Gold at $35.00.

INDEX, PART II

A

PAGE

Access.
See also Canoe routes; Roads.
Martin-Bird property 56
Matachewan-Kenogami area 4, 5
Acid volcanics 10, 11
See also Trachyte flows; Tuffs.
Acidic intrusives 24, 26
See also Granite; Syenite.
Acknowledgments 3, 4
Agaura Explorations, Ltd. 51
Agglomerates 9, 11, 44
Agriculture. *See* Farm land.
Airplanes, landings for 4
Algoman intrusives 8
See also Diorite; Granite; Lamprophyre; Porphyry; Syenite.
Distribution; petrography 17-25
Gold associated with 12
Lebel tp. 59
Algoman period 12, 30
Allen, Mat. 51
Allen-Coghill gold claims.
Geology; workings 51, 52
Route to 5
Alma tp.
Early survey 2
Folds 28
Gold, discovery 1
Prospecting, notes 53
Rocks 9, 11, 19, 27
granite, photomicrograph 18
syenite porphyry 21, 24
Amygdaloidal lava 9, 10, 48
Analyses.
Schists, Matachewan Consol. g. m. ... 38
Andesite 9
Ankerite 12
Anticlines 13, 28
Aplite dikes 19
Arbade gold m. 30, 48
Geology; workings 47
syenite porphyry 23
Route to 5
Arbade Gold Mines, Ltd. 47
Argillite 8, 9, 13, 14
Argyle tp.
Early survey 2, 3
Rocks 9
Arkose 8, 16, 27, 44
Armstrong, R. 56
Arno Mines, Ltd. 47
Ashley gold m. 3, 4
Fault 30
Power line to 5, 10
Road to. *See* Ashley road.
Ashley road 3-6, 31, 42
See also Elk L.–Matachewan road.
Branch trails 5
Rocks on and near 9, 11, 13-17, 27, 28
conglomerate, photo 25
syenite porphyry 22

PAGE

Ashley Gold Mining Corpn., Ltd. 1
See also Ashley g. m.
Auriferous quartz. *See* Quartz, auriferous, veins.

B

Baden tp.
See also Arbade g. m.; Matachewan l.
Early survey 2
Folds 28
Roads 5
Rocks 9, 10, 20
granite, photomicrograph 18
syenite porphyry 23
Sand plain 6
Water power 5
Baden Gold Mines 46
Property, geology and workings 44-46
road to 5
sketch map of 45
Baldwin gold claims.
See Lucky-Kirkland g. m.
Bannockburn tp.
See also Ashley g. m.
Early surveys 2, 3
Faults 30
Rocks 9, 11, 27
granite; photomicrograph 19, 20
Barite 2
Deposits described 54, 55
Basalt 9
See also Greenstone.
Matachewan Consolidated g. m. 40
ore, photo 37
Basaltic schist 38, 51, 52
Basic intrusives 17, 23, 24, 47
See also Diabase; Diorite; Gabbro.
Basic volcanics 9-11
See also Basalt.
Bastian lake 11
Batholith 19, 24, 28
Beaver lake 11
Bell, Robt. 2
Belt lake.
Gold claims, map 45
Bidgood Kirkland Gold Mines, Ltd. ... 60
Biederman barite deposit 54
Big Bend falls.
See Matachewan falls.
Bird, S. J. 56
Bird lake 11
Blackburn lake 10
Blain tp. 19
Blanche river 7, 13, 16
See also Englehart r.
Bloom lake 24
Bloom Lake Consolidated Mines, Ltd. .. 43, 46
Claims, geology and workings 42, 43
sketch map, geological ..... *facing* 36
syenite porphyry 24

PAGE
Bombs 11
Bompas lake, route to 5
Bompas tp 27
Boulder clay (till) 6, 8, 32
Bradley, Nelson 50
Breccia 49
Bridge, floating, photo 4
Pillow lava near 9
Brookbank, L.
Gold claims, geology, workings 50, 51
road to 5
Browning lake 30, 54
Bruce, E. L. 39
Burrows, A. G. 2, 25, 38, 52
Notes by, on barite deposits 54
on Montreal r. channel 7
Burt lake, route to 5
Burt tp.
Access 5
Rocks 8, 9, 11, 27
granite 19
structure 29
sulphides 12
Sand plains 6

C

Cairo tp.
Barite 2, 54
Early survey 2
Fault topography 7
Fluorite 2
Gold, discovery 1
mining claims 42-44
Map, geological, coloured (No. 44a) *in pocket*
Power line 5
Prospecting, notes 53
Rocks 8-12, 17, 19, 27
gabbro 26
syenite porphyry 21, 23
Sand plain 6
Syncline 13-15, 28
Calcite 12, 44, 51
Cameron lake 30
Campbell, A. P. 44
Campbell, John 56
Canada Northern Power Corporation 5
Canoe routes 2, 4, 5
Carbonate 17, 33, 48
Martin-Bird property 57
Carbonate schist 9, 11, 35, 37
Analyses 38
Faulted 29
Gold associated with 40, 50, 52
Martin-Bird property 57
Origin; petrography 12, 13
Central Matachewan Mining Corpn.
Properties; operations 46
road to 5
Chalcopyrite 33, 43, 44, 50-52
Lebel tp 59-61
Channel vein 41
Charlewood, G. H. 3
Chert 9, 12-15
Chief lake 11
Chlorite 17
Christie, George.
Gold claim, geology 50
Chrome mica 12, 35, 38
Claims.
See Mining claims.

PAGE
Cobalt series.
Conglomerate, photo 25
Distribution; lithology 27, 28
Hearst tp 57
Ore-bearing rocks under 34
Relation to Matachewan formation 25
Timiskaming syncline under 13, 30
Topographic effect 6, 8, 28
Coghill, Bert 51
Coles, B. C. 3
Collins, W. H. 28
Colorado-Ontario Development Co. 2
Colour phases in rocks.
Porphyry 32, 41, 50
Schists 38, 57
Conglomerate.
Cobalt series 8, 27, 43, 46
Hearst tp 57
photo 25
Timiskaming series 13-16, 42, 43
Hearst tp 56, 57
Lebel tp 59-61
photo 15
Conglomerate greywacké 9, 13
Conglomeratic quartzite 9, 13, 14
Coniagas Mines, Ltd. 51
Conroyal Gold Mines, Ltd. 61
Contacts.
Gold associated with 8, 12, 34, 37
granite and tuff 46, 47
syenite intrusive 43
Cooke, H. C. 2, 11, 21, 29, 56
Craig, E. C. 4
Crawford, Harry 44
Creek vein 46
Crooked creek 7

D

Dacite 9, 10
Davidson, Jake.
Gold discovery 2
site of, photo 35
Davidson creek.
Ancient bed Montreal r. 7
Gold, discovery 2
see also Young-Davidson g. m.
Photo 31
Rocks 28
Davidson's landing. *See* Moyneur's hotel.
Derby, A. 3, 24
Diabase 6, 8, 19, 39, 42, 43, 46, 50
See also Keweenawan; Matachewan formation.
Age 8, 26
Conglomerate on, photo 25
Distribution; petrography 25-27
Martin-Bird property 57
Porphyritic, photo 26
Structure relations 29, 30
Diorite 8, 9
See also Basalt; Diabase; Diorite porphyry; Quartz diorite.
Distribution; petrography 17-19
Lebel tp 59, 61
Martin-Bird property 56
Photomicrograph 17
Diorite porphyry.
Martin-Bird property 56, 57
Discovery vein, McNeil Synd. 49

PAGE
Discovery vein, Thesaurus Gold Mines 41
Dolomite 11
Drag folds 50, 51
Martin-Bird property 57, 58
Drainage 7
Drift. *See* Glacial deposits.
Dunbar, A. P. 3, 43

E

Eby tp.
See also Kenogami l.; Lucky-Kirkland g. m.
Access 5
Farm land 6
Gold mining 52, 53
Prospecting, notes 53, 54
Rocks 9, 11, 16, 19, 24
diorite, petrography 18
structure 29
sulphides 12
syenite 21, 23
Timber 6
Economic geology. *See* Geology, economic.
Eight Foot dike 48, 49
Elk lake, silver discovery 1
Elk Lake, routes from 4
Elk Lake–Ashley road. *See* Ashley road.
Elk Lake–Matachewan road 5, 53
See also Ashley road.
Englehart river 29
Character 7
Sand plain 6, 53
Explorations, early 2

F

Farm land 6
Faults.
Dikes parallel to 27
Eby tp. 53
Lebel tp. 59, 60
Martin-Bird property 57
Mistinikon l. 13, 29, 30
Montreal r. 12, 29
Topographic feature 7, 30
Feldspar porphyry 43, 44
Eby tp. 23, 24, 52
Lebel tp. 59, 61
Martin-Bird property 56
Petrography 16
Felsite 48
Ferguson highway 5, 7, 52
Rocks near 9, 13, 16, 53
Finns 6
Fish 6
Flavelle tp.
Access 5
Gold claims 51, 52
Prospecting, notes 53
Rocks 9, 13, 15, 19, 27
diorite 17-19
photomicrographs 17
structure 29
syenite porphyry 21, 22
Flows 9, 13, 29
Trachyte 59-61
Floyd, C. A. 47
Fluorite 2, 51

PAGE
Fluviatile deposits 6, 8
Folding 8, 28, 29
See also Drag folds.
Causes 19
Forestry Branch 3
Forgan dike 49
Fort Matachewan 29
Early survey 2
History 6
Rocks 6, 11, 12, 14, 26
Fox, Tom 48
Fractures. *See* Shear zones.
Fragmental rocks. *See* Agglomerates; Tuffs.
French gold claim.
Geology; workings 47
Route to 5
Fuchsite 12, 38
Furnival, G. M. 3

G

Gabbro 26
Galena 51, 61
Galer lake 15
Geology, economic.
Lebel tp. 59-61
Martin-Bird property 58
Matachewan-Kenogami area 31-55
Geology, general.
Martin-Bird property 56
Matachewan-Kenogami area 8-28
Geology, structural.
See also Faults; Folding; Synclines.
Martin-Bird property 57, 58
Matachewan-Kenogami area 28-30
G. G. 4,222, 4,223, 4,328, 4,329 claims 54
Glacial deposits 6-8, 16
Glendinning, Dr. H. 55
Glenora Gold Mines, Ltd. 61
Gneiss 21
Gneissic granite 19
Gold.
Deposits, location of 8, 36, 58
see also Carbonate schist; Contacts; Syenite porphyry.
Discovery.
McNeil tp. 48, 49
Young-Davidson g. m. 1, 35
Mining properties described.
see also Mining claims.
Lebel tp. 59-61
Martin-Bird Syndicate 56-58
Matachewan-Kenogami area 31-54
Native 40, 42, 47, 49
Ore.
Matachewan Consol. g. m., photo. 37
photomicrograph 41
Young-Davidson g. m., photo. *frontis.*
Origin 32
Values. *See* Geology, economic.
Goodfish Mining Co., Ltd. 61
Goodwin, W. M. 2
Gordon, M. B. R. 54
Gowganda formation 28
Gravel. *See* Sand and gravel.
Granite 8, 22, 44, 48
Age relations 24
Gold associated with 46, 47
Petrography 19-21
Photomicrographs 18, 19

PAGE

Granite porphyry 8, 43
Petrography; photomicrograph 19-21
Green mica 12, 35, 38
Greenstone 13, 42, 43
See also Basalt; Schists.
Distribution 9
Gold associated with 35, 44, 47-51
Inclusions in diorite 19
Prospecting in 44, 53
Structure 28
"Grey porphyry."
See also Porphyry, colour phases.
Gold values in 41
Greywacké.
Cobalt series 8, 27
Timiskaming series 42, 43
distribution 13, 14
Lebel tp. 59-61
Martin-Bird property 56
Gross tp.
Access; power lines 5
Rocks 10, 12, 19
Sand plain 6

H

Hearst tp. *See* Martin-Bird g. claims.
Height-of-land 7
Hematite 11, 33
Hincks tp. 2, 3
Historical notes 1, 2, 31
Hollinger lake 10, 20, 26
Hollinger Consol. Gold Mines, Ltd.
Acknowledgments to 4
Airplane service 4
Operations, Young-Davidson g. m. 1, 31
trench-sampling, photo 34
Option, French g. claims 47
Holmes creek 15
Holmes lake 15
Holmes tp.
Access 5, 53
Fault 7
Gold mining 50, 51
Prospecting, note 53
Rocks 9-15, 19, 27
diorite, petrography 18
flows, structure 29
syenite porphyry 21, 22
Hopkins, P. E. 2, 48, 52, 59
Hornblende diorite 20
Hornblende syenite 22, 60
Hornblende syenite porphyry 22, 23
Gold values in 42
Hudson's Bay Co. post 6
Hurd gold claim. *See* Arbade g. m.
Hydro-Electric Power Commission 5

I

Ilmenite 28
Indian chute 4, 5
Indian Reserve 2, 19
Iron formation 9, 11, 43
Isador (Indian) 48
Isador dike 49

J

James tp., silver discovery 1
Jameson, J. F. 4
Jardine, H. 60
Jowsey-Segsworth gold claims.
See McNeil Syndicate.

K

Kallies, Theodore.
Gold claims, values 47, 48
Kay, Geo. F. 2
Keewatin series.
See also Greenstone; Lavas; Tuffs.
Alteration 39
Diabase 9
Distribution; lithology 9-13
Gold in 8, 36
Intrusives in, granite 19
syenite 23, 37, 43
Lebel tp. 61
Martin-Bird property 56
Sediments 11
Structure 28
Timiskaming contacts 12, 13, 39
ore bodies at 34, 37
relationship 16, 39
Kells, Hugh.
Gold claims, geology 10, 26, 44
Kenogami lake.
Description 7
Rocks 13, 16, 23
Cobalt series 27
Timber in area; trails from 5
Kenogami station.
Photo 15
Rocks near 16
Keweenawan diabase 8, 28
Kirkland Gold Belt Mines, Ltd. 60, 61
Kirkland Lake gold area.
Faults 30
Mine timbers for 5, 6
Ore deposits, note 36
Syenite 24
Syncline 13, 16
Knight, C. W. 25
Knott lake 12

L

Laccolith 56
L'Africaine, Steve 6
Laird, H. C. 30
Lakeside-Kirkland Gold Mines, Ltd. 61
Lamprophyre 8, 44
Martin-Bird property 56, 57
Petrography 24, 25
Larder lake.
Gold claims. *See* Martin-Bird g. claims.
Larder City 56
Lavas 9, 10, 48
See also Flows; Keewatin series.
Lebel tp.
Gold mg. properties, notes on 59-61
Lebel Lode, Ltd. 61
Lee tp. 27
Limestone 11
Limonite 42, 52
Log lake 22, 27
Diabase hills near 6
Longpoint lake 4
Lorrain formation 28
Lough, D. 56

PAGE

L. S. 4 gold claim 59
L. S. 296 gold claim 61
Lucky-Kirkland gold m.
  Fault 30, 53
  Geology; workings 52, 53
  Rocks 13, 23
Lucky-Kirkland Gold Mines, Ltd. 52
Ludgate, D. J. 4
Lumbering 5

M

McDonald, S. L. 52
McNeil tp.
  Gold mining 48-50
  Trails to 5
McNeil Syndicate 48, 49
McVittie tp. 56
Magnetite 11, 33
Map, key 1
Maps, geological, coloured.
  Matachewan gold area (No. 44a) *in pocket*
  Matachewan-Kenogami area (No. 44b) ..... *in pocket*
Maps, geological, sketch.
  Claims of Baden Gold Mines 45
  Martin-Bird property ..... *facing* 56
  Properties of Young-Davidson, Matachewan Consol., and Bloom Lake Consol. ..... *facing* 36
Maps, notes on 3
Margo mines 43
Mariposite 12, 38
Martin, J., Sr. 56
Martin-Bird gold claims.
  Geology, report on 56-58
  Sketch map, geological ..... *facing* 56
Martin-Bird Syndicate.
  Officers; operations 56
Matachewan falls 5, 7, 10, 11, 47
Matachewan formation.
  See also Diabase.
  Age 8, 26
  Distribution; petrography 25-27
  Keweenawan compared with 28
  Structure relations 29, 30
Matachewan lake 5
  Description 7
  Fault 13, 25, 27, 29
  Gold claims 44, 46, 47
  Roads and trails 5
  Rocks 11, 14, 20
  Syncline 13
Matachewan townsite 7, 11
  Gold claims near 31, 43
  Power line 5
  Roads and other means of access 4, 5
  Rocks near 12, 24
    diabase, photo 26
  Settlement, notes and photo 6
Matachewan-Ashley road. *See* Ashley road.
Matachewan Canadian gold m. 1, 2
Matachewan Canadian Gold, Ltd. 36
Matachewan Consolidated gold m. 3, 42, 43
  Description of property and workings, 36-42
  History 2, 36
    see also Matachewan Canadian g. m.
  Mill 1, 36
  Ore, photo 37
    photomicrograph 41

PAGE

Matachewan Consolidated gold m.—*Cont'd*
  Ore bodies 39-42
    comparison with Kirkland Lake 36
    with Young-Davidson 36, 42
    plan of 160-foot level, showing 40
  Photograph 31
  Power line to 5
  Rocks 35, 36-39
    carbonate schist 12, 37-41
      analyses 38
    granite porphyry 20, 21
      see also Mg. claims, 5,406.
    syenite porphyry 22, 32, 36, 37, 42
  Sketch map, geological ..... *facing* 36
Matachewan Consolidated Mines, Ltd.
  See also Matachewan Consolidated g.m.
  Capital; incorporation; ownership 1, 36
Matachewan Gold Mines, Ltd. 2, 3
  See also Matachewan Consolidated Mines.
Matachewan Pioneer Syndicate 12, 43
Matachewan-Swastika road 4, 5
Matachewan Townsite Mines 43
Mica. *See* Green mica.
Micmack (Indian) 48
Micmack dike 49
Microphotos. *See* Photomicrographs.
Middleton lake 15
Midlothian tp. 13
Miller, D., gold claims 44
Miller, W. G. 25
Mine timbers 5, 6
Minette 24
Mining claims.
  See also G. G., L. S., and P. g. claims.
  2,566, 2,715 ..... *facing* 56, 57
  5,371 ..... 20, 21, 24, 31, *facing* 36
  5,372 ..... 10, 12, 30-35, *facing* 36, 42
  5,374 ..... 31, *facing* 36
  5,375 ..... 30-32, 35, 36, *facing* 36, 42
  5,379 ..... 12, 32, 35, 36, *facing* 36
  5,380 ..... 12, 36, *facing* 36
  5,383 ..... 20, 21, 24, 25, 28, 31, *facing* 36
  5,387, 5,389, 5,390 43
  5,396 12
  5,402 ..... 12, *facing* 36
  5,406 ..... 20, 21, 24, *facing* 36
  5,421 42
  5,513, 5,514 ..... *facing* 36, 42
  5,651 43
  5,868, 5,871, 5,872, 5,901 46
  5,902, 5,903 47
  6,140, 6,194, 6,231, 6,294 42
  6,391, 6,393 10
  6,440, 6,441 42
  6,543 ..... 44, 45
  6,544 ..... 45, 46
  6,618, 6,667 42
  6,686 47
  6,796 60
  6,829 30
  7,318, 7,319 48
  7,388 26
  7,914, 8,155 ..... 44, 45
  8,193 47
  9,882 60
  9,929 50
  10,018 51
  10,030 10
  10,401 48

PAGE
Mining claims—*Continued*
16,042 ... 54
19,410 ... 49
23,717 ... *facing* 56, 57, 58
24,849 ... *facing* 56, 57
24,935, 24,957 ... 56, *facing* 56, 57
24,958 ... *facing* 56, 57
25,024, 25,069, 25,072, 25,076 ... *facing* 56, 57
25,080 ... 57
25,324 ... *facing* 56, 57
Mistinikon lake.
Airplanes ... 4
Barite ... 54
Bridge, floating, photo ... 4
Description ... 7
Fault ... 13, 25, 27, 29, 30
Gold claims ... 50
Rocks ... 17, 25, 27
Syncline ... 13
Water power ... 5
Moffatt-Hall Mines, Ltd.
Property described ... 59, 60
Molybdenite ... 52
Montpetit's farm.
Rocks near ... 17
Trails from ... 5
Montreal river.
See also Matachewan l.; Old Woman rapids; West branch.
Early survey on ... 2
Faults ... 7, 12, 24
Road on ... 4
Rocks ... 12, 24, 28
Syncline ... 13
Montrose tp. ... 2, 3
Monzonitic porphyry ... 20
Morris Kirkland Gold Mines, Ltd. ... 60
Morrisette tp. *See* Goodfish Mg. Co.
Morrison lake ... 5, 43
Motor boats ... 4, 5, 56
Moyneur, J. B. ... 3
Gold claims ... 44
Moyneur, Mrs. J. B. ... 3
Moyneur's hotel ... 3
Diabase near ... 28
Pot-holes near ... 7
Moyneur lake, sand plain ... 6
M. R. mining claims. *See* Baden Gold Mines.
Murdoch, W. P. ... 4
Muskeg ... 7

N

Narrow lake ... 10, 12, 29
Natural resources ... 5, 6
Navigable waterways. *See* Canoe routes.
Night Hawk, route to ... 5
Nokomis lake ... 20
Northern Development, Dept. of ... 4

O

O'Brien, J., gold claims ... 44
O'Connell Gold Mines, Ltd. ... 43
Old Woman rapids ... 5, 14, 29
Gold claims near ... 43
Oliver, D. G. ... 50
Oliver, K. S. ... 49
Oliver dike ... 49
Oliver Gold Syndicate ... 49, 50
Olivine gabbro ... 26
O'Meara, G. ... 56
Ontario Barium, Ltd. ... 54
Ontario Research Foundation ... 55
Opeepeesway area, faults ... 30
Otisse, Ed., gold claims ... 44
Otisse, Sam., gold discovery ... 2
Otisse gold claims ... 1, 2
See also Matachewan Consol. g. m.
Otisse lake ... 12
Gold mg. *See* Bloom Lake Consol. Mines; Matachewan Consol. g. m.
Otto tp. ... 21
Oxidation, pre-glacial, depth ... 32, 34

P

P. 9,849 gold claim ... 49
Parsons, J. R. L. ... 2
Pegmatitic quartz veins.
Gold values in ... 41
Photomicrographs.
Diorite ... 17
Granite ... 18
dioritic phase ... 19
Granite porphyry ... 20
Ore, Young-Davidson g. m. ... 33
Syenite porphyry ... 22, 23
Physiography. *See* Topography.
Pillow lava ... 9, 10, 48
Plan, Matachewan Consol. g. m. ... 40
Pleistocene ... 8
Porcupine lake, airplanes ... 4
Porcupine Goldfields Development and Finance Co., Ltd. ... 2, 31
Porphyritic diabase, photo ... 26
Porphyry.
See also Diorite, Feldspar, Granite, Quartz-feldspar, and Syenite porphyry.
Colour phases in ... 32, 41, 50
Lebel tp. ... 59, 60
Martin-Bird property ... 56
Matachewan-Kenogami area, types ... 23, 24
Photomicrograph ... 20
Pot-holes ... 7
Powell tp.
See also Mistinikon l.
Early survey ... 2
Gold, discovery ... 2
mining properties ... 31-44
Map, geological, coloured (No. 44a) ... *in pocket*
Power line ... 5
Rocks ... 8-12, 17, 27
age relations ... 16
granite porphyry ... 19, 20
sediments ... 13-15, 27
syenite porphyry ... 23
Synclines ... 12-15, 28
Pre-Cambrian ... 8-28
Premier Gold Mining Co. ... 60
Prospectors, notes for ... 53
See also Colour phases in rocks; Contacts.
Pyrite ... 12, 42, 50-52
Auriferous ... 33, 39-44
photomicrograph ... 41
Cubic ... 40, 42, 48
Lebel tp. ... 59-61
Old Woman rapids, massive ... 29

PAGE
Pyritized schist....35, 40
Analyses; origin....38
Gold associated with....12, 38
Pyroclastics. *See* Agglomerate; Tuffs.
Pyroxenite....17

Q

Quartz, auriferous, veins.
See also Geology, economic.
Mode of occurrence....32, 36
Stockwork, Young-Davidson g. m., photo....35
Stringers, McNeil tp., photo....49
Quartz diabase....8
See also Diabase.
Quartz diorite....44
Lebel tp....59
Quartz-feldspar porphyry.
Martin-Bird property....56
Quartz-hornblende diorite....20
Quartz porphyry....44, 46-49
Quartzite....9, 11, 33
Quaternary....8
Queen Lebel. *See* Lakeside-Kirkland Gold Mines.
Quilty, J....48

R

Radisson lake, route to....5
Red porphyry.
See also Porphyry, colour phases.
Gold associated with....32, 35
Rhyolite....9,10
See also Tuffs.
Rhyolite porphyry....43
Rickaby, H. C....2, 30, 44, 45, 48
Roads....4, 5
See also Ashley road; Ferguson highway.
Robertson tp....48
Ryan lake....22

S

St. Paul lake....5, 10, 13
Sand and gravel....8
Sand plains, fluviatile....6
Scheelite....39
Schists.
See also Carbonate, Pyritized, Silicified schists.
Gold-bearing, colour phases....38, 57
Scotch dike....49
Sedimentary rocks.
See Cobalt series; Timiskaming series.
Separation lake....2, 9
Serpentine....17
Settlements, notes and photo....6
Sharp creek....57
Shaw, E. H....3
Shear zones....12, 13, 39, 46, 50
Martin-Bird property....57, 58
Shields, William J....3, 44, 46
Silicified schists....41, 50
Silver, discovery....1
Sketch maps. *See* Maps, geological, sketch; plan.
Slate....9, 13, 14 56
Soil. *See* Farm land.

PAGE
South dike....49
Spherulitic lava....9, 10, 48
Squaw lake....11
Steve lake....10
Striations....30, 53
Structural geology....28-30
Martin-Bird property....57
Sudbury Basin Mines, Ltd....36
Sulphides....12, 29
See also Chacopyrite; Galena; Pyrite.
Surveys, early....2
Swastika....4, 5, 52
Swayze area, faults....30
Syenite....47, 48, 53
See also Syenite porphyry.
Petrography....21
Syenite porphyry.
Age relations....24
Gold assoc. with....8, 32, 42-44, 50-53
Intrusive effect of....13, 50
Oxidation, depth of....32, 34
Petrography; photomicrograph....21-24, 32
Synclines....8, 12-15, 28-30
Martin-Bird property....56

T

Temiskaming and Northern Ont. R'y.. 4, 52
Rocks on....16, 53
Kenogami sta., photo....15
Striations....30, 53
Thesaurus Gold Mines, Ltd.
Property, geology and workings....46, 47
road to....5
Thomson, J. Ellis....33, 41
Till. *See* Boulder clay.
Timber....5
Timiskaming series.
Contact with Keewatin....12, 34, 37, 42
ore bodies at....34
relationship....16, 39
Distribution; lithology....13, 17
Lebel tp....59-61
Martin-Bird property....57
Structure....28-30
Todd, E. W....59, 60
Tom Fox (Indian)....48
Tom Fox lake....49
Topography....6, 7
Faults indicated by....30
Tourmaline....39, 42, 43, 51
Trachyte flows....59-61
Trails....5
Transportation....4, 56
Trench-sampling, photo....34
Tuffs.
Distribution; petrography....9, 10
Gold associated with....44-48, 50
Lebel tp., Timiskaming series....59, 60
Turtle lake....2

U

United States Smelting, Refining and Mining Co....51

V

Veins, quartz.
See Quartz, auriferous, veins.
Ventures, Ltd....1, 4, 36

PAGE
Veterans' patents, land held as..... 53
Vogesite..... 24
Volcanics.
See Keewatin series; Trachyte flows.

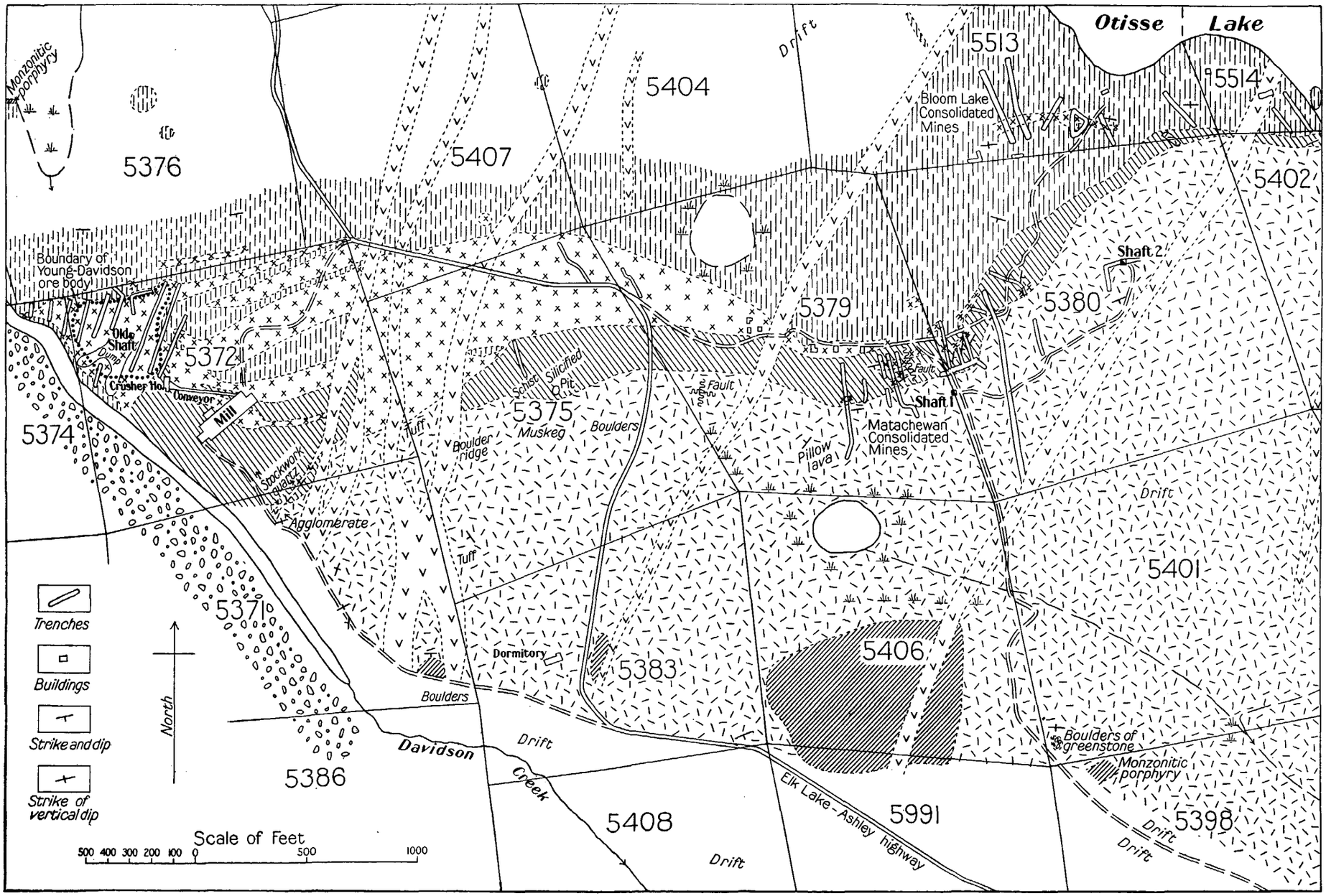
W

Watabeag lake, route to..... 5
Water power..... 5
Water routes. *See* Canoe routes; Motor boats.
Webb, J. B..... 24
Wells, T. H..... 4, 38
West branch, Montreal river.
See also Mistinikon l.
Channel, notes by A. G. Burrows... 7
Westcutt, Frank, gold claims..... 44
Wiley lake..... 5, 51
Woman River Gold Mines, Ltd..... 48

Y

Yarrow tp.
See also Mistinikon l.
Barite deposit.....54, 55
Early survey..... 2
PAGE
Yarrow tp.—*Continued*
Gold claims, geology..... 50
Iron ore..... 2
Young, W. C..... 3, 43
Young-Davidson gold m..... 3
Description of property and workings 31-35
Discovery..... 2
site of, photo..... 35
History.....1, 2, 31
Mill.....1, 31, 32
Ore, photo.....*frontis.*
photomicrograph..... 33
Ore bodies..... 33-35
comparison with Kirkland Lake... 36
with Matachewan Consol.....36, 42
Power line to..... 5
Rocks.....10, 25, 28, 30, 32-35, 47, 50
carbonate schist.....12, 35
granite porphyry..... 20
see also Mg. claims, 5,371, 5,383
syenite porphyry.....22, 32
photomicrograph..... 23
Sketch map, geological.....*facing* 36
Young-Davidson Mines, Limited.
See also Young-Davidson g. m.
Controlled by Hollinger Consol..... 1. 31

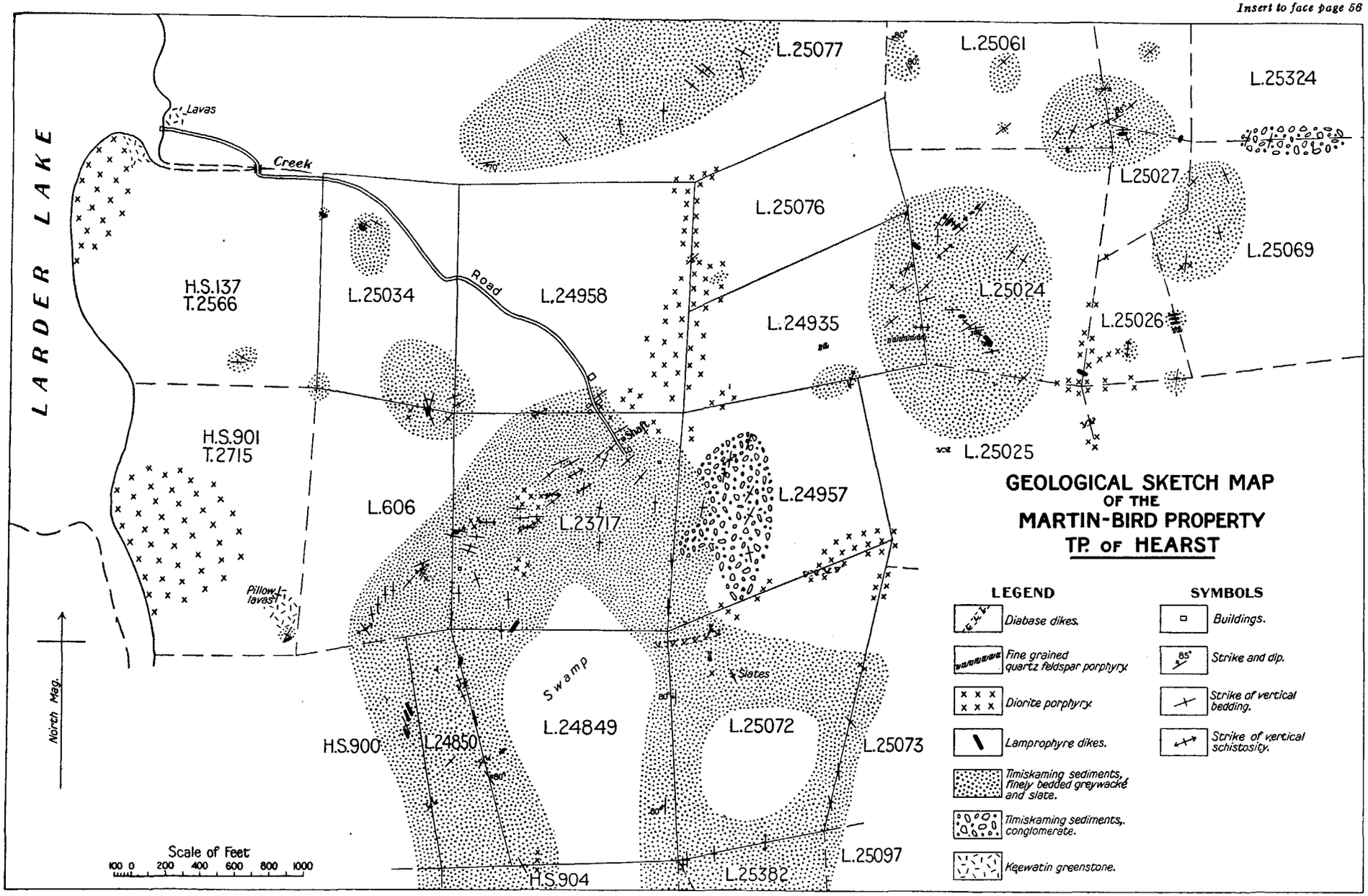
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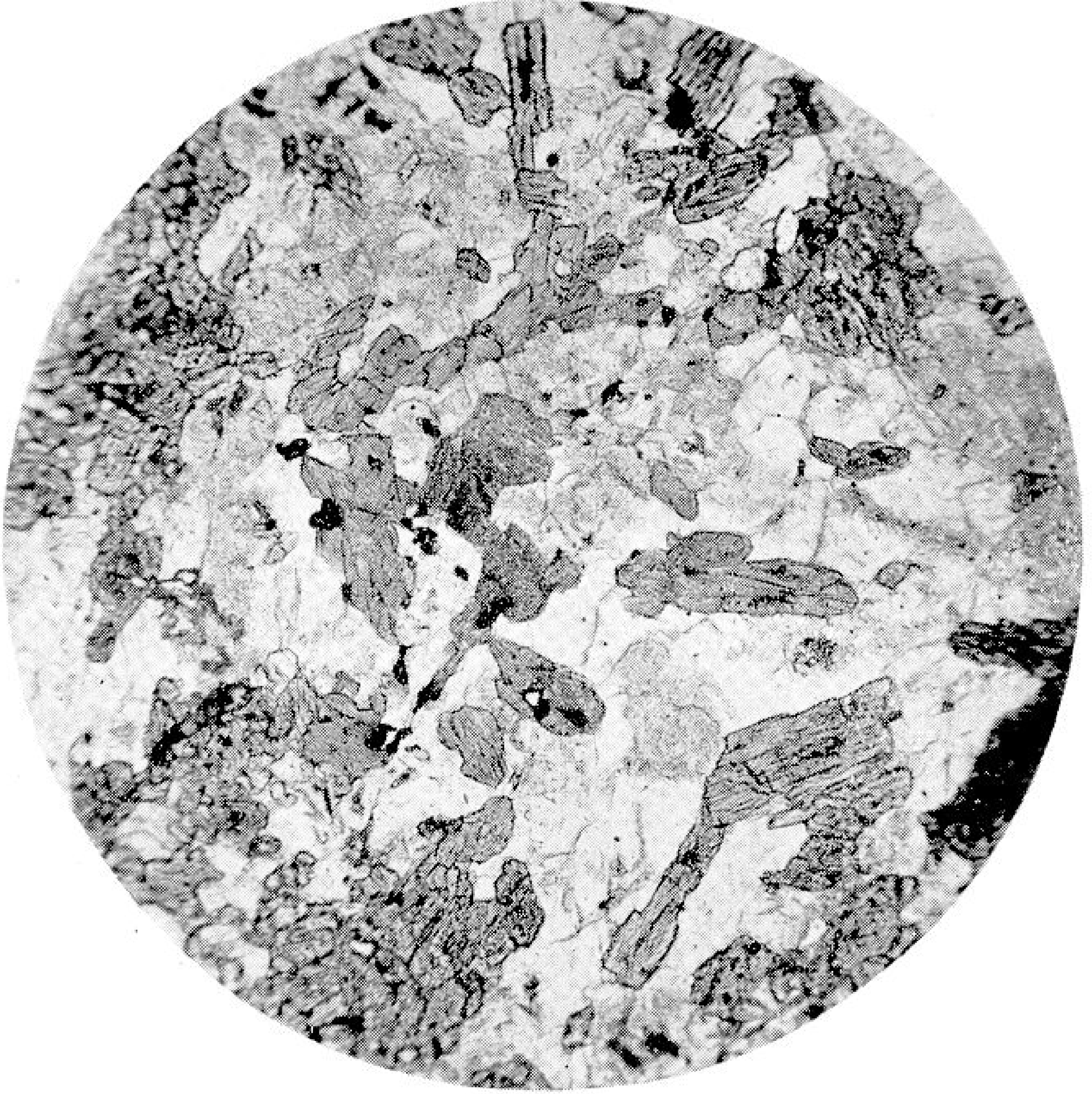


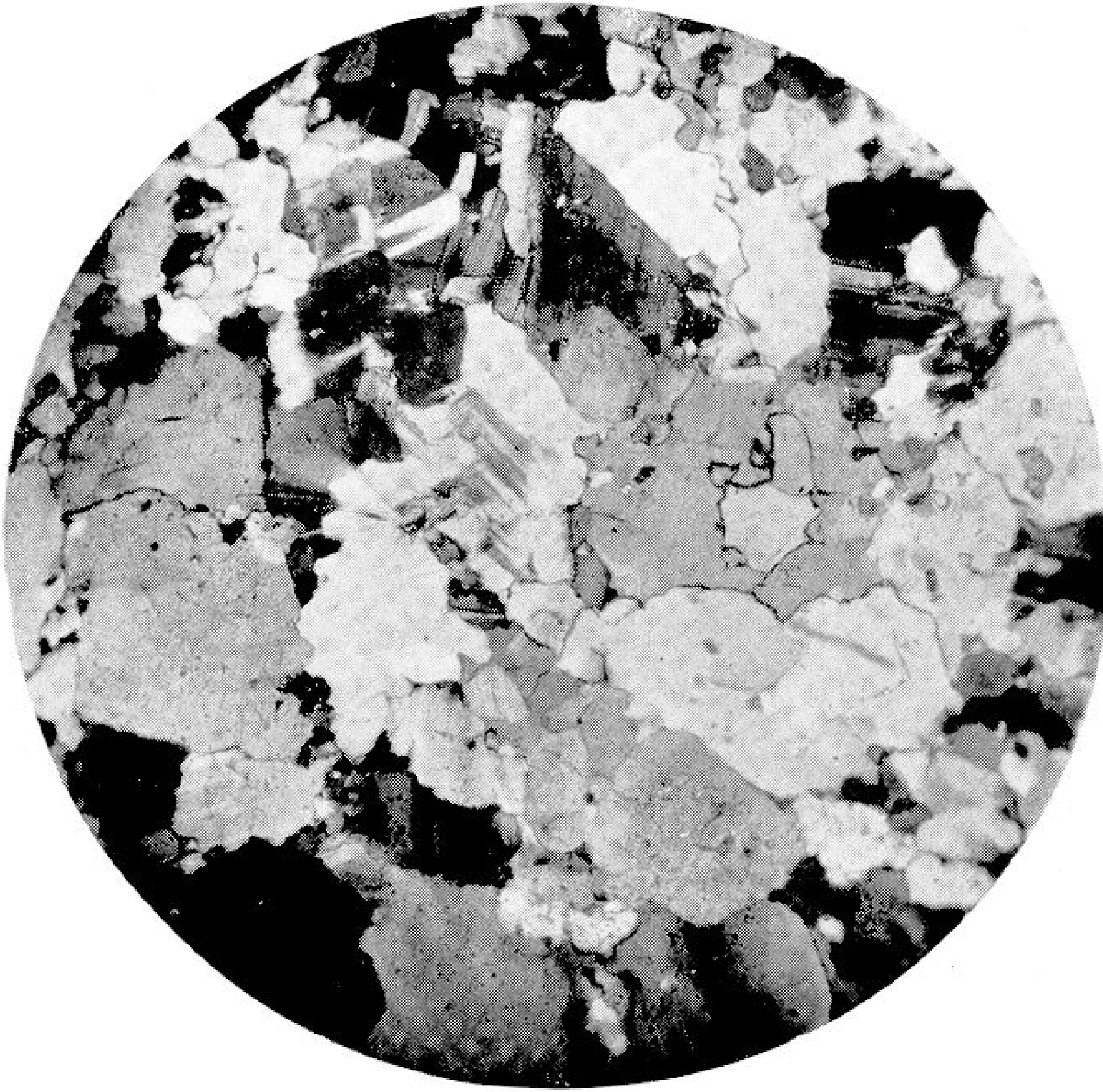
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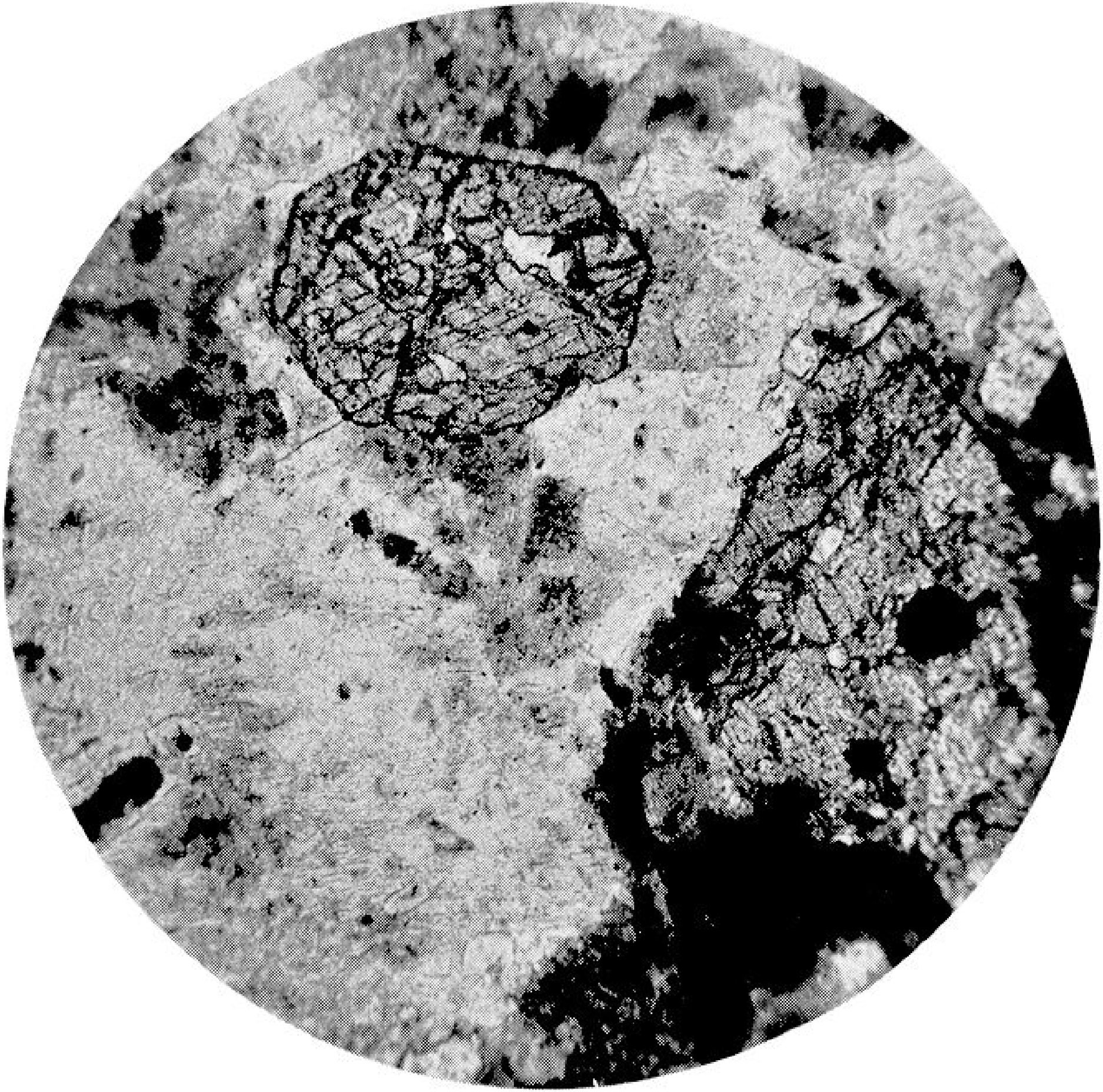
- Cobalt — Conglomerate
- Matachewan — Diabase dike
- Algoman — Syenite porphyry
- Algoman — Granitic and monzonitic porphyry
- Timiskaming — Conglomerate etc.
- Keewatin — Carbonate schist with lenses of silicified schist
- Keewatin — Greenstone and tuff

GEOLOGICAL SKETCH MAP OF PART OF THE PROPERTIES OF YOUNG-DAVIDSON MINES, LIMITED, MATACHEWAN CONSOLIDATED MINES, LIMITED, AND BLOOM LAKE CONSOLIDATED MINES, LIMITED.
(For general geology refer to map No. 44a.)

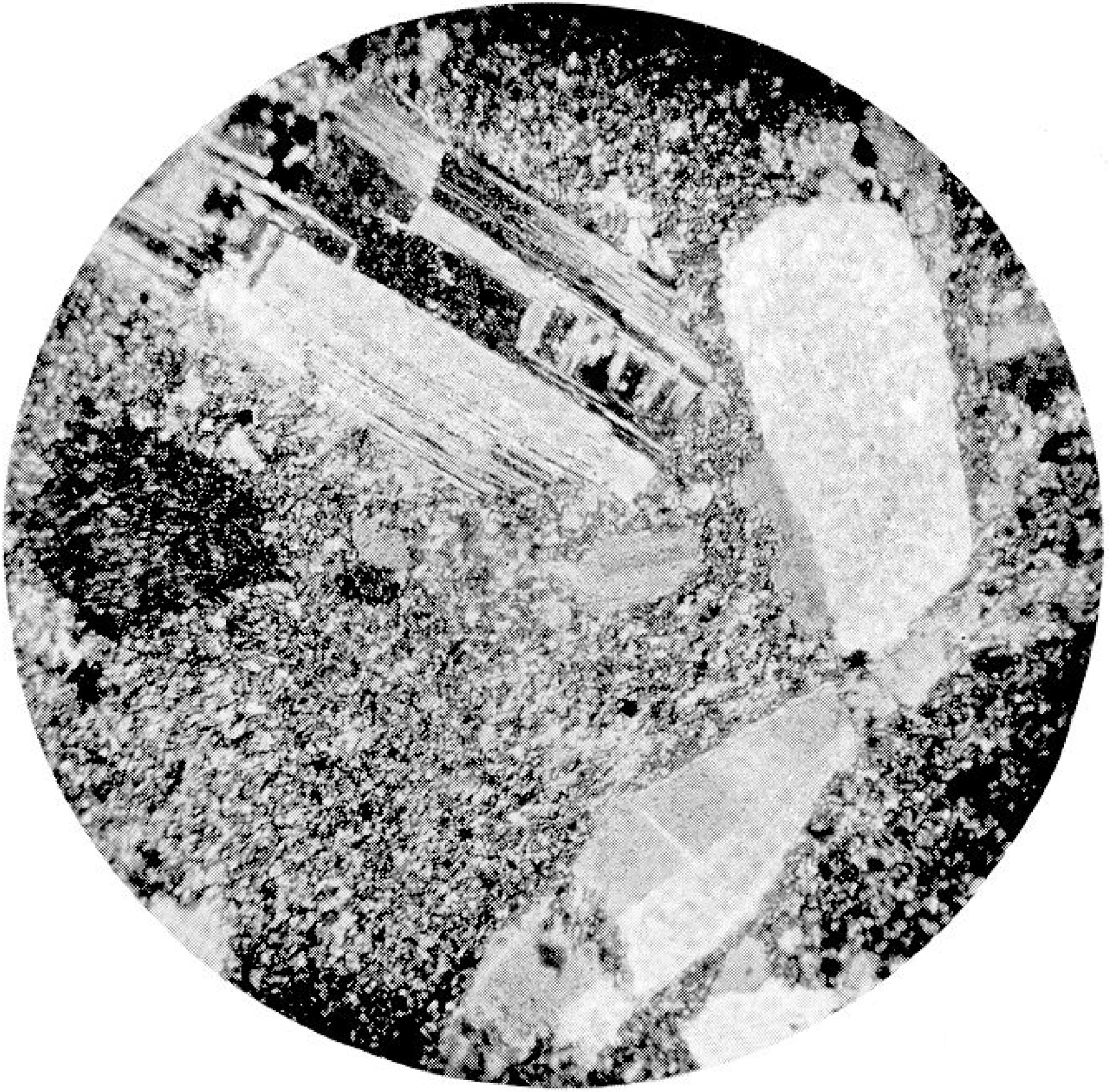

LARDER LAKE
Lavas
Creek
Road
L.25077
L.25061
L.25324
L.25027
L.25076
L.25069
H.S.137
T.2566
L.25034
L.24958
L.24935
L.25024
L.25026
L.25025
H.S.901
T.2715
L.606
L.23717
L.24957
Pillow Lavas
Swamp
Slates
L.24849
L.25072
L.25073
H.S.900
L.24850
L.25097
L.25382
H.S.904
North Mag.
Scale of Feet
100 0 200 400 600 800 1000
GEOLOGICAL SKETCH MAP
OF THE
MARTIN-BIRD PROPERTY
TP. OF HEARST
LEGEND
Diabase dikes.
Fine grained quartz feldspar porphyry.
Diorite porphyry.
Lamprophyre dikes.
Timiskaming sediments, finely bedded greywacke and slate.
Timiskaming sediments, conglomerate.
Keewatin greenstone.
SYMBOLS
Buildings.
Strike and dip.
Strike of vertical bedding.
Strike of vertical schistosity.





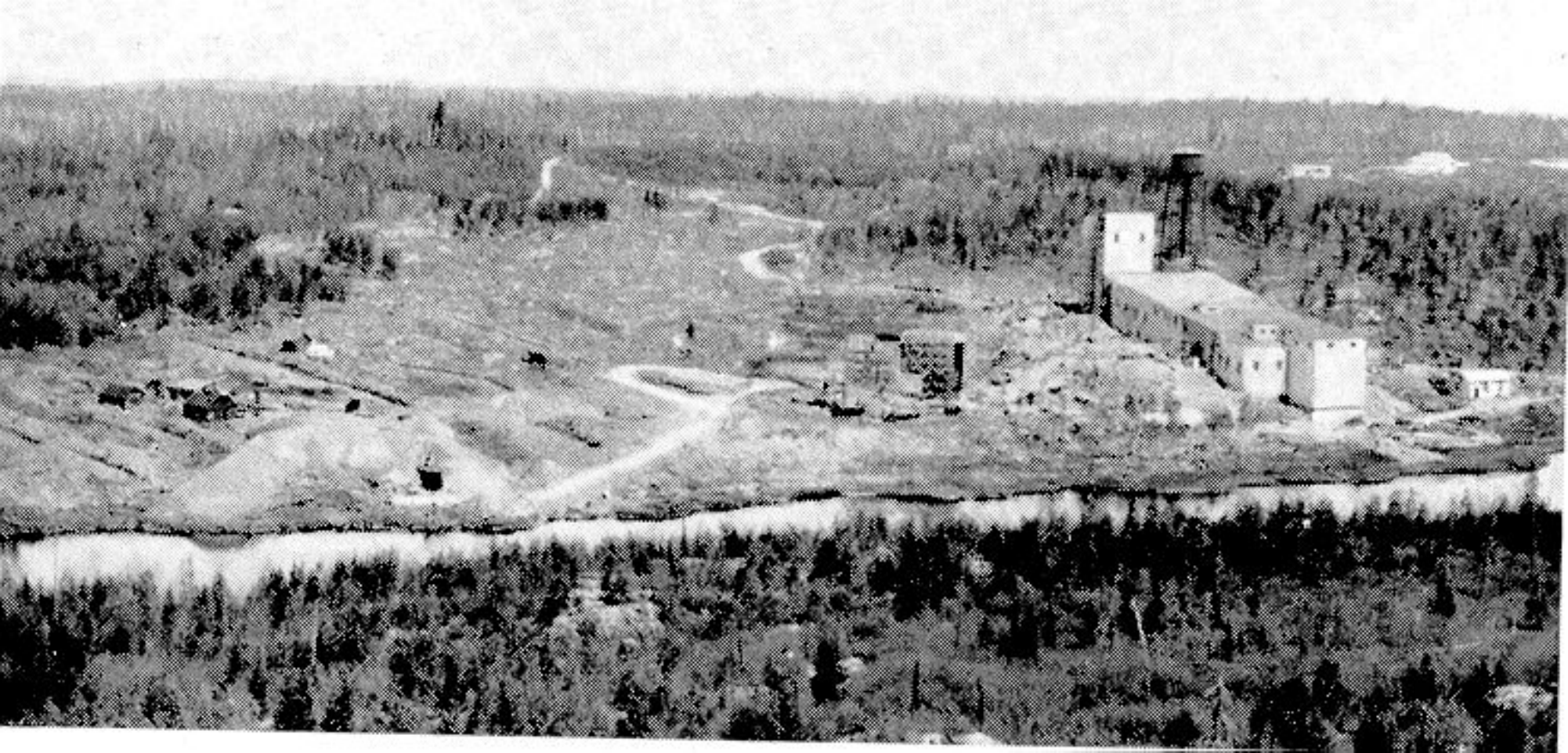


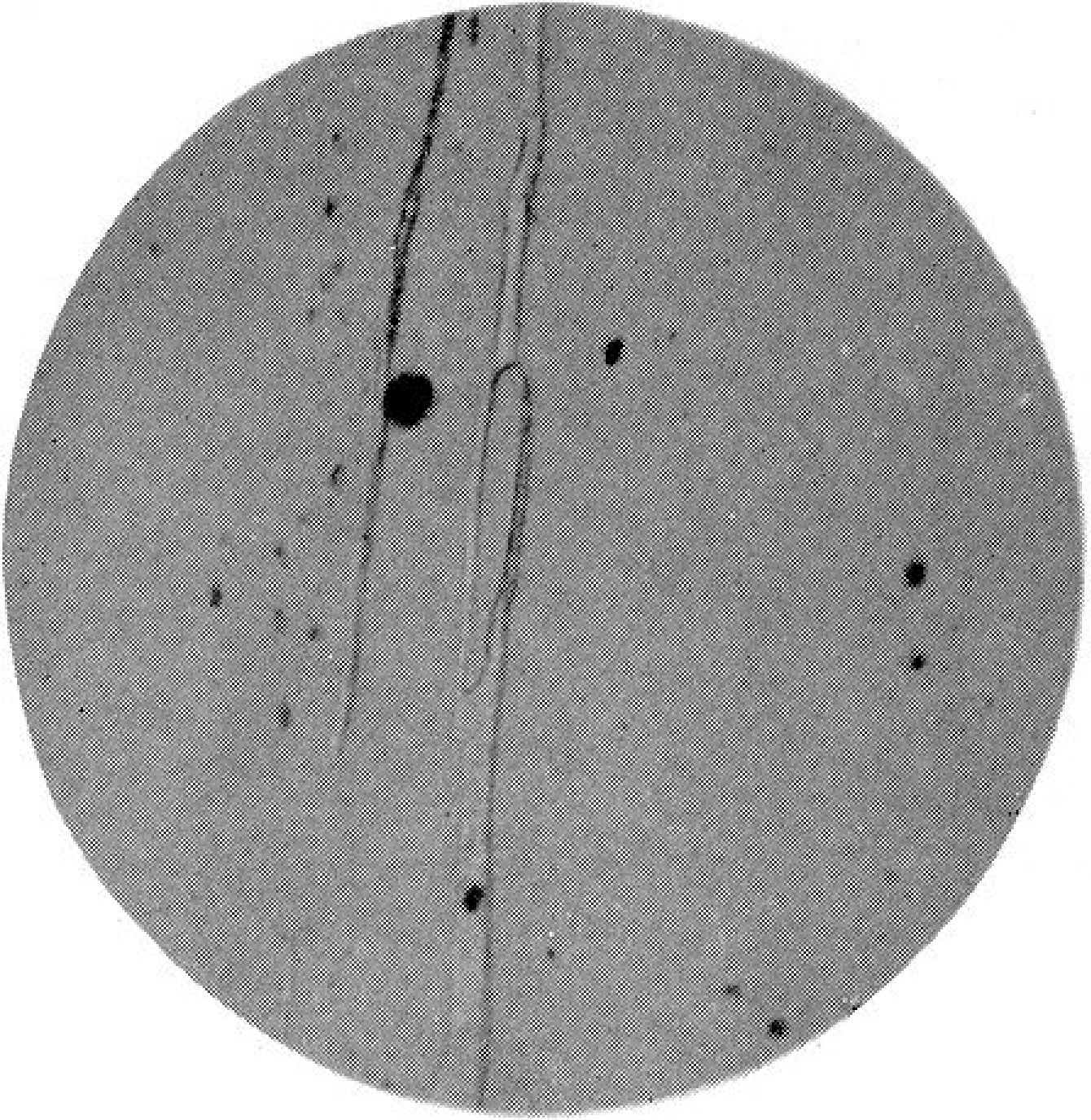








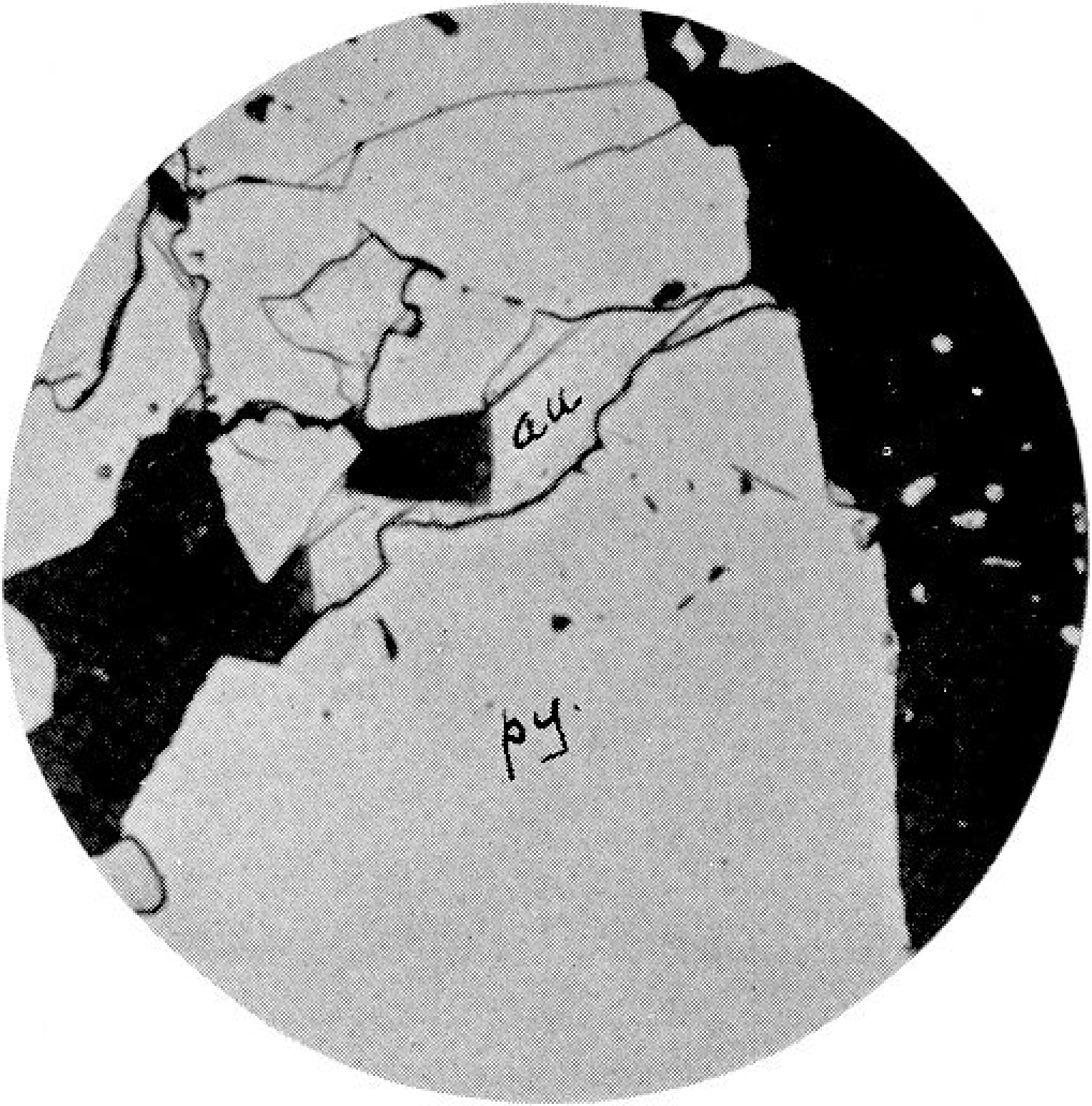




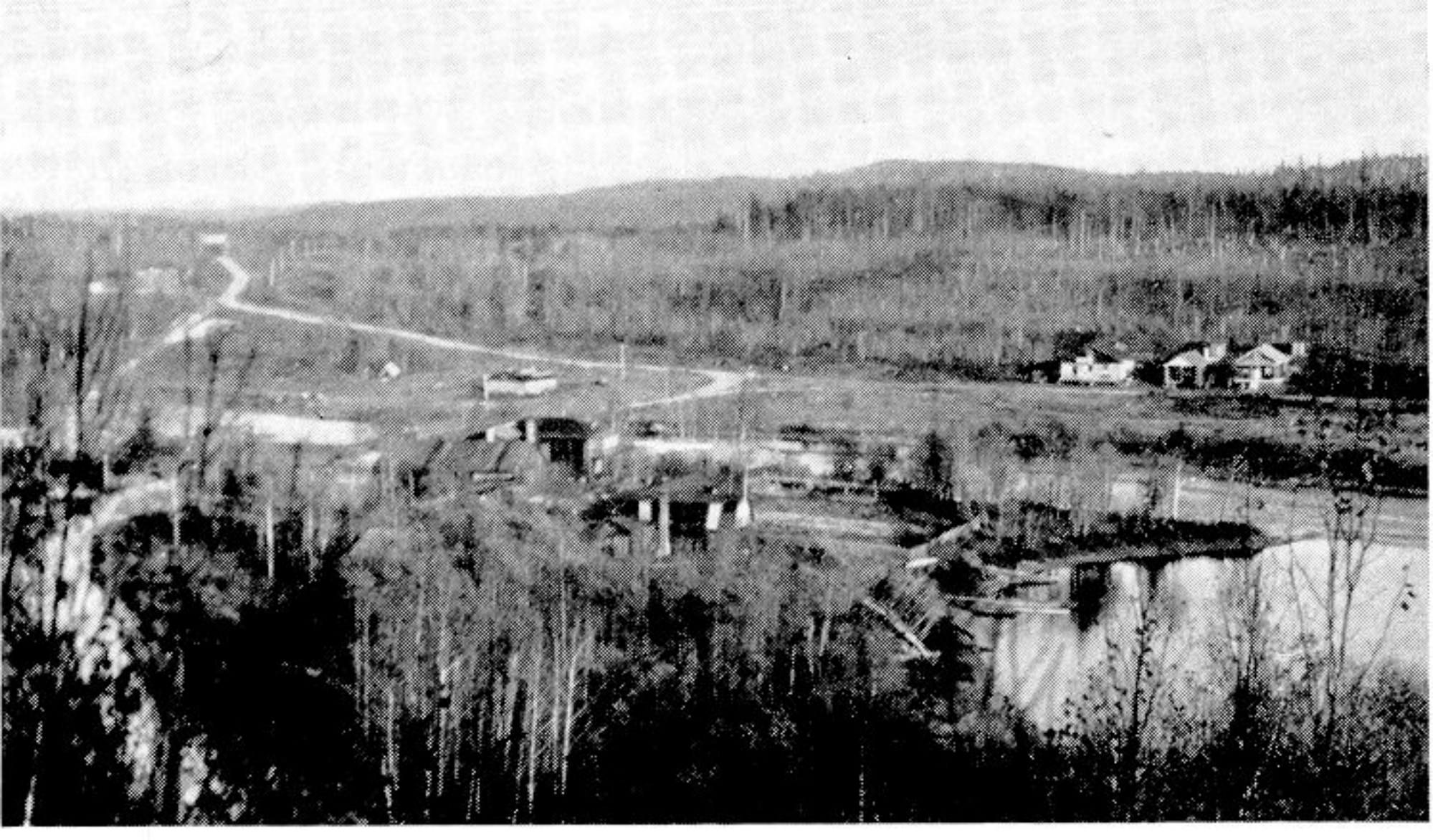







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PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLIV, PART III, 1935

Little Long Lac Gold Area

By
E. L. BRUCE

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Contents, Vol. XLIV, Part III

Introduction 1
Acknowledgments 1
General Description of the Map Area. 2
Means of Access 2
Previous Work 3
Topography 5
Natural Resources 9
General Geology 10
Table of Formations 10
Keewatin 10
Timiskaming Series 12
Lithological Character 12
Structure 16
Origin 18
Age Relations 18
Post-Timiskaming Intrusives 20
Diorite 20
Acidic Intrusives 21
Keweenawan(?) 25
Pleistocene 25
Recent 27
Structural Geology 27
Folding 27
Faulting 27
Historical Geology 28
Economic Geology 28
Gold Deposits 29
Iron Formation 32
Sand and Gravel Deposits 32
Future of the Area 33
Description of Properties 33
Properties Mainly in the Sediments... 33
Little Long Lac Gold Mines 33
MacLeod-Cockshutt Gold Mines... 45
Bankfield Gold Mines 46
Hard Rock Gold Mines 51
Mosher Long Lac Gold Mines 51
Oro Plata Group 52
Longacre Long Lac Gold Mines 52
Wells Longlac Mines 53
Kenogamisis Exploration Syndicate 53
Other Properties 53
Properties in Keewatin Rocks 54
Roche Long Lac Gold Mines 54
Lac Development Company 54
Langmuir Long Lac Gold Mines... 55
Lafayette Long Lac Gold Mines... 56
Other Properties 56

ILLUSTRATIONS

Aerial view looking northward over Little Long Lac mine ..... *frontispiece*
Aerial view of the Bankfield mine 7
Vertical photograph east of Wild Goose lake, showing parallel glacial ridges and transverse dry valleys 8
Photomicrograph of greywacké from the 3rd level, Little Long Lac mine 14
Photomicrograph of porphyry, Hard Rock mine 23
Photomicrograph of porphyry, Bankfield mine 24
Photomicrograph of porphyry containing sulphides, Bankfield mine 24
Railway cut through an esker at Bankfield station 26
Back of the 2nd level, Little Long Lac mine, showing parallelism of the quartz veinlets 36
Vein with anticlinal form, 700-foot level, Little Long Lac mine 38
Photomicrograph of vein quartz, Little Long Lac mine, showing brecciation 39
Photomicrograph of Little Long Lac ore showing brecciated pyrite cemented by bournonite 39
Photomicrograph of Little Long Lac ore showing gold in quartz 41
Photomicrograph of Little Long Lac ore showing gold in bournonite 41
Photomicrograph of Little Long Lac ore showing grains of gold in pyrite 42
Iron formation showing drag fold, MacLeod-Cockshutt mine 45
Photomicrograph of sheared greywacké, Bankfield mine 46
Photomicrograph of ore from drill core, Bankfield mine, showing arsenopyrite and pyrite impregnating fractured rock 47
Photomicrograph of ore from drill core, Bankfield mine, showing ilmenite replacing pyrite.. 48
Photomicrograph of ore from drill core, Bankfield mine, showing chalcopyrite as veinlets in fractured pyrite 49

SKETCH MAPS, SECTIONS, AND DIAGRAMS

Index map showing the position of the Little Long Lac area 2
Cross-section of the vein and shaft, Little Long Lac mine 35
Sketch of face of drift, 3rd level, Little Long Lac mine, showing veins of two ages 37
Sketch of face of drift, 5th level, Little Long Lac mine, showing quartz veins cutting through a calcite seam 37
Diagram showing the sequence of deposition of the vein minerals, Little Long Lac mine... 42
Longitudinal section, Little Long Lac mine 43
Geological sketch map of the property of MacLeod-Cockshutt Gold Mines 44
Geological sketch map of the property of Bankfield Gold mines ..... *facing* 46
Block diagram of parts of the Nos. 2 and 4 ore zones, Bankfield mine, showing the location of trenches and diamond-drill holes 50

COLOURED GEOLOGICAL MAP
(In pocket at back of report)

Map No. 44d—Little Long Lac Gold Area, District of Thunder Bay, Ontario. Scale, ½ mile to the inch.

Photo by Royal Canadian Air Force



View looking northward over Little Long Lac mine. The original discovery was made near the end of the point west of the water tank. The building in course of erection is the mill. The road to Geraldton can be seen directly across the bay.

LITTLE LONG LAC GOLD AREA

By E. L. Bruce

INTRODUCTION

Gold has been found in many places in the vicinity of Little Long Lac (Kenogamisis lake), district of Thunder Bay. One mine in that area is now producing the metal, and on many other properties much development work is being done. The deposits at the Little Long Lac mine are in inconspicuous shear zones; hence careful examination of fractures in which quartz or sulphides occur is necessary, and heavy overburden and swampy conditions makes this slow, difficult, and costly.

Gold occurs in quartz veins, generally narrow, occupying shear zones in basic lavas, greywacké, iron formation, dioritic intrusions, and dikes of feldspar and quartz porphyry. In most of these there are only minor amounts of pyrite and arsenopyrite and still smaller amounts of chalcopyrite and pyrrhotite. Rarely, other metallic minerals are present. In some places gold is present in silicified and pyritized rock along shear zones in which there are no definite quartz veins.

No ores of other metals have been found. Magnetite and hematite occur in bands of iron formation interstratified with the sedimentary formations, and a large part of the area now being prospected for gold was formerly staked for iron. Most of the lenses are small, and all are much too lean to give any promise of the occurrence of bodies of workable grade.

The widespread deposits of glacial material furnish abundant supplies of gravel and sand for the construction of buildings and roads.

Acknowledgments

The co-operation and generous assistance of all those working in or interested in the area added considerably to the amount of information obtained. Without exception, the records of all the companies operating in the area were placed at the writer's disposal with no reservations. For this generous courtesy, thanks are tendered to Joseph Errington, Little Long Lac Gold Mines; W. H. Connell, Connell Mining and Exploration Syndicate; C. D. H. MacAlpine, Bankfield Gold Mines; Miles Flynn and John Flynn, Oro Plata Mining Company; George Raynor, Lac Development Company; John Rea, Roche Long Lac Gold Mines; T. H. Rea and W. Smith, Hard Rock Gold Mines; and Thayer Lindsley.

Those in charge of the operations at the various properties gave generously of their information and in many ways assisted the field work. Many courtesies and much help were received from Alan Barton, Little Long Lac Gold Mines, and members of his staff; Cyril Stewart, MacLeod-Cockshutt Gold Mines; Charles Houston and John Reid, Mosher Long Lac Gold Mines; A. F. Matheson, Longlac Lagoon Gold Mines; J. P. Nolan, Langmuir Long Lac Gold Mines; E. F. Creelman, Magnet Lake Gold Mines; John W. McKenzie, Bankfield Gold Mines; A. E. Tyson, Lac Development Company; T. L. Gledhill and John Stevenson, Longacre Long Lac Gold Mines; A. Cockshutt, Kenogamisis

Exploration Syndicate; and many others. For use of detailed geological maps grateful acknowledgment is made to W. Samuel. Polished specimens of ore samples, which greatly facilitated study of the ore minerals, were kindly prepared by Dr. Maurice Haycock, of the Mining and Metallurgical Division of the Mines Branch, Department of Mines, Ottawa.

A large part of the credit for the field work is due to V. B. Meen, senior assistant during the season, C. H. Knight, and S. J. Barkley, to whom the writer is much indebted for their energetic and wholehearted co-operation during a field season marked by much disagreeable weather and in an area that offers many difficulties.

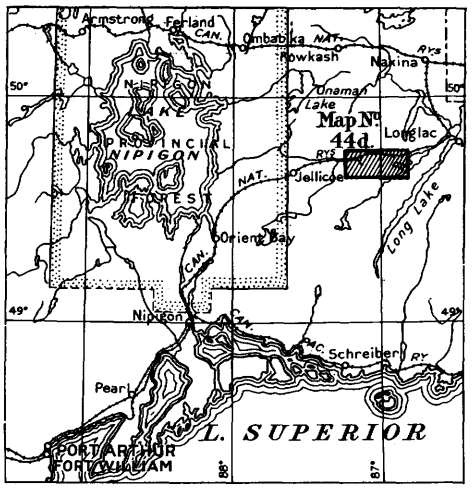


Fig. 1—Index map showing the position of the Little Long Lac area. Scale, 60 miles to the inch.

General Description of the Map Area

Little Long Lac lies approximately 50 miles east of Lake Nipigon and about the same distance north of Lake Superior (see Fig. 1). The present report covers an area slightly larger than the three townships of Ashmore, Errington, and Lindsley. The northern boundary of the map accompanying this report (No. 44d) lies half a mile north of the base line run by H. Sutcliffe in 1934, which cuts across Devilfish bay of Little Long Lac a short distance east of Langmuir and crosses the most northerly arm of Wild Goose lake. The eastern boundary extends southward from a point on the base line a short distance east of Langmuir. The southern boundary is about 6½ miles south of the base line; the western boundary lies just west of the southwest tip of Wild Goose lake. Within this rectangle are located most of the prospects now under development, but a few lie outside, both east and west, and new discoveries have recently been reported to the north. By far the largest number of operations are near Little Long Lac, but the area of active prospecting extends westward to Wild Goose lake.

Means of Access

The Canadian National Railway line from Longlac to Port Arthur and Fort William skirts the northern shores of Little Long Lac and Wild Goose lake,

and no part of the area is far from railway transportation. During the summer equipment and supplies for the properties adjacent to Little Long Lac have been unloaded from the trains at Hardrock station, where the track is close to the lakeshore. By motor-boat and scows, transportation to most of the working properties is then fairly easy. Little Long Lac and Hard Rock properties are situated on the lakeshore; the MacLeod-Cockshutt and Mosher claims are, by road, somewhat over a mile from the lake, so that goods must be again transferred from scows to wagons or sleighs. The Roche Long Lac property is reached by boat from Hardrock up Eldee (Boulder) creek to Eldee lake and thence by road. West of Little Long Lac the Longacre Long Lac company has cleared a road from their property to the rapids at the mouth of Magnet creek and thence to Bankfield station on the railway. The Bankfield company formerly brought supplies from Bankfield station by road to the north end of Magnet lake and thence by boat across that lake to the property, which lies on the south shore of the lake. A road has now been constructed from the workings to the railway at a point a mile and a half west of Bankfield station, thus eliminating the necessity of trans-shipping goods from wagons to boats.

During the winter the Little Long Lac mine and other properties in that vicinity are served from Geraldton, which is 3 miles west of Hardrock and directly north of the Little Long Lac mine. It is a mile and three-quarters from the lake. The grade is easy and a road is now being constructed direct to Little Long Lac mine so that, in future, summer as well as winter service will be possible from Geraldton to that part of the area.

Previous Work

There is no record of any early exploration of Little Long Lac. In 1870, Robert Bell[1] explored the route from McKay lake to Long lake and thence northward. There was at the time a post of the Hudson's Bay Company situated at the north end of Long lake, and no doubt the Little Long Lac area to the west was well known to the fur-traders. The first geological report in which reference is made to any of the formations at Little Long Lac is that of work done by A. P. Coleman[2] in 1908. At that time, however, claims had already been staked covering the whole country from Little Long Lac west to Magnet lake.

In 1916, A. G. Burrows[3] examined the area from Longlac to Jellicoe and mapped the main canoe routes. On the map accompanying his report all of the pre-granite formations are grouped together as Keewatin, but in the text of the report it is suggested that the sedimentary rocks may be of a different age from that of the volcanics.

In 1917, T. L. Tanton[4] made a geological examination along the railway from Nipigon to Longlac and remapped part of the area previously included in the maps of Dr. Coleman covering the iron ranges east of Lake Nipigon. In his report, Tanton mentions the occurrence of gold-bearing quartz float along the shore of Little Long Lac south of the main narrows. In 1920, a geological map[5] covering a large area west of Longlac was issued by the Geological Survey. No report other than the summary just mentioned was published to accompany the map

[1]Robt. Bell, Geol. Surv. Can., Rept. of Progress, 1870-71.
[2]A. P. Coleman, Ont. Bur. Mines, Vol. XVIII, pt. 1, 1909.
[3]A. G. Burrows, Ont. Bur. Mines, Vol. XXVI, 1917.
[4]T. L. Tanton, Geol. Surv. Can., Sum. Rept., 1917, pt. E.
[5]Geol. Surv. Can., map No. 1766, 1920.

In 1933, E. M. Burwash of the staff of the Ontario Department of Mines examined the gold deposits discovered in the Little Long Lac area and in the vicinity of Atigogama lake. His report was published in mimeographed form.

The search for iron ores, which was carried on so vigorously in western Ontario in the early part of the century, led to the first prospecting of the Little Long Lac area. Iron formation was discovered in the Nipigon basin in 1870 by Peter McKellar, who was assistant to Dr. Robert Bell in his exploration of the country north of Lake Superior. On the west point of the Slate islands in Lake Nipigon he found slaty rock containing some hematite. Bell, in his report of the work of that year, also states[1] that "Mr. Beatty [probably Walter Beatty, O.L.S., who ran an exploration survey line southeast of Lake Nipigon in 1870] shewed me a specimen of a fine-grained, siliceous, slaty magnetic ore, which he took from a band two feet thick on the portage at the west end of Little Long lake."

Prospecting for iron ore was in progress east of Lake Nipigon during the summer of 1900,[2] and in 1901 Parks[3] stated that many claims had been staked in the iron ranges along the Sturgeon river and that the band of iron formation south of the Sturgeon river had been traced eastward, with some interruptions, as far as Little Long Lac.

During the summers of 1906, 1907, and 1908, Coleman[4] and his assistants mapped the iron ranges both east and west of Lake Nipigon. By the summer of 1908, prospecting had extended to Little Long Lac and claims were staked covering the area now forming the Little Long Lac claims and adjacent properties. Some stripping was done on the crumpled iron formation on the large island in the west end of Barton bay.

No bodies of iron ore were found in any of the bands of iron formation, and interest in the mineral resources of the region subsided. Even the report of a quartz vein 15 inches wide, with a gold content of $4 per ton, occurring in a railway cut near Jellicoe, and of quartz and pyrite containing gold to the value of $2 per ton from the shores of Barton bay of Little Long Lac,[5] received little attention.

It was not until late in the summer of 1925 that claims were staked for gold in the vicinity of Beardmore. The story of the discovery of the ore body of the Little Long Lac mine, which led to renewed interest in the Little Long Lac area, is a somewhat unusual one. During the war, Tony Oklend went to Little Long Lac and built himself a cabin on the property now held by the Longlac Lagoon Gold Mines. In the course of his trapping along the shores of the lake, he discovered, south of the Main narrows, a boulder in which there was a metallic mineral. Oklend took samples of this to the Hudson's Bay post at Longlac, where it was identified as gold. It is said that he chiselled a considerable quantity of gold out of this boulder. Later, rumours of this got abroad, and claims were staked covering the country in which the boulder had been found. No discoveries seem to have been made, and most of the claims were allowed to lapse. In 1931, gold was found by W. Smith on the point where the shaft of the Hard Rock mine is now being sunk. The claims to the west were optioned by the Homestake Mining Company, and a large amount of exploration work was done. Only small values were found, and work was discontinued.

[1]Robt. Bell, op. cit., p. 348.
[2]J. W. Bain, Ont. Bur. Mines, Vol. X, 1901, p. 214.
[3]W. A. Parks, Geol. Surv. Can., Vol. XIV, 1901, p. 107A.
[4]Ont. Bur. Mines, Vol. XVI, pt. 1, 1907, pp. 105-148; Vol. XVII, 1908, pp. 136-189; Vol. XVIII, pt. 1, 1909, pp. 141-179.
[5]A. G. Burrows, op. cit., p. 244.

The revival of interest was undoubtedly due to the discovery of the vein of the Little Long Lac mine by T. A. Johnson. There is some difference in the minor details of the story of the discovery as told by Johnson and by Oklend, who was with Johnson, but the main facts correspond. Johnson, accompanied by Robert Wells, came to the Little Long Lac area in the fall of 1931 and, after visiting the Smith find, went up the creek, from Barton bay of Little Long Lac to Magnet lake. As the morning of October 3 was showery, they cruised around the shoreline and Johnson noticed an outcrop of rock in the middle of the lake. Going out to it he found a shear zone containing quartz with some metallic minerals and, after some further examination, a piece which contained gold. The following day Johnson and Wells staked a group of 18 claims, part of which are now the property of Bankfield Gold Mines. Johnson discovered the south zone on the Bankfield early in May, 1932, by panning rusty material.

Toward the end of June, 1932, Johnson and Oklend met at Bankfield station and arranged to prospect together. They first visited the place where Oklend claimed he had obtained several hundred dollars' worth of gold from a boulder. Some gold could be panned from a shear zone near a pit at that place, but apparently nothing was found that seemed to Johnson to be of importance. The two men then visited Eldee lake and the next day examined the shore of part of the east end of Little Long Lac. They next went to the west end of the lake and camped on the large island in Barton bay. Apparently they found nothing of interest and decided to return to the east end, where the boulder had been found, and attempt to get some material from the lake bottom with a long-handled shovel. On the way there, they observed shearing on a point on the south shore of the bay. On landing they found two quartz stringers, in one of which there was some dark mineral. Johnson was of the opinion that it was bismuthinite and might be gold-bearing. Oklend recalled that he had seen a shear zone a short distance southwest, and they decided to inspect it. In passing the point where the Little Long Lac vein outcrops Johnson claims that he saw veins in the water and insisted on stopping to examine them. In one of these gold was visible, and they were able to pan gold from the rusty material. On the evening of that day, July 5, Johnson staked the discovery claim, T.B. 10,560, and, in the following couple of days, the adjoining claims now forming the property of Little Long Lac Gold Mines. Through P. E. Hopkins, the Sudbury Diamond Drill Company became interested; the properties were examined by A. A. Barton, and on his recommendation it was decided that development work should be undertaken.

The first reference to the shear zone at this locality is in Coleman's report (the italics are the present writer's):[1]—

> The first suggestion of iron formation is found on the south side of the western end of the lake, in location A.L. 439, where low cliffs of Keewatin rocks rise west of a marshy bay. A few thin seams of banded grey and black material are evidently very low-grade samples of the usual iron formation. They are associated with green schist and irregular masses of coarse arkose, all squeezed and more or less drawn out and torn asunder. *There are also many small seams of white quartz in shear zones.*

Topography

Little Long Lac drains northeast by the Kenogami river to James bay. Wild Goose lake, lying in the western part of the map area covered by this report, drains westward to Lake Nipigon and thence to Lake Superior. The height-of-land between the Hudson Bay basin and the St. Lawrence drainage

[1]A. P. Coleman, "Iron Ranges of Nipigon District," Ont. Bur. Mines, Vol. XVIII, pt. 1, 1909, p. 146.

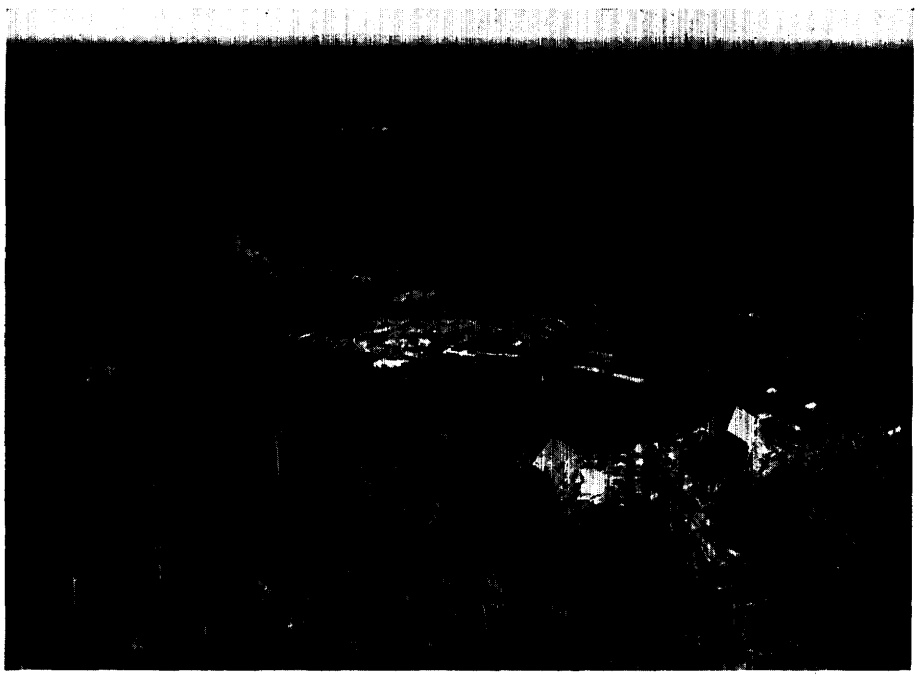
system in this region is only twenty-five miles north of Lake Superior. In the vicinity of Lake Nipigon the cutting of the streams back into the sills of diabase that surround the lake has produced a rugged and picturesque topography, characterized by steep-sided valleys separated by ridges of considerable elevation. A comparatively short distance inland the valleys of the westward-draining streams are only slightly below the level of the upland that stretches north and east, and the drainage systems are characterized by numerous lakes, some of them large but all of them shallow. This feature is common in the great flat areas that form the watersheds of the Canadian shield but is even more marked here than in most places, since the continental glaciers seem to have remained stagnant for a long time along the upland north of Lake Superior and to have deposited there a thick mantle of gravel and sand, which masks many of the inequalities of the rock floor and has disorganized any drainage systems that might have been left after glacial erosion. There are also certain ridges and hills composed of material deposited either beneath the glacier as winding ridges, or in front of the ice-sheet as oval or crescentic hills. These hills are now the most prominent elevations of the Little Long Lac area. The hollows between the elevations are occupied by extensive swamps and by many small lakes, which have no visible outlets. As a result outcrops of consolidated rocks are relatively not abundant nor extensive. Much of the country has escaped being burnt over in recent years, and the small and inconspicuous natural outcrops are, accordingly, difficult to find. Owing to the extensive swamps and marshes and to the location of the area on the upland near the height-of-land, drainage is very slow, and following periods of excessive rainfall or snowfall, much of the land around the lakes is flooded; the water level reaches its normal height comparatively late in the summer.

At only a few places do rock ridges or hills rise much above the general level. Along the north boundary of the township of Ashmore volcanic rocks are well exposed and form a ridge of considerable elevation. Looking northward from the top of this toward the string of lakes, of which Hutchison lake is the largest, the difference of elevation is striking since that slope of the rock ridge is not concealed by glacial deposits. To the south, however, sand and gravel have lodged behind the protecting elevation so that the surface slopes gently southward to Little Long Lac, and from that side the ridge does not appear as a conspicuous elevation. The steady upgrade from the lake is easily noticeable, however, along the railway from Hardrock to Geraldton, in spite of the fact that the slope is so gentle that much of it is undrained and swampy. Farther west, near the northeast corner of the township of Lindsley, a ridge of conglomerate has a similar steeply sloping northward face, which must be a marked feature in the topography as seen from the north. From the south the smooth islope of the surface upward to the rock crest is so gentle that it gives the tmpression of being practically flat. Along the south side of the southwest extension of Barton bay, the most prominent rock ridge in the map area rises fairly steeply from the marshy lakeshore; to the south of it the glacial deposits are banked to form a gentle southward slope similar to that just described north of Little Long Lac.

The elevations formed by the deposition of glacial material are somewhat concealed by forest growth, and few of them are conspicuous landmarks. From the air, however, they are easily recognized. North of Little Long Lac they occur as oval or irregular hills. Between Magnet lake and Wild Goose lake well-developed esker ridges give the topography a strikingly linear character (See photograph on page 8). Of elevations of oval form the highest is one in

the northern part of the township of Errington. As the slopes southward are gentle, it is only on looking northward from its crest that one realizes its prominence. The most striking of the linear glacial ridges is that lying west of Magnet lake. It rises abruptly from the west shore of the lake and falls with almost equal sharpness to the west (see photograph below). At that point it is only a few chains wide. Northward it broadens and along the railway merges imperceptibly into the gentle slope rising northward to the rock ridge near the northeastern corner of the township of Lindsley. Its well-drained gravelly surface has been utilized for the Bankfield road.

Photo by Royal Canadian Air Force

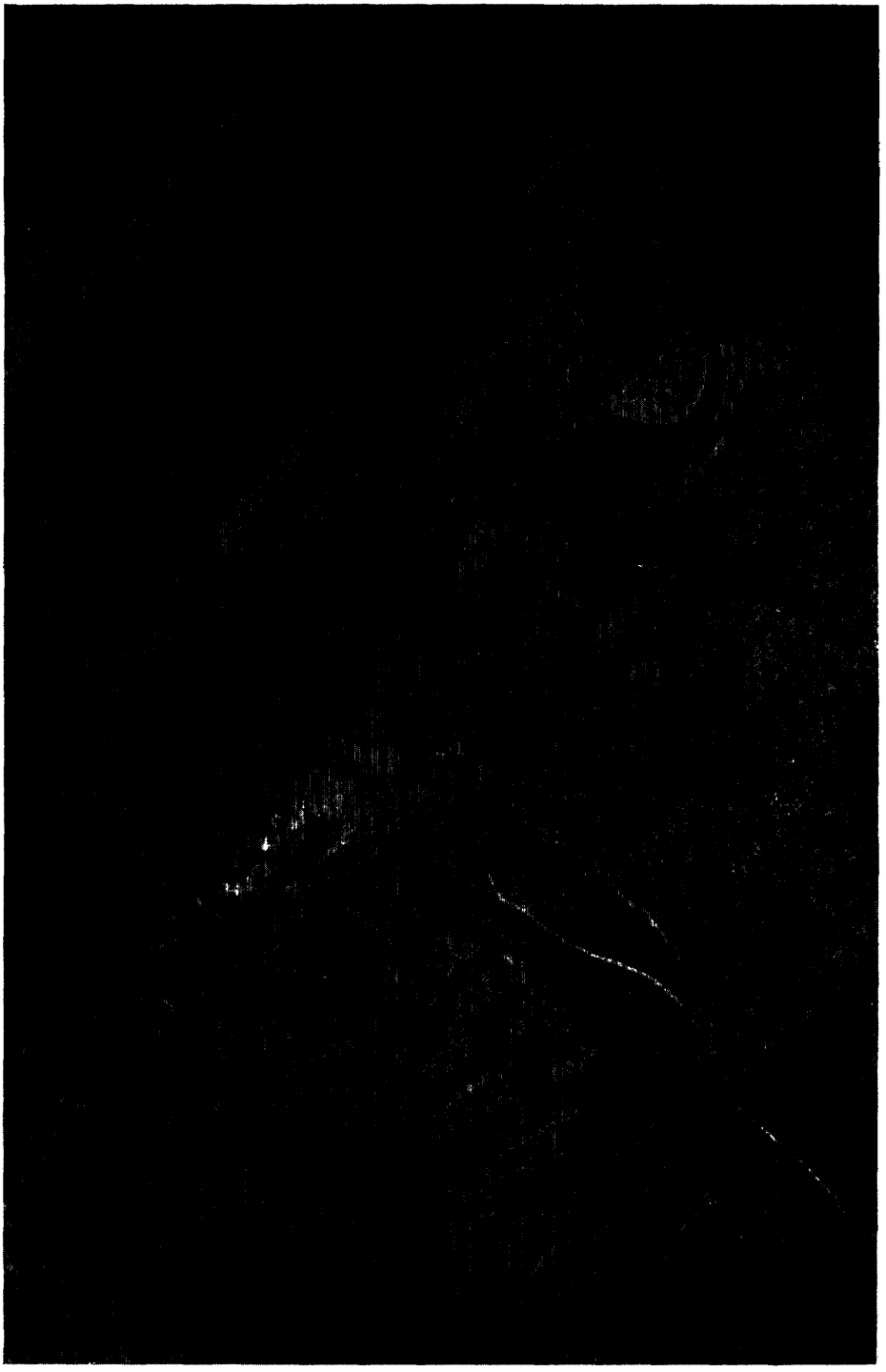


View of the Bankfield mine showing glacial ridge in the foreground and site of the shaft in the middle distance.

Other esker ridges that do not rise as high above the surrounding country occur at many places in the area. Most of them trend northeast-southwest, but some are nearly east-west, and a few are nearly north-south, as is the Bankfield ridge. Many of the smaller ones have very steep sides and resemble railway grades in cross-section. A ridge of this type extends across claim T.B.10,607 in a southwesterly direction; the south end, which forms the north shore of Mosher lake at its northeastern corner, runs east and west. Narrow ridges rising above the swampy country north of the small pond in the southeast corner of T.B.10,482 of the MacLeod-Cockshutt claims are remarkable for the fact that they run almost due east and west. They rise only about 15 feet above the swamps on either side, and the slopes are as steep as the sand can rest.

Rather remarkable features in the topography between Magnet lake and Wild Goose lake are the transverse valleys cutting directly across the parallel esker ridges (see photograph on page 8). These apparently do not now contain streams, but they are broader and better developed than the valleys of the small modern streams, which flow northeastward parallel to the eskers. One of the

Photo by Royal Canadian Air Force



Vertical photograph east of Wild Goose lake, showing northeast-southwest parallel ridges of glacial debris and transverse dry valleys. Scale of centre of picture about 20 chains to 1 inch.

best developed of these transverse valleys gradually disappears to the northwest in a belt of country in which the parallel ridges are not developed. It seems possible that these transverse valleys were formed during the northward retreat of the last thin remnants of the ice-sheet and that the water from the melting ice escaped laterally along the ice front, into lakes lying either east or west. As the ice retreated new drainage ways of the same type were developed and previous ones abandoned, until final withdrawal of the ice freed the normal northeastward outlet and allowed the establishment of the present stream systems, leaving the transverse valleys abandoned by the streams that formed them.

The most noticeable features of the region are the large marshy and swampy areas broken only here and there by sandy and gravelly ridges.

A large part of the region is covered by lakes. These vary from mere ponds to bodies of water several square miles in area. All of the lakes are shallow, and the size of many of them depends to an unusual degree upon the time of year. Thus the whole southern half of Eldee lake changes from lake in June to marsh in August; what are islands in Little Long Lac early in the season are peninsulas at a latter time, and bays become marshes.

Many of the lakes occupy depressions formed by the irregular deposition of glacial drift and have no visible outlets. The group of lakes lying northeast of Wild Goose lake are of this character. Still smaller bodies of water in the drift are of the pot-hole type, the banks of which rise steeply. The larger lakes form the headwaters of streams flowing to James bay or Lake Nipigon. Lakes in this area differ from those in most areas of pre-Cambrian rocks in the comparatively few rock exposures along their shores; that is, they lie almost entirely in basins of glacial debris. The result is that their outlines are, for the most part, controlled by the trends of glacial ridges, not by rock structures. They are irregular in outline and characterized by narrow peninsulas and sharp points formed by glacial ridges.

Since the area lies on the height-of-land between two great drainage basins there are no large rivers. The small streams have the character that would be expected where the mantle of glacial material is so extensive. For large parts of their courses they meander in swampy or marshy valleys and have few lake expansions. The local base levels for the graded portions of the streams are determined in most cases by the level of the lakes to which they drain or, in a few cases, by glacial ridges over which they form rapids. Thus the sluggish meandering streams entering Magnet lake have that lake as a temporary base level. Magnet creek flows out of the lake down a bouldery rapid, below which it meanders in a shallow valley for a distance of 3 miles to a second rapid over boulders, where it crosses a glacial ridge to enter Little Long Lac. There is one small expansion where the stream flows into and out of the north end of a marshy lake. The creek draining Eldee lake into Little Long Lac is a broad sluggish stream without any rapids. These are the largest streams in the three townships.

Natural Resources

Formerly a considerable quantity of furs was taken in this region, but the amount now obtained is not large and is certain to decrease. There are some areas of good soil, but much of the region is covered with sandy glacial deposits or is swampy. Moreover, the climate is rather too rigorous for profitable farming even were the soil fertile. Spruce trees of good size are fairly abundant and are valuable in the early stages of development of the mining industry for

the building of cabins, for mine timber, and for fuel. In this area, lying as it does on the height-of-land, there is no possibility of developing hydro-electric power locally, but the relatively short distance from Nipigon makes electric power readily available.

GENERAL GEOLOGY

All of the consolidated rocks of the Little Long Lac area are pre-Cambrian in age. Overlying them are sands and gravels of glacial origin, and in places there are areas of recent clays and, where drainage is retarded, of peat. The pre-Cambrian rocks include highly altered lavas, which, on the basis of lithological character, degree of metamorphism, and relation to other formations, are here called Keewatin; sediments of some variety, with possibly some contemporaneous volcanic rocks; various older intrusives; and diabase, which occurs as dikes and is similar lithologically and probably genetically related to the diabase more extensively developed in the vicinity of Lake Nipigon.

In the geological classification used in this report the terms Keewatin and Timiskaming must be understood to be used tentatively, since the area is far removed from the type localities for those series. Lack of exposures has made difficult the correlation and differentiation of rocks even locally, and more detailed work may show that there have been included, under some of the groups, rocks that are of different ages.

Table of Formations

QUATERNARY	
RECENT:	Clay, peat.
PLEISTOCENE:	Till, sand, gravel.
	Unconformity
PRE-CAMBRIAN	
KEWEENAWAN(?):	Quartz diabase dikes.
	Intrusive contact
POST-TIMISKAMING:	Granite porphyry, feldspar and quartz porphyry dikes. *Intrusive contact* Diorite, diorite porphyry.
	Intrusive contact
TIMISKAMING:	Greywacké, arkose, impure quartzite, chlorite schists. Iron formation. Conglomerate.
	Unconformity
KEEWATIN:	Greenstone, volcanic fragmentals, chlorite schists, and thin beds of black slate.

Keewatin

The rocks assigned to the Keewatin series are mainly of volcanic origin with a few narrow bands of soft black slate. Basic lavas make up the greater part of the series, but there are some lenses of tuff and agglomerate.

The basic lavas are andesites or more basic varieties. In many places they still show typical ellipsoidal weathering and, locally, amygdaloidal structures. Well-developed ellipsoidal forms are to be seen along the shores of Little Long Lac and in the railway cuts a mile west of Langmuir. There is also an area of ellipsoidal-weathering lavas along the base line at the northwest corner of Ashmore township. Other exposures are to be seen at the Main narrows of Little Long Lac, along the eastern boundary of claim T.B. 10,513 north of the

West narrows, in trenches north of the lower portage on Magnet creek, in the area north of the lake and west of the Geraldton road, and at several other localities. At most of these places the rocks are fine-grained, massive, and dark-green in colour. The ellipsoids are generally of medium size, the longer diameters of the ellipses ranging from 18 inches to 2 feet in length. In the exposure on T.B.10,513, however, the ellipsoids are of large size, the long diameter of an ellipse showing on one surface being about 4 feet in length.

A thin section of ellipsoidal lava from the occurrences along the railway one mile west of Langmuir was examined by Burrows. His description is as follows:[1]—

> A specimen of pillow lava from one mile west of Langmuir station is dark-greenish in colour, and has a clayey odour. Under the microscope it proves to be greatly altered, showing secondary feldspar (albite), hornblende, chlorite, calcite, and iron ore.

The basic lavas that are assigned to the Keewatin are commonly so similar in petrographic character that no detailed examination of those occuring in this area was considered necessary. However, a thin section from the ellipsoidal lavas along the base line forming the north boundary of the township of Ashmore was examined. It consists of a felt of tiny, lath-shaped feldspar crystals, a good deal of calcite, and abundant chlorite. The feldspar is not greatly altered and is still determinable as a basic variety of the composition of labradorite.

Much of the massive greenstone differs from the ellipsoidal-weathering type only in the lack of ellipsoids. There are places where the grain size of massive varieties is large, and in outcrops isolated by glacial cover or by swamp, it is difficult to be sure whether dark-coloured rocks of a texture coarser than that of the typical greenstone are parts of thick flows or are bodies of diorite of post-Timiskaming age. Associated with the ellipsoidal-weathering lava, from which the specimen whose microscopic character was described above was taken, are rocks of this coarser-grained type. At that place they have been included with the lavas. On the other hand, rocks exposed northwest of Langmuir, which are not unlike them in the hand specimen, have been mapped as diorite. So also have several masses of such rock on the claims of the Roche Long Lac Gold Mines east of Eldee lake. Some of these are unquestionably intrusive; others are doubtful.

Under shearing stresses the basic volcanics become chlorite schists. In a few places lavas that are still massive have been so altered by the formation of carbonates that the rocks are greyish on fresh fractures and rusty-weathering. Alteration of this latter type can be seen in the rocks exposed in the railway cuts east of Hardrock station and in the trenches on the Lafayette claims.

West of the Geraldton road between Little Long Lac and the railway, fragmental volcanics, both coarse and fine grained, occur with the lavas. In some of these the fragments are like ordinary greenstone in appearance and are included in a lighter-coloured matrix, which may be tuffaceous. The fragments have diameters as great as 4 inches. In other places, a fine-grained, light-grey, finely banded rock occurs with ellipsoidal greenstone. Commonly the thickness of such beds is only a few feet, and they are usually much crumpled.

The small exposures of rock made at Hardrock station by the construction of the railway, by trenching on the claims immediately to the north of the right-of-way, and by the railway cutting a short distance to the east are of a soft black slate. No bedding could be observed in any of the outcrops, but cleavage is well developed. This band of slate is apparently the same as that

[1]A. G. Burrows, Ont. Bur. Mines, Vol. XXVI, 1917, p. 234.

which outcrops on the southeast shore of the lake a mile or more to the east. No rock is exposed on the large island lying between these two points. Greenstone occurs both north and south of the slate, and diamond-drilling on some of the claims near Hardrock shows that the greenstone is not far to the south. Evidently the slate band is a part of the Keewatin series rather than of the great sedimentary series that has been assigned to the Timiskaming.

The attitude of the volcanic rocks has been determined at very few points. Clearly the general strike in the eastern part of the map area is nearly east-west, as shown by the band of slate just described. In a few places elongation of the ellipsoids also indicates that strike. The tuffaceous beds show that the dips are steep. At one point on T.B.10,944 the shapes of the pillows seem to indicate that the tops face southward. A determination made on the ellipsoidal lava on T.B.10,513 indicates that the tops are north at that point. These observations are from such scattered localities that little weight should be given to them. In all cases the schistosity is approximately east-west and vertical or very steep.

Timiskaming Series

The rocks classed as Timiskaming in age are so heterogeneous in character that it is impossible to offer any generalization as to their lithology. For the most part, if not entirely, they are of sedimentary origin and mainly clastic. There are, however, certain bands that may be altered lavas; others may be tuffs. The iron formation although undoubtedly a sediment is probably not clastic, and its origin offers a problem that is yet unsettled.

The distribution of the rocks of the Timiskaming series will be most easily grasped by reference to the map. They extend across the entire southern part of the area and for an undetermined distance southward. The part within the map area is thought to be the northern limb of a major syncline. Undoubtedly there is some duplication in the succession as a result of folding and possibly of faulting, but in the main it is a simple succession, with the beds facing southward excepting where there are local minor folds.

Lithological Character

Certain horizons of this series seem to be marked by conglomerate, which occurs not as continuous beds but as lenses which taper out and reappear along the strike. Some lenses, however, are apparently local, as no continuations of them have yet been found. The conglomerate member most continuously recognizable is that which occurs near or at what is thought to be the base of the series. At one place conglomerate has been found within a few feet of greenstones of the Keewatin series. In a few others conglomerate is separated from greenstone by only a narrow drift cover. At many places no conglomerate has been found near the line where the contact between the two series should be. Possibly, as is so commonly the case, conglomerate was not formed at such places, or it is possible that at certain places the contact between volcanics and sediments may be a fault zone.

On the south side of the point forming the west side of the Main narrows of Little Long Lac, 100 feet west of No. 4 post of claim T.B.10,022, low outcrops of rock occur along the lakeshore. The easterly outcrops are a fine-grained, dark-green rock, which is thought to be diorite. Ellipsoidal-weathering greenstone outcrops on the west side of the narrows only a short distance to the north. Separated from the diorite by only a few feet of sand is an outcrop of conglomerate containing pebbles of feldspar porphyry and a fine-grained, quartzitic-

looking rock. All are ellipsoidal in form, the largest being an inch and a half in greatest diameter. The long axes are all in an east-west direction. The matrix is fine-grained, greenish-grey in colour, and massive.

Conglomerate is well exposed on the Tyson claims between Little Long Lac and Eldee lake. Nine chains south of the No. 1 post of claim T.B.10,162 the claim line crosses a low ridge of conglomerate. The larger pebbles, which are an inch in longest diameter, are well rounded, but particles of about the size of a pea are quite angular. A thin section of the matrix shows that it consists of well-rounded fragments of quartz, some of which are composed of parts of more than one crystal. Calcite is abundant, and in some areas there are poorly formed laths of feldspar. The origin of these was not satisfactorily determined. Biotite is abundant; chlorite and pyrite are less common.

The conglomerate south of the Magnet lake portage near the edge of the creek is not well exposed; it differs from the occurrence just described in having a rather sandy matrix, which is somewhat schistose. On the Longacre road, a quarter of a mile north of Magnet creek, there is a low outcrop of conglomerate, which contains abundant well-rounded pebbles, most of which consist of a rock that somewhat resembles greenstone. A few of granite were observed, and several cherty ones, of which one is a black variety. The matrix is slaty with a cleavage S.70°E. The pebbles do not show any noticeable elongation in that direction.

At the northeast corner of Lindsley township, a conspicuous ridge of conglomerate extends for a quarter of a mile west from mile 18 on the base line. It is by far the largest exposure of conglomerate in the Little Long Lac area. Pebbles are abundant and of considerable variety. The commonest are of a dull-greenish, fine-grained rock, which resembles some types of greenstone. There are also many porphyry pebbles and a considerable number of typical granite. One bean-shaped pebble consists of chlorite schist and has the planes of schistosity parallel to its elongation and to the well-marked schistosity of the matrix of the conglomerate. Quartz, chert, and jasper pebbles are numerous. The matrix is a green schistose material. The foliation has a general east-west trend but is curved around the harder pebbles. Most of the pebbles are ellipsoidal with the planes containing the long axis parallel to the schistosity of the matrix. In contrast to this there are some granite pebbles that are nearly perfect spheres.

Thin sections were prepared of some of the typical pebbles. One of the granite pebbles under the microscope proved to be remarkably fresh. The minerals present are quartz, orthoclase, microcline, oligoclase, and hornblende. Some of the feldspar crystals show marked zonal growth. The hornblende is in well-formed crystals, which are considerably smaller than those of feldspar. Prismatic sections have a brilliant green to yellowish-green pleochroism. Quartz is abundant and was the last mineral to form. Secondary minerals are not abundant. The feldspars are faintly cloudy, probably owing to the presence of kaolin; sericite foils are scattered through both orthoclase and plagioclase.

Microscopic examination of the dull-green rock that resembles some varieties of greenstone was rather unsatisfactory owing to the fine grain of the specimens. Chlorite, quartz, epidote, calcite, and plagioclase are recognizable. The plagioclase occurs in small elongated forms, which seem to be secondary. A pebble apparently of feldspar porphyry was also examined microscopically. It appears decidedly porphyritic in thin section, and there is a marked difference in size between the phenocrysts and the groundmass. The minerals occurring as phenocrysts are quartz and feldspar in about equal proportions and hornblende

in minor amounts. A large part of the feldspar is the variety orthoclase; the plagioclase crystals are oligoclase. The groundmass is so fine grained that not all of its constituents can be distinguished, but quartz, chlorite, sericite, and hornblende can be recognized. Most of the phenocrysts are fractured, and the fragments are so scattered through the groundmass that in places the rock resembles a greywacké. The rounding of the phenocrysts and the granulation of their edges, however, indicate that the fragmental character is due to brecciation.

A fairly continuous horizon of conglomerate lies just south of Mosher lake. It is traceable across several claims of the Mosher Long Lac Gold Mines and extends westward into the claims of the Longlac Lagoon Gold Mines. One chain east of No. 3 post of T.B.10,045, this conglomerate bed is 30 feet thick. The pebbles in it are granite, porphyry, and quartz. Some of the pebbles have



Photomicrograph of greywacké from the 3rd level, 275 feet west of the shaft, Little Long Lac mine. The narrow, fine-grained zone crossing the photograph obliquely is a carbonate veinlet. (Crossed nicols, × 22.)

apparently been elongated; and the rather quartzose matrix is curved around them. One pebble was found in which the matrix fills fractures in it. On claims T.B.10,849 and T.B.10,850 conglomerate of this band is exposed for a considerable length and has a width of at least 50 feet. In that lens most of the pebbles are granite. The matrix is quartzose and distinctly foliated.

Most of the rocks of the Timiskaming series are greywackés. The colour is generally grey, but a few beds are decidedly greenish. Quartz is commonly a prominent constituent and can be recognized by the fact that the grains weather in relief and by the bright, fresh surfaces when broken. Under the microscope the fragmental character of the rock is usually readily recognizable (see photomicrograph above). Quartz occurs in angular to rounded particles. In some beds feldspar is almost as abundant as quartz. The most common variety is oligoclase, and it is usually little altered. The proportions of chlorite, amphibole, calcite, magnetite, and other minor constituents are quite variable. Probably some of the fragments were angular when deposited in the sedimentary beds, but in some specimens the angular character, especially of the quartz

particles, may be due to fracturing subsequent to consolidation. In some localities biotite occurs in the rocks and is probably evidence of stress conditions.

Bedding is not marked in many of the greywackés, but in places it is strikingly developed, usually where there are thin beds of different shades of grey. In places gradation in grain is distinctly marked. Some of the cores from holes drilled on the Longlac Lagoon property show this phenomenon repeated many times in a core length of 50 feet. The gradual change in grain from coarse to fine and the sharp transition again to coarse-textured material indicate that the tops face south. Where the beds of greywacké are in contact with bands of iron formation the bedding is most strikingly marked by alternations of greywacké and iron-rich sediments of black or red colour. Ordinarily the east-west shearing that has affected all the rocks is so well marked that it serves to obscure bedding where there is no marked colour contrast in adjacent beds. It is evident from a survey of drill-cores, however, that there are many places where on the surface rocks appear very uniform in their attitude and yet actually are so closely folded that thin, plastic beds have taken on a crenulated character, quite similar to the contorted character shown by some beds of iron formation.

The iron formation is the most striking member of the sedimentary series. It was probably originally deposited in lenses, but the lenticular character has been accentuated by later disturbances that have affected the series. Under stresses which fractured the greywacké beds the thickness of some of the lenses of iron formation has been increased by crumpling; other lenses have been thinned and possibly even pulled apart.

Several bands of iron formation cross the area. Certain of these have been traced fairly continuously by dip-needle surveys, but it is difficult to correlate magnetic effects with surface mapping, as much depends upon what shall be classed as iron formation. Thus greywacké with a few thin bands of iron oxides may be considered iron formation by one person and merely iron-rich greywacké by another. Very lean material may cause a decided effect on the dip needle. The largest band of iron formation is that which outcrops on the large island west of the Little Long Lac mine. It probably owes some of its thickness at that point to close folding. It is well banded, with alternate layers of iron oxides and silica. The iron oxide bands are mixtures of magnetite, specular hematite, and quartz. The silica is fine-grained, and both white and red varieties occur. Disturbance is shown chiefly in the crumpling of the beds, but there is also an east-west shearing. Where the bedding has a north-south strike, as it has on the north side of the island where the rocks are best exposed, the shearing is more marked than the bedding. The bedding is displaced along innumerable shear planes usually only a fraction of an inch and in many places in opposite directions on shear planes only a few inches apart.

The iron content of even the richest of the iron formations is less than 40 per cent. No bodies of iron ore were located during the prospecting of the area for iron, and there is no evidence that there are any.

Certain bands of dark-coloured rock, interbedded with rocks that are clearly of sedimentary origin, have been thought by some to be of volcanic origin. Most of these are now fine-grained chlorite schists. Several specimens from drill-cores on the Longlac Lagoon claims were examined; and the one that in the hand specimen most resembled a basic lava proved to be fine-grained, somewhat sheared diorite. Blocky, well-formed crystals of plagioclase make up the greater part of the section, and the rock is identical with rocks from other areas that can without any doubt be classified as diorite. The rock from

which this specimen was obtained, therefore, is very probably a dike, or possibly a sill of diorite intruding the greywackés.

Another fine-grained, speckled rock under the microscope shows a distinct foliation. It contains a large amount of chlorite, which forms a mesh in which small feldspar or quartz individuals are held. The rock is so fine-grained that it is difficult to make accurate determination, but it seems possible that it was originally a sediment containing a considerable proportion of ferrous iron, which on recrystallization gave rise to chlorite. A slaty rock from the west boundary of T.B.10,950 was determined as chlorite schist in the field and thought to be a squeezed lava. It is associated with iron formation. Thin sections show that it is without doubt a clastic sediment, since it contains tiny fragments of quartz and of a fresh-looking plagioclase with narrow twinning *lamellae* and a composition not more basic than oligoclase. The matrix consists of abundant chlorite, the foils of which lie in a roughly parallel arrangement and give the rock its distinct slaty cleavage.

Up to the present, examination of specimens from bands that appeared to be lavas has shown only diorite or types that seem to be clastic in origin. It has been suggested that some of these may be tuffs. There is no evidence in the thin sections examined to support this theory. Since they are interbedded with rocks that are clearly of sedimentary origin it is probable that these highly chloritic bands, other than those that are intrusive, are sediments in which there was sufficient ferrous iron to form abundant chlorite when the rocks were subjected to stress.

Structure

That a large part of the area in which consolidated formations occur is concealed beneath sand, gravel, and swamp is one of the chief difficulties in determining the structure of the sedimentary series. In addition, bedding is not marked in many of the greywackés, and shearing is so well developed that it may easily be mistaken for bedding. The conglomerate lenses and the iron formation members give definite information as to the strike and dip of the bedding, but no one band is unique in character; and the problem arises as to whether the series is a simple one or is duplicated by folding or faulting. Generally the dips are nearly vertical. Locally there are flatter dips, which may be either to the south or north. Drag folds, which are common in the iron formation, plunge to the west at an angle of approximately 30 degrees.

The first problem that arises is that of the relative position of the lavas lying north of Little Long Lac and the sediments. The discontinuous band of conglomerate, lenses of which occur here and there along the southern edge of the area of volcanics, does not give clear evidence of the relation, but such data as there are seem to indicate that the volcanics furnished pebbles for the conglomerate, which therefore lies above the lavas. Hence the sediments form a syncline to the south. This is corroborated by the fact that the contact between the two series, as followed westward, curves sharply northward at several places, whereas the schistosity maintains a fairly constant east-west direction. Taken in conjunction with the westward plunge of the folds, which can be seen at many places, the observed relation of bedding to schistosity is possible only if there is a syncline to the south.

Accepting these points of evidence for the existence and position of a major syncline in which the sedimentary series lies, the question arises as to the presence and number of minor folds in this major structure. The occurrence of two conglomerate beds not unlike in appearance, the one lying next the volcanics,

the other lying south of Mosher lake, suggests at once a simple synclinal structure. On this assumption the Mosher lake conglomerate bed would be the base of the series, as is the northern one. There are no volcanics immediately south of the Mosher lake conglomerate; hence such a simple structure would leave no place for the great thicknesses of greywacké and slate that lie farther south. In the same way, the connecting of adjacent bands of iron formation to form diagrammatic synclines and anticlines leads to impossible hypotheses as to structure. For example, on the MacLeod-Cockshutt property two heavy bands of iron formation are separated by a band of very lean iron formation or greywacké containing some iron oxides. The structure, however, is not a minor syncline, since analysis of the drag folds indicates that both bands of iron formation are on the same limb of a fold, and hence are merely successive beds in the series, and that both have the tops to the northward. There is, therefore, a synclinal axis somewhere to the north. The fold is probably only a minor one, and it is not shown in the cross-section accompanying the map.

Here and there, the attitude of the beds can be determined by the relative size of grain. Some of the cores from holes drilled under the lake in the northern part of T.B.10,609 show many alternations of beds, which from north to south grade from coarse to fine, the alternations being marked by fine material in sharp contact with coarse material, indicating that the beds here face southward. If there are no faults they are, therefore, above the greenstone lying to the north.

In a general way the succession of sediments in the series is as follows: Beginning with the conglomerate at the north, which is thought to be the base of the series, a section southward to a point not far south of Mosher lake shows a large proportion of greywacké, several bands of iron formation, one rather continuous bed of conglomerate, and several bands of fine-grained chlorite schist. South of this zone of heterogeneous sediments a broad zone of rather homogeneous slaty greywacké extends southward nearly to the southern tip of the southwest arm of Little Long Lac. The most southerly exposures are of rocks quite different from the typical sediments, since they are biotitic and hornblendic. They may possibly be metamorphic equivalents of the greywacké altered by the granite intrusions that regional geological maps show in that direction. Whatever the origin of these rocks toward the south, no zone of rocks containing any iron formation or any lenses of conglomerate has been reported. Thus the southern limb of the syncline lies south of the present map-sheet, probably well south of Little Long Lac. It may have been removed by the intrusions of granite, which here lie a considerable distance to the south. Burrow's map shows no outcrops along the Wintering river, which enters the south end of the southwest arm of Little Long Lac, but a straight line between the contact of granite and older rocks on Long lake and that on the Namewaminikan (Sturgeon) river would pass 2½ miles south of Little Long Lac, or approximately 3 miles south of the south boundary of the map-sheet.

The major structure, therefore, is a syncline plunging westward at an angle of approximately 30 degrees. Only the northern limb lies within the present map-sheet. The syncline is so closely folded, that the dips are steep where the beds are not involved in minor folds. On this major structure there are several known minor folds and probably many others not yet recognized because of lack of recognizable horizon markers. The fact has been mentioned that the beds in the northern part of T.B.10,609 face southward, as they normally would do in a syncline such as that assumed. It is probable that all of the beds north of this point face southward. At the Little Long Lac mine and on the large island west of it, however, the strike, instead of being east-west, curves southward, and

it is evident that in that locality the beds are involved in a drag fold. Drag folds on the north boundary of T.B.10,054 indicate a syncline to the south, so that it seems that between this zone of drag folds and that to the north there must be a minor anticlinal axis. Again, on the MacLeod-Cockshutt property the northward-facing beds indicate that somewhere to the north, probably concealed by overburden, is a minor syncline and, therefore, that a minor anticlinal axis lies to the south. No attempt has been made in the cross-section to project this structure to the plane of the section, since there is no information as to the position of the northern limb of the drag fold.

Origin

The greater part of the Timiskaming series here, as in other places where rocks have been assigned to that age, consists of clastic sediments which are not thoroughly weathered. In many beds even the feldspars are quite fresh, although in some places later crystallization may explain that fact. Commonly, the fragments of which the greywacké is made up are not well rounded, and it seems likely that they were not transported from any great distance. The debris was probably stream-carried and deposited in coalescing piedmont fans.

Explanation of the origin of the iron formation offers more difficulties. The fine-grained silica, hematite, and magnetite could not have been deposited as a clastic sediment. It seems likely that they were deposited by some sort of chemical precipitation, possibly from colloidal solutions.[1]

Age Relations

The structure of the sedimentary series shows that it is younger than the volcanics that lie north of it. The steep dips of the beds along the northern margin give no evidence of superposition, but the position of the tops of the beds as shown by grain gradation and the relations of the drag folds, bedding, and regional schistosity show conclusively that the sediments were deposited subsequent to the lavas of the Keewatin series. The evidence of a time interval between the two series is somewhat less convincing. The occurrence in the northernmost bands of conglomerate of pebbles of greenstone-like rocks, chlorite schists, jasper, and chert, all of which can be duplicated in rocks of the Keewatin series, seems fairly reliable evidence that the volcanics had consolidated and undergone erosion before the beginning of deposition of the sedimentary beds and that, from some neighbouring region, material for the formation of the conglomerate, greywacké, and iron formation was derived from rocks similar in character and probably equivalent in age to the Keewatin rocks now exposed in the area. The common occurrence of granite and quartz porphyry pebbles in the conglomerate shows that a deep-seated intrusive must have been uncovered not far away. Although there is no direct evidence, it is possible that this intrusive was post-Keewatin in age. If it were, then there must have been a period of major disturbance between the extrusion of the volcanics and the deposition of the sedimentary series.

Intruding both the Keewatin and the Timiskaming series are igneous rocks of some variety. Stocks and probably sills of diorite are the most widely developed type. Succeeding them are dikes of feldspar porphyry and small stocks of granite porphyry, rather high in soda. Lastly came narrow dikes of diabase.

[1]E. S. Moore and J. E. Maynard, "Solution, Transportation and Precipitation of Iron and Silica," Econ. Geol., Vol. 24, p. 272, *et. seq.*

On the basis of time sequence as well as on lithological similarity, the sedimentary series has been termed Timiskaming in this report. This usage must be considered tentative, since the area is a long distance from the one where the series occurs to which the name Timiskaming was first applied. Here, as in all other areas where such rocks occur, they are of terrestrial origin.

Burrows described the mica and quartzose schists in the Little Long Lac area as of sedimentary origin but found no evidence to justify separating them from the rocks of the Keewatin series. He noted a similarity between these schists and those of the Coutchiching series at Rainy lake.[1] One of the chief differences between the two is the occurrence at Little Long Lac of conglomerate along with the finer-grained clastics. As conglomerate is exposed along the lakeshore at only one point, and that outcrop is covered at periods of high water, it is not likely that Burrows saw any. If he had, he might have suggested correlation of these rocks with the Timiskaming series as he did for the conglomeratic rocks at Beatty lake north of Jellicoe.[2]

Coleman and Moore in their reports on the iron formation east of Lake Nipigon differentiated a sedimentary series, largely conglomeratic, from the Keewatin and called it Lower Huronian. For the most part, the non-conglomeratic sediments were not included, as there was some doubt as to their pre-Huronian age.[3]

Tanton[4] applied the name "Windegokan" to the rocks previously classified by Coleman and Moore as Lower Huronian. He described the series as consisting of iron formation, greywacké, and conglomerate and considered that it was unconformably above the schist complex, but with only a slight structural discordance between the two series. He placed all of the sediments of the Little Long Lac area in the schist complex of pre-Windegokan age. Thus Coleman and Moore, Tanton, and Burrows agreed in including all but the conglomerate, and the sediments closely associated with it, in the basement complex. The only differences in their classifications is the use of different terms—Lower Huronian, Windegokan, and Timiskaming—for the dominantly conglomeratic rocks.

On the other hand Langford, who examined the Beardmore-Nezah area, which lies along the Canadian National railway from Jellicoe west to Warneford, south of the Windigokan area mapped by Coleman and Moore, separated the sedimentary rocks from the volcanics and assigned them to the Timiskaming series:[5]—

> The rocks assigned to this age [Timiskaming] form an undoubted sedimentary series, which is a distinctly different type from any other found in the area. . . . The conglomerate that is found near the base of the Timiskaming carries boulders of deep-seated igneous rocks and, therefore, could only be formed after erosion had cut deeply into the earlier formations. . . .
>
> It was possible to trace these Timiskaming rocks northward to Lake Windigokan and to establish the fact that they are a part of the series which Moore[6] called the Windegokan. He placed the conglomerate and some of the greywacké in the Lower Huronian . . . but was in doubt about the remainder of the greywacké.

During the present work a brief visit was made to the area near Lake Windigokan. Although time did not permit any detailed examination of the conglomerate lying north of that lake, certain resemblances between it and that

[1] A. G. Burrows, Ont. Bur. Mines, Vol. XXVI, 1917, p. 239.
[2] Ibid, p. 241.
[3] E. S. Moore, "Iron Ranges East of Lake Nipigon," Ont. Bur. Mines, Vol. XVI, pt. 1, 1907, p. 140.
[4] T. L. Tanton, Geol. Surv. Can., Sum. Rept., 1917, pt. E.
Map No. 1836, 1921, reissued as maps Nos. 2,368 (312A), 1934, and 2,369 (313A), 1934,
[5] Geo. B. Langford, "Geology of the Beardmore-Nezah Gold Area," Ont. Dept. Mines. Vol. XXXVII, pt. 4, 1928, p. 101.
[6] Moore did not use the term Windegokan. It was first used by Tanton.

at Little Long Lac were evident. In both, the pebbles are of the same kind of rock, and commonly they appear to have been elongated and arranged with the long axes in an east-west direction. The matrix of the conglomerate from both areas appears to be very similar and in many places has been rendered schistose and moulded around the pebbles. The greywackés of the two areas are lithologically indistinguishable. Some of the sediments in the Beardmore area were also examined, but none of the conglomerate lenses of the series was seen. The greywacké exposed along the railway between Warneford and Beardmore is somewhat more schistose than most of the greywacké at Little Long Lac, but there does not appear to be any other essential difference.

Since, therefore, the sediments at Little Long Lac are lithologically similar to those near Lake Windigokan and locally at both places have undergone severe deformation so that a marked east-west schistosity has been developed, it is believed that they belong to the same series, for which the older name Timiskaming is tentatively adopted rather than the name Windegokan.

Post-Timiskaming Intrusives

Intrusive rocks of at least three ages cut the Timiskaming and Keewatin rocks. The oldest of these has been called at various places gabbro or diorite. Some exposures consist very largely of dark-coloured minerals; others are speckled rocks. They occur as oval-shaped or irregular masses and as elongated lenses, which may be sills. They are clearly later than the sediments, but where there has been much shearing it is not easy to differentiate them from highly chloritic beds.

One small area of granite porphyry has been found, and there are many dikes of feldspar porphyry or quartz porphyry. Most of the dikes have an east-west strike. The latest pre-Cambrian rock is diabase, which is probably related to the larger masses around Lake Nipigon. Here it occurs only as relatively small dikes, generally with a north-south strike and nearly vertical.

Diorite

Two large areas of diorite occur in the three townships mapped. In addition there are many smaller areas and very many small lenses and narrow sills that are too small to be shown on the scale used. In the larger masses the rock has a granitic texture. The proportion of dark and light minerals varies. In some exposures the rock is composed of so large a proportion of dark minerals that it has a dark-green to nearly black colour. In others the rock has a speckled appearance with white to pale-greenish feldspars and dark-green to black amphiboles as constituents. In one area on the claims northeast of Barton bay the texture is much coarser than usual and the amphibole is bladed actinolite in crystals up to an inch in length.

Microscopically the rock shows variations similar to those seen in the hand specimen. Strangely enough even the dark-coloured varieties when examined in thin section show a large proportion of feldspar, and some are made up almost entirely of that mineral. This variety occurs in parts of the long tongue of diorite that extends across the Kenogamisis syndicate claims and on to the claims of the Hard Rock Gold Mines to the west. The rock is a speckled green and white variety, which is somewhat sheared, so that many of the grains have a rounded appearance. In thin section it appears entirely crystalline and equigranular. Plagioclase, which has the composition of andesine, occurs in stout laths and is by far the most abundant mineral. Quartz fills the spaces between

the plagioclase crystals. Calcite and chlorite are fairly abundant, the latter, no doubt, being secondary after original hornblende. In a specimen from a drill-core from the claims of the Longlac Lagoon Gold Mines, chlorite makes up about one-third of the total volume of the rock and lies between blocky crystals of andesine. Quartz is present only in small amounts. Calcite occurs fairly abundantly, and there is a good deal of pyrite in irregular grains, most of which are imbedded in chlorite.

The larger bodies are probably irregular bosses; the elongated ones are sills, some of which may be strictly conformable to the bedding of the sediments, but many, no doubt, are parallel only locally and in general cut the bedding.

Massive diorite in contact with sediments is easily recognized, and its intrusive character is clear. In areas of volcanics, however, it is less readily recognized in the field, since it is similar in appearance to the coarse-grained lavas in the thicker parts of basic flows. Where rock outcrops are small and isolated by glacial drift, it is, therefore, impossible to be certain that this type of rock is correctly mapped. Hence, there may be some outcrops shown as diorite that further examination would determine to be lavas; on the other hand, some occurrences of coarse-grained andesite may have been mapped as diorite. Where shearing has been intense, diorite, especially if fine-grained, alters to chlorite schist, and sills of it may thus become indistinguishable from sedimentary beds that contained a high content of ferrous iron which formed chlorite during metamorphism. Thus there is an east-west zone across the southern part of the claims of the MacLeod-Cockshutt Gold Mines, the Mosher Long Lac Gold Mines, and the Longlac Lagoon Gold Mines in which it is difficult to be certain of the origin of the rocks. Undoubtedly some diorite is present, but the origin of some of the schists cannot be determined with any certainty.

No contact metamorphic effects of the diorite intrusions have been recognized.

Acidic Intrusives

Acidic intrusives of two types occur; chemical analyses of these are shown in the following table:—

TABLE NO. I

	No. 1	No. 2	No. 3
	per cent.	per cent.	per cent.
SiO_2	62.36	62.92	68.48
Al_2O_3	17.52	15.05	13.93
Fe_2O_3	.69	1.94	1.46
FeO	.62	.27	.35
CaO	3.78	4.71	3.30
MgO	1.15	.89	.82
Na_2O	5.46	6.13	7.36
K_2O	1.70	2.29	.25
TiO_2	.33	.41	.27
P_2O_5	.06	.10	.08
MnO	.....	.03	.02
CO_2	4.15	3.00	2.96
H_2O	1.04	1.12	.45
FeS_2	1.20	1.41	.58
Total	100.06	100.27	100.31
Specific gravity	2.762	2.69	2.68

Analyst, W. K. McNeill.

The proportion of the minerals occurring in the specimens is shown in Table II, which is a recast of the chemical analyses of Table I.

TABLE NO. II

	No. 1	No. 2	No. 3
	per cent.	per cent.	per cent.
Albite	46.12	51.87	62.34
Anorthite	1.28 } 47.40	3.05 } 54.92	.70 } 63.04
Orthoclase	.....	13.38	1.11
Sericite	14.53	.....	.85
Calcite	5.10	6.55	4.70
Magnesite	2.44 } 7.94	.21 } 6.76	1.70 } 6.40
Siderite	.40	.....	.....
Chlorite	.....	2.07	.....
Epidote	.....	.....	2.02
Kaolin	7.08	2.31	1.94
Apatite	.25	.24	.19
Magnetite	.....	.....	.46
Ilmenite	.62	.69	.70
Quartz	20.70	15.12	22.68
Pyrite	1.20	1.41	.58
Limonite	.82	2.25	.37
Total	100.66	99.69	100.34

Sample No. 1—Porphyry on claim T.B. 9,991, Hard Rock Gold Mines.
Sample No. 2—Porphyry on claims of the Bankfield Gold Mines.
Sample No. 3—Soda granite porphyry on claim T.B. 10,998.

Both types are characterized by high proportions of soda (see Table I). Southwest of Magnet lake on claim T.B.10,998, a white rock that is not noticeably porphyritic has been exposed by trenching. The known size of the body is 500 by 250 feet, but the margins are covered by drift and the contact has been determined only along the north side, where it has been intersected by diamond-drilling.

A specimen from a drill-core at a point not far from the northern edge of the mass is composed of white rock of granitic texture. Under the microscope it is seen to be porphyritic, but the difference in size of phenocrysts and minerals of the groundmass is not very marked. There is abundant plagioclase, considerable quartz, a little orthoclase, and a small amount of apatite. The rock is fairly fresh but contains carbonate, chlorite, epidote, sericite, and disseminated cubes of pyrite. The plagioclase consists of stout, lath-shaped crystals of albite having the composition Ab_{98} An_2. The albite twinning *lamellae* are very fine, and some are crumpled. Orthoclase occurs sparingly. Calcite is the most abundant secondary mineral, the greater part of which occurs as isolated patches and veinlets within the plagioclase crystals. Pale-green chlorite is sparingly present, chiefly along the margins of the pyrite grains. An analysis of a specimen of this rock is given in Table I, analysis No. 3.

In many parts of the area there are small masses and dikes of porphyritic rocks, which vary considerably in composition and may belong to different periods. One type is white or light-grey in colour, and the phenocrysts are albite; these are most likely related to the rock just described. Others are darker grey in colour with pinkish feldspars, which are basic oligoclase in composition and thus, in that constituent, nearer to the diorites than to the soda granite. However, as they are fresh in character and somewhat like the albitic type in appearance, they have been mapped in the same colour.

Those of the light-coloured, soda-rich type are commonly fine-grained, and the phenocrysts are not conspicuous even on the weathered surfaces. In the field some of these were mistaken for quartzite or arkose. One of the largest masses of this rock is on claim T.B.9,991 of the Hard Rock property. It is very dense and light-grey to nearly white in colour, except where disseminated pyrite has caused some discoloration. A distinct shearing is recognizable, along which there are commonly tiny quartz veins. In the hand specimen the rock resembles a quartzite, but in thin section it is easily recognized as a porphyry (see photomicrograph below). The phenocrysts are albite with a few rounded grains of quartz. The feldspars are well formed, but some of them are fractured. The groundmass is composed of quartz and feldspar. Sericite, calcite, and a little chlorite are present. Analysis No. 1, Table I, is of this rock.



Photomicrograph of porphyry, claim T.B.9,991, Hard Rock mine. (Crossed nicols, × 22.)

Dikes of very similar character occur on the Bankfield claims (see photomicrographs on page 24). An analysis of a specimen from one of these is given in Table I, analysis No. 2. It shows a total silica content almost the same as that of the Hard Rock porphyry and somewhat lower than that of the mass on claim T.B.10,998. The difference is apparently in the amount of quartz present. The most marked difference, however, is in the amount of orthoclase, of which the dike rocks contain a considerable amount and the massive rock almost none. In the recast analysis of the Bankfield porphyry, the presence of limonite is assumed in order to account for the ferric iron of the analysis, and the carbonate present is calculated as containing some magnesium. The rock, however, effervesces freely with cold acid.

Other dikes of somewhat different appearance but all weathering to light colours and highly feldspathic, occur on the claims of the Lac Development Company, the Roche Long Lac Gold Mines, the Longlac Lagoon Gold Mines, and the Magnet Lake Gold Mines. The dike on the claims of the Lac Develop ment Company cuts volcanics; it is greyish in colour and has phenocrysts o feldspar recognizable in the hand specimen. Under the microscope the feldspars prove to be mostly plagioclase, of a variety near the oligoclase-andesine

boundary. Quartz phenocrysts also are present, and there is considerable biotite, some foils of which are enclosed in quartz phenocrysts. The groundmass is a fine-grained aggregate of quartz and feldspar. Sericite is abundant both in



Photomicrograph of porphyry from the south ore zone, Bankfield mine. (Crossed nicols, × 22.)

the feldspar phenocrysts and in the groundmass. Chlorite, epidote, and calcite are present. The dike on the Magnet Lake claims south of Magnet creek is very similar but contains more chlorite; biotite is less abundant and is greenish in



Photomicrograph of porphyry containing sulphides (black), from the south ore zone, Bankfield mine. (Crossed nicols, × 22.)

colour, sericite is abundant, and there is some epidote. The Longlac Lagoon dike is light-grey in colour, and the porphyritic character is recognizable in the hand specimen. It is slightly sheared, and sericite coats the shear planes.

Under the microscope it has much the same characteristics as those noted for the other dikes. No quartz phenocrysts occur, some of the feldspars are fractured, and there is abundant sericite and considerable chlorite.

The general trend of the feldspar porphyry and quartz porphyry dikes is east-west, parallel to the general direction of shearing. The dikes themselves are more or less sheared and must, therefore, have been intruded before the end of the period of most intense deformation. They intrude the volcanics, the sediments, and the diorite. They may not all belong to the same period of intrusion, but there is sufficient resemblance (see Table I) in most of them to indicate that they are probably related.

Keweenawan(?)

Diabase dikes occur rather commonly. None of them is large, but so far as can be judged from the scanty outcrops some are continuous for considerable distances. The largest seen is less than two hundred feet in width. It outcrops on the point on claim T.B.14,486 of the Hard Rock property and at low-water level is exposed on the point across the lake to the north. A few others are of sufficient size to be shown on the map. All of them have the composition of typical quartz diabase. Labradorite occurs in well-formed, stout, lath-shaped crystals and is fairly fresh, but some of the crystals are fractured. Augite is abundant and occupies the spaces between the feldspar crystals; quartz is present, both as individual grains and as micrographic intergrowths with feldspar. A little magnetite and hornblende are the other primary minerals. The secondary minerals are chlorite and epidote. Chlorite occurs in feathery aggregates, no doubt as an alteration product of hornblende. Epidote is fairly abundant, both as granular aggregates and as veinlets in fractured plagioclase crystals. Most of the diabase dikes have a north-south direction and appear to be vertical or nearly so.

Pleistocene

No rocks of any age between the diabase and the unconsolidated gravels, sands, and clays, deposited during the glacial period, occur in this region. If any were formed, they have been completely removed by subsequent erosion.

Glacial erosion is shown by glacial striae, which still remain on many rock exposures. There are several places where till rests upon material so thoroughly oxidized that it seems possible that it represents weathering products formed prior to the ice age. Thus, in the trenches exposing the granite porphyry on claim T.B.10,998, in trenches on the Bankfield property, and in trenches on the claims of the Kenogamisis syndicate, grey glacial material, composed of sandy clay containing pebbles and boulders, rests with a sharp contact upon red clay, evidently the result of the oxidation of the underlying rocks, which contain pyrite or arsenopyrite sparsely disseminated through them. If this red material is not due to pre-glacial weathering, then it must be assumed that oxygenated waters percolated through the grey boulder clay without altering its colour and oxidized the underlying sulphide-bearing rocks.

Glacial deposits are widespread and in places are very thick, as much as 60 feet of sand and gravel having been found. They present a variety of forms. As seen from the air and as shown in photographs, there are two general topographic types of glacial deposits. Certain areas and zones show irregular and unorganized knolls and ridges, apparently formed along ice fronts or between lobes of the retreating glaciers. In other places there is a marked southwest-

northeast trend to the ridges, and these are probably all typical eskers (see photograph on page 8). On the ground some individual eskers can be followed for a mile or more. Mostly they are steep-sided ridges, and many of them at the northern extremities merge into a sand plain that rises gently to the east-west trending ridge of volcanics along the north edge of the map area. Where cuts have been made across these ridges of glacial material they are found to consist mainly of stratified sand or very fine gravel (see photograph below). The irregular or oval-shaped ridges are mostly unstratified. No stratified clay, such as is deposited in glacial lakes, is known within the Little Long Lac area, but Coleman described a long narrow bay of an early stage of Lake Ojibway, which probably occupied the position of the present Long lake; since the country is so flat, it is possible that bays extended from it as far west as Little Long Lac.



Railway cut through an esker at Bankfield station, Canadian National railway.

If so, stratified clays may be found when excavations are made in some of the lower-lying flats. None has been noticed in any of the trenches, only boulder clay resting directly upon the pre-Cambrian formations. The following quotations from Dr. Coleman's report are interesting in this connection:[1]—

It was long ago observed by Spencer and Taylor that the higher Algonquin beaches imply a water level considerably above certain cols or low passes crossing the watershed between the Great Lakes and James bay. . . .

The next col which has been studied lies between Jackfish on Lake Superior and Long lake. . . . As determined by aneroid the divide between Black river, flowing into Lake Superior, and Long lake is about 1,040 [feet], considerably below terraces of Lake Algonquin to the north and east. The divide and the shores of Long lake itself, 1,013 feet above sea, show indistinct beach deposits, so that one may conclude that the ice which occupied the col during the earlier stages of Lake Algonquin left this basin as a long narrow bay at a later period. . . .

There are no striking beaches around the shores of Long lake, perhaps because its valley formed only a very narrow bay of Lake Ojibway. . . .

At the north end of the lake, near its outlet into Kenogami or English river, there are considerable areas of lake deposits both sand and clay. The clearing near the old Hudson's Bay

[1]A. P. Coleman, "Lake Ojibway; Last of the Great Glacial Lakes," Ont. Bur. Mines, Vol. XVIII, pt. 1, 1909, pp. 286, 291.

post and the new post of Revillon Brothers shows sandy soil rising 10 or 15 feet as a terrace on the east side of the lake. The new post of the Hudson's Bay Company on the west side is on a low flat of clay rising from 3 to 10 feet above the lake, well stratified in darker and lighter layers an inch thick. . . .

West of Long lake the country is swampy or muskeg with many small lakes showing little solid rock and no sand or clay; but on Little Long lake boulder clay and morainic ridges are seen, with a few terraces, which may be lacustrine. One near a narrows was found to be 23 feet high and to consist of silty sand at the bottom, followed by coarse sand with a thin sheet of gravel on top. The surface is undulating, and suggests a lake deposit at the edge of an ice sheet.

It seems likely from present evidence that the Little Long Lac area was not covered by the waters of Lake Ojibway at any time. The transverse dry valleys mentioned in the discussion of topography seem to be evidence of temporary transverse drainage during the retreat of the glacier. These valleys cut across the esker deposits and probably carried the water from the melting ice into local depressions, from which it no doubt drained either to Lake Ojibway or to the south. Probably in these local lakes some clays were deposited.

Recent

Deposits of the present day consist chiefly of the organic material collecting in the lakes, marshes, and swamps. Much of the area is so poorly drained that peat is accumulating widely. Even where there is considerable gradient the underlying sand is mantled by a covering of moss. In many places the moss and peat are several feet thick. As there are no large streams, no recent stream deposits of clay or sand of any importance occur.

STRUCTURAL GEOLOGY

Folding

The close folding that the rocks have undergone has been touched on in discussing the sediments of the Timiskaming series. The dip of these formations is generally steep, indicating a closely folded major syncline to the south. On this are imposed minor folds, of which probably only a few have yet been recognized. These folds plunge westward at about 30 degrees. The axis of a minor anticline lies along the south shore of Barton bay in the vicinity of Little Long Lac mine, and another lies south of the MacLeod-Cockshutt mine.

Faulting

Faulting is difficult to recognize, since exposures are poor. In tracing formations where outcrops are scanty, curves have been assumed. Actually the beds may be offset by faults, but evidence of this cannot be obtained until definite horizons have been traced for some distance. It seems likely that there are strike faults parallel to the bedding or nearly so, and undoubtedly there has been a considerable amount of movement on the east-west shear planes that occur in so many zones. Evidence of this can be seen where minor folds so deflect the beds that the shearing intersects the bedding at quite apparent angles.

Low-angle faults, which have caused considerable difficulty in mining operations, have been encountered in underground work at the Little Long Lac mine. They are later than the veins but only slightly displace them. None of them could have been recognized were there no underground work; they will be discussed in a later part of this report.

HISTORICAL GEOLOGY

The geological history of the area may be summarized briefly. During the earliest period here, as in so many parts of the Canadian shield, there was a great outpouring of lavas, mainly of basic types, with here and there the laying-down of muds in local bodies of water. Disturbances of some magnitude were caused in parts of the region by the intrusion of granites toward the close of this period. Then followed a long period of erosion, which cut down the ancient mountains and exposed their granite cores. The debris formed during at least a part of this period was deposited in this particular area, and probably for a long distance north and south, as a thick series of gravels, sands, and clays. It seems likely that rivers flowing down from the uplands formed delta fans as they reached lower levels and deposited upon less eroded parts of the old complex the products of rock waste brought down from the more elevated regions.

After the accumulation and consolidation of a great thickness of these sediments, mountain-building movements again affected the region, and both series of rocks were thrown into close, east-west trending folds and probably also considerably affected by faulting. At the same time there were great invasions of granite, which are now found in adjoining areas and which are represented here by some of the relatively small intrusive masses that cut the Timiskaming rocks. Later still came dikes of diabase. After the intrusion of the diabase there was a long interval of time during which there was probably much erosion and much deposition. There is left only the evidence of erosion, which removed any sediments that may have been deposited and cut so deeply that rocks formed at considerable depth were exposed at the surface.

Comparatively recently the continental glaciers advanced, so scouring and polishing the weathered rocks that much of the disintegrated material was removed. Possibly here and there some patches of residual products were left in protected places. As the glaciers retreated great thicknesses of unassorted sand and gravel were deposited in front of the ice during periods of stagnation, and long ridges of stratified sands were formed beneath it. Also, where the ice was stagnant for a considerable time, transverse spillways developed carrying the water across the direction of the esker ridges and excavating channels to the glacial lakes that lay here and there in front of the ice cap and that probably all drained to one of the glacial Great Lakes. Finally, with the retreat of the ice, the present lakes were established with their imperfect drainage systems, which leave a large part of the area marshy and swampy and permit the development of widespread peat bogs.

ECONOMIC GEOLOGY

Gold is the only mineral occurring in the Little Long Lac area that is of primary economic importance. Sand and gravel deposits located conveniently to the operating properties are of great utility, but their value depends solely upon the success of the gold-mining ventures, excepting where they are used in railway maintenance or in road construction, neither of which requirements would be of large proportions without some primary production from the area. None of the iron formation contains any concentrations of iron ore. The iron content of even the richest portions of the beds is far below that necessary for workable deposits, and the quantity of this highest grade material is probably not large. In addition magnetite and hematite are so intimately associated that beneficiation seems impossible.

The history of the exploration of the area has been summarized earlier in this report. It may seem strange that, during the intensive search for bodies of iron ore that was carried on between 1900 and 1909, no one happened to recognize any of the gold-bearing veins. There were probably several reasons for this. At that time the attention of prospectors and those in charge of development operations was focused on the iron formation, in which, with few exceptions, no gold-bearing veins occur. Most of the veins occur in inconspicuous shear zones, which are easily passed over even when search is being made for them. At the time the iron formation was being prospected it had become a rather generally accepted opinion that there were no workable gold deposits in Ontario, so that the mention in Coleman's report of quartz veins in sheared sedimentary beds aroused no interest then nor for a long time afterward, even when supplemented by the reports of Burrows and Tanton referring to the occurrence of gold at various places in the region. In addition, there is heavy drift cover, much swamp and marsh, and few outcrops along the lake shores. Hence, with no adjacent mining fields in similar rocks to provide a stimulus this area failed for a long time to attract prospectors.

Gold Deposits

Development work has not yet proceeded far enough to make possible a classification that will include with certainty all of the gold deposits that may be found. For convenience of discussion rather than on any genetic differences or similarities they will be taken up with reference to the rocks in which they occur. Most of the development work to date has been done on deposits in the sedimentary rocks of the Timiskaming series. Among these deposits there seem to be three types:—

1. Shear zones in sediments, along which narrow but closely spaced quartz veins occur in parallel planes.
2. Irregular veins of quartz accompanied by pyrite, filling fractures in iron formation.
3. Zones of pyritization and silicification in both sediments and intrusives.

The ore may be wholly in one type of rock or partly in one and partly in the other.

In the greenstone and in the massive diorite of post-Timiskaming age gold occurs in definite quartz veins, generally lenticular but in many cases traceable along the strike for considerable distances.

Gold-bearing veins have been found only in the northern part of the belt of Timiskaming sediments. As shown in the discussion of the general geology, the sediments along the north side of the major syncline are heterogeneous with at least two conglomeratic horizons, several discontinuous bands of iron formation, zones of massive greywacké, more thinly bedded greywacké, chloritic schists, sills of diorite, and east-west dikes or possibly sills of feldspar porphyry. Farther south the sedimentary series is less heterogeneous and is apparently a monotonous succession of rather slaty greywackés. The northern belt has undergone minor folding, a feature that is not present or at any rate has not been recognized in the rocks farther south. The gold deposits so far found in the Timiskaming sediments are located in the highly disturbed heterogeneous portion of the syncline.

The most favourable type of sediments for deposits of the first type is the belt of rather massive and apparently thick-bedded greywacké or arkose that lies between the two northern bands of iron formation. It is in this belt that the veins of the Little Long Lac mine are located. A drag fold forms a minor

anticline plunging westward, and the massive character and brittleness of the rock has made possible persistent east-west shear zones in this disturbed area. The shearing crosses the bedding at a noticeable angle and is much more conspicuous than the rather obscure planes of sedimentation. The best developed shear planes dip steeply towards the south, but there are less prominent ones dipping to the north and forming a conjugate series with the southward-dipping ones. The gold deposits consist of quartz veins sufficiently closely spaced in these shear zones and of high enough gold content to make ore. Most of the quartz veins are thin lenses which, considering their width, have remarkable continuity. In places quartz veins have curved forms, probably where they follow bedding (see photograph on page 38).

Deposits of the second type differ structurally from those of the first, mainly owing to the circumstance that they occur in much less homogeneous sediments. The iron formation, where highest in iron, consists of layers of silica and iron oxides of about equal thickness, generally not more than half an inch. Leaner iron formation is made up of a few lenses of iron oxides in greywacké, either massive and highly quartzose or slaty in character. In such rocks fractures are much less regular than those in the thick-bedded, homogeneous greywacké in which most deposits of the first type occur. The quartz veinlets in crumpled and fractured iron-rich bands follow both shear and bedding planes and consequently are very irregular and commonly contorted, as is the iron formation.

In the diorite and the feldspar porphyries, gold occurs under still different conditions. The diorite in many places is intercalated with sediments and in places is sheared into chlorite schist. The replacement of some of its constituents by pyrite and the filling of tiny fractures by quartz has formed ore bodies in which sulphides and gold are disseminated through a zone of schistose and altered rock. There are similar occurrences where dikes or irregular masses of feldspar or quartz porphyry occur in the sediments. The acidic intrusive, however, has yielded more commonly by fracturing and in some places has a fairly regular shearing similar to that which is found in the thick-bedded greywacké, but it contains a larger number of irregular quartz veinlets and more introduced pyrite disseminated through the zones.

Quartz veins in the greenstones and in the diorites intruding the greenstones are somewhat different in type from those in the sediments. In general the shearing is less regular, and the veins tend to have the marked lenticular form that is characteristic of veins in the Keewatin volcanics. Although the veins are so variable in width that they may be two or three feet wide in some places and only as many inches in others, most of them are fairly continuous for considerable lengths along the strike, as will be seen from descriptions of working properties to follow. Masses of diorite intruding the greenstone have undergone less shearing than have those within the sediments, probably because the sediments are heterogeneous and movement was easier in a rock with marked structure planes than in the lavas in which the bedding planes are less distinct. Hence quartz veins in diorite intruding greenstone have much the same character as have those in adjacent areas of greenstone. There seems to be a somewhat greater number of veins along the contact between the two types of rock than elsewhere, owing, no doubt, to localization of fracturing by the slightly different competence of the diorite and volcanics.

The mineral association in the gold deposits varies somewhat in the various types, but there are certain general features that are common to all. By far the greater part of the gold occurs as native metal associated with quartz. Other metallic minerals are arsenopyrite, which is fairly abundant in some deposits

and entirely absent from others; pyrite, which occurs in all; and chalcopyrite and pyrrhotite, present only sparingly. In some specimens from the Little Long Lac mine, small quantities of bournonite were found in microscopic examination; it cements fractured pyrite and has been observed with tiny particles of gold completely enclosed within it (see photomicrograph on page 41). Stibnite has been recognized in the ore of the Little Long Lac mine, and there are doubtless other minerals, as analysis of the ore shows that bismuth is present. The proportion of sulphides varies considerably in different types of deposits. In the veins in the greywacké, minerals other than quartz make up only a small part of the whole. In some of the replacement zones pyrite is present in sufficient quantity to cause a heavy staining of the weathered outcrops. Details of the mineral occurrences and of paragenesis will be discussed in connection with each deposit.

Wall-rock alteration is not intense in deposits of the first two types. Generally the greywacké alongside of quartz veins is as fresh as that at some distance away; but in some places there is noticeable alteration, which has developed carbonate in much greater quantities than is ordinarily the case in these rocks. In the zones containing much pyrite there is commonly a rather intense silicification as well as introduction of pyrite. Pyrite is commonly associated with chlorite, which forms a shell between the sulphide and the feldspar and quartz that make up most of the rock. There is no conclusive evidence of the relations of chlorite and pyrite, but it seems likely that both resulted from a rather continuous process, the chlorite possibly forming first and later being replaced by pyrite.

No definite statement can be made as to the age of the deposits. They are clearly younger than the rocks of the area with the possible exception of the diabase. The diabase cuts across the zones of regional shearing, and it seems probable that it is also younger than the mineralization that occurs in the sheared zones. This is deduced from the fact that there is apparently no displacement of the diabase dike that crosses through the mineralized zone that is being explored by diamond-drilling on claim T.B. 10,738 of the Longlac Lagoon property. To the east the granite that outcrops around the northern end of Long lake projects as a broad salient southwestward, probably nearly to the east boundary of the Little Long Lac map area. There are no data as to the attitude of the upper surface of the batholith, but it may plunge westward as the folds in the overlying rocks do and thus underlie the Little Long Lac area at depth. If so, the magma from which it consolidated may have been the source of the mineralizing solutions from which the quartz veins and their metallic contents were derived. At present it can only be said that such a magma could have produced residual solutions capable of supplying the minerals that are found in the ore bodies.

The continuation of veins along the strike or in depth will be influenced by the structural conditions under which they occur. As has been shown the most productive veins yet found in the region occur in the heterogeneous sedimentary formations along the north margin of the Timiskaming series. The richest of these are in massive greywacké or arkose. Detailed structural information is not available, but it is clear that where the shearing and bedding are approximately parallel there will be little change of conditions within the limits that can be reached in mining. On the other hand where productive veins are in shear zones on the crest of a minor fold or in the trough of a minor syncline there will be a change of conditions where the shear planes pass from one type of formation to another. As the folds here plunge westward the depth of any

favourable zone occurring near the crest or trough of a fold will decrease eastward and increase toward the west and will depend upon the stratigraphic thickness of the favourable bed. It does not, of course, follow that productive veins in one formation will cease to be productive when they pass into sedimentary formations of somewhat different character or, for that matter, into Keewatin rocks, but it must be borne in mind that there is the possibility of some change taking place in the physical character of a vein zone at such a contact. On the other hand, shear zones not prominent in thin-bedded slaty greywacké may become much more pronounced and possibly contain veins of value if they pass at depth or laterally into more massive and brittle rock.

So far as the intrusives are concerned, the diorites in many cases seem to occur as sills in the sediments; consequently any ore zones in them would be subject to structural control similar to that indicated for the sediments. Most of the feldspar porphyry and quartz porphyry masses seem to be vertical or nearly so and thus approximately parallel to the regional shearing. Accordingly, there is no likelihood of a definite shear zone passing out of these porphyries into other rocks at depth, except where it occurs near the margin of the intrusive and has a slight divergence in its dip from that of the plane of contact.

Since the volcanic rocks are all highly tilted and approximately uniform in character, there seems little reason to expect a change of character of the veins in them. Certain exceptions must, however, be noted. In the volcanics north of the Little Long Lac mine there are several areas of agglomeratic and tuffaceous rocks. No doubt, these would behave differently under stress than the massive flows; hence there might be some physical change in veins passing across the contacts between flows and tuffs.

Iron Formation

The iron formation east of Lake Nipigon, the western extensions of which are found in the Little Long Lac area, was rather thoroughly examined as a possible source of iron ore. In many places trenching was supplemented by diamond-drilling. The highest-grade formations found are those near Lake Nipigon, where, however, only picked samples contain more than 40 per cent. metallic iron. Assays of the best samples from the south range, as given by Coleman, show a content of metallic iron of 38.06 per cent. An average sample across a width of 82 feet contained 30.06 per cent.[1] Coleman summarizes results as follows:[2]—

> In general it may be said that in the aggregate there is a considerable amount of lean ore with comparatively small amounts of injurious impurities, but generally in narrow lenses separated by several feet of jasper and schist.

The iron formation in the Little Long Lac area is much less extensive and probably on the whole of lower grade than that farther west. There is no possibility of any workable deposit of iron ore occurring in it.

Sand and Gravel Deposits

The thick and widespread deposits of glacial material furnish abundant supplies of sand and gravel for constructional purposes. Several large pits were opened up during the building of the railway, which, between Hardrock

[1]A. P. Coleman, "Iron Ranges East of Lake Nipigon," Ont. Bur. Mines, Vol. XVI, pt. 1, 1907, p. 127.
[2]Ibid, p. 128.

and Keemle, cuts through several ridges exposing considerable thicknesses of sand and gravel (see photograph on page 26). Along the shores of Little Long Lac several ridges have been cut into by wave action, making it possible to load gravel and sand directly from the pits into barges for transportation to the Little Long Lac mine. Conveniently located deposits of gravel and sand facilitated road construction from Geraldton south to the lake, and the excellent occurrences so abundant throughout the region will be valuable when the time comes for highway building.

Future of the Area

Gold-bearing veins are not confined to any one kind of rock, but are localized rather by its physical character. Thus the brittleness of the massive greywacké in the sedimentary formations was favourable for the formation of fractures wherever folding developed. In any other rock of similar competence shear zones may be expected under similar conditions. The high gold content in the Little Long Lac lode is unique among discoveries so far made in the area. On other properties occurrences of high-grade material have been found, but they are erratic, and in practically all cases the average values over mineable widths indicate at best only material of medium grade. Even at the Little Long Lac mine the shear zone was so inconspicuous that, had conditions for its discovery been any less favourable, it might easily have remained unnoticed. The heavy overburden and swampy nature of much of the country make thorough prospecting difficult, and it is quite likely that other deposits similar to those now known will yet be discovered.

Extensions of known vein zones will depend upon the character of the rocks in which they lie and, where the wall rocks are favourable sedimentary formations, upon the relation of the shear zones to the bedding. These factors have been discussed earlier. The small size of the outcrops of intrusive rocks indicate that the igneous rocks associated with the vein-forming solutions probably lie at a considerable depth below the present surface. Hence there is no danger of the cutting off of the veins by igneous rocks below, nor of any sudden change in the character of the vein minerals.

DESCRIPTION OF PROPERTIES

A large number of companies are prospecting and developing groups of claims in the Little Long Lac area. The Little Long Lac mine began production in the latter part of 1934, several others have begun underground work, and much diamond-drilling and trenching have been carried on. The following descriptions refer to conditions as they were at the end of the field season in September, 1934, or in some cases earlier, since the last visits to some of the properties were made some time before field work was completed; developments since September are not recorded except for a brief mention of some incidental information received later.

Properties Mainly in the Sediments

Little Long Lac Gold Mines

The Little Long Lac mine is situated on the south side of Barton bay, the most westerly bay of Little Long Lac (see frontispiece). The company owns 35 claims along the south and west sides of the bay and beneath it. The workings are on mining claim T.B.10,560.

The consolidated rocks underlying this group of claims consist chiefly of sediments. A small area of diorite is exposed to the southeast of the shaft, and a narrow diabase dike outcrops on a point west of the large island. It strikes north and south and must lie beneath the marsh at the west end of the bay. Recently a 4-inch lamprophyric dike considerably altered to calcite has been intersected in the underground workings. The sediments are massive greywacké and bands of iron formation. A thick band of iron formation is exposed on claims west of Barton bay and on the north side of the large island. North of the bay, it is concealed by marsh and swamp except at three places. A second band of iron formation is exposed at various places on the claims of the Mosher Long Lac Gold Mines, immediately south of the Little Long Lac mine, and continues as a strong zone across the claims of the Longlac Lagoon Gold Mines. Between these two bands the rock is greywacké, which is massive, thick-bedded, greyish in colour, and of medium texture. It shows bedding only in a few places. Under the microscope, a specimen from the north side of the drift 275 feet west of the shaft on the 3rd level of the Little Long Lac mine appears distinctly fragmental with abundant subangular to angular pieces of quartz and plagioclase and a few well-rounded particles of quartz (see photomicrograph on page 14). The plaglioclase is fresh and of the composition of oligoclase. Most of the quartz shows no strain, but some of the fragments are fractured. The matrix is a fine-grained aggregate of quartz and feldspar, the quartz occurring in a few places in the section as a fine-textured mosaic. Chlorite and sericite occur in considerable quantities. The foils of these minerals give the rock a slight foliation, which curves around the fragments. The rock is a typical greywacké.

The most conspicuous structural feature is an east-west shearing so pronounced that in many places it causes a platy parting easily mistaken for bedding. In the greywacké the bedding is recognizable only in a few places; near the mine buildings it strikes slightly north of west and thus is nearly at right angles to the shearing. On the southwest end of the large island the bedding strikes N.68°W. and dips 75°S.W. The iron formation beds are much contorted, and cleavage plates show the bedding crossing the shear planes at all angles. Along many of the shear planes there have been slight movements, so that in many places the beds are offset from a quarter of an inch to half an inch. The iron formation is much more closely folded than the adjoining greywacké. It has been dragged into close plications, probably because the massive greywacké to the south and the massive greenstone or conglomerate to the north were more competent formations. The lack of well-marked bedding in the greywacké, however, makes it less easy to recognize folding in it than in the distinctly bedded, iron-bearing members. So far as structure has been determined the ore bodies at the Little Long Lac mine are along the crest of a minor anticline that plunges at about 30°W. The possible influence of this structure has been discussed previously. No major faults are indicated on the surface, but the scattered outcrops do not lend themselves to accurate determination. Underground several flat faults have been encountered. These do not affect the distribution of the rock formations; they will be discussed in connection with the ore bodies.

Jointing occurs in three systems. The best developed one is nearly horizontal, the second strikes S.80°W. and dips 85°N. and the third is a less distinct set of joints, which strikes north-south and is nearly vertical.

The ore body of the Little Long Lac mine is a lode composed of quartz veins, lying in a zone which for a width of 5 feet or more contains a sufficient

number of them, with a high enough gold content, to form an ore shoot of good grade. The lode lies along a curved surface. The strike on the second level is approximately N.80°E., but there are gentle curves in it. On the 3rd level, the part west of the shaft strikes N.75°E.; east of the shaft the lode curves in a gentle arc to a more northerly strike. On the 4th level from the west end, 400 feet west of the shaft, to a point 170 feet east of it, the strike is N.55°E. Farther east the strike is N.65°E. The dip also varies (see Fig. 2). From the

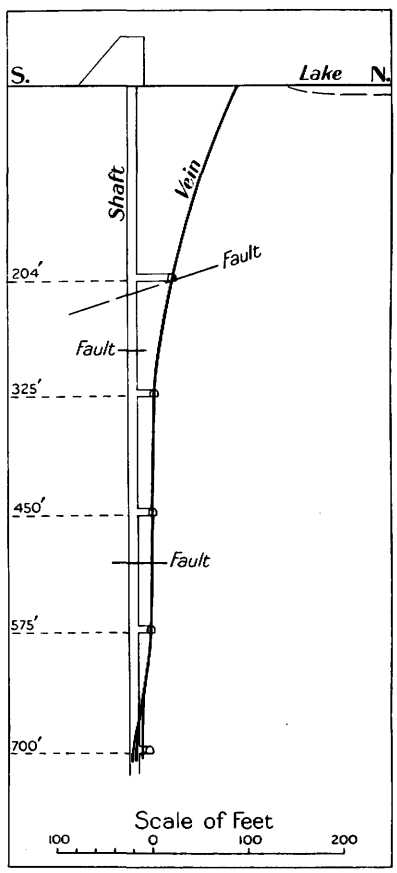
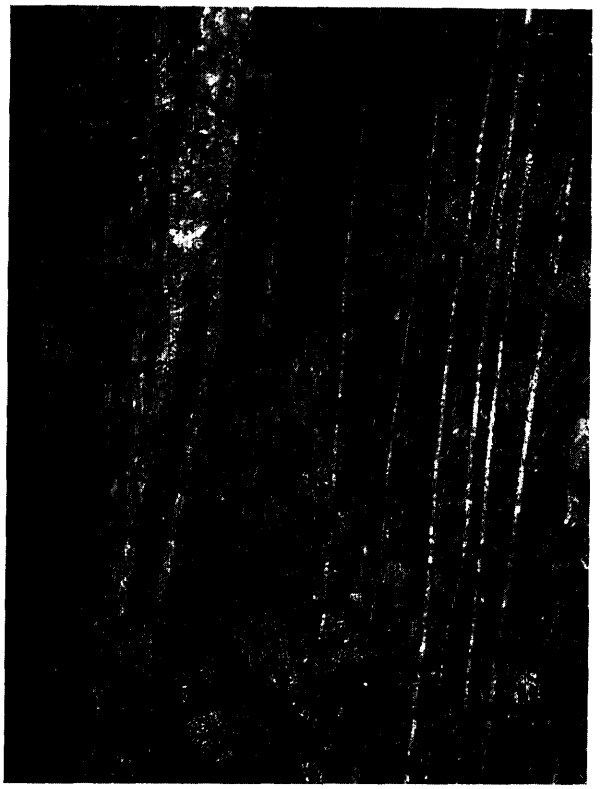


Fig. 2—Cross-section of the vein and shaft, Little Long Lac mine.

surface to the 2nd level (204 feet), the average dip is 70°S. From the 2nd to the 3rd, 80°S. Below the 3rd the dip is still to the south, but is only 2 to 3 degrees from vertical. In some places there is a main vein in which the width of quartz is as much as a foot. In other places there are two veins 3 to 4 inches wide. On either side of the main fissures are narrower veins. Many of these are parallel to the larger ones, but there are, as well, veinlets oblique to and linking up the parallel fissures. For considerable lengths larger veins are lacking, and only the relatively small ones are present. Some of these are remarkably continuous. Veinlets of quartz only an eighth to a quarter of an inch in thickness can be traced for 12 to 15 feet along the shear planes without

any interruption whatever and with little variation in thickness (see photograph below). The total amount of quartz present in any one face does not at first sight appear large, but careful examination shows that, in addition to the larger veins and the conspicuous veinlets, there are a large number of tiny cracks which also contain quartz.

The following description of the vein zone at several places will indicate its general character. On the 2nd level, 30 feet west of the shaft, the back of the drift shows two main quartz veins, each 2½ to 3 inches in width, and several



Back of the 2nd level, Little Long Lac mine, 30 feet west of the shaft, showing parallelism of the quartz veinlets. The area shown in the photograph is 4½ by 6 feet.

smaller veins from an eighth to a quarter of an inch wide. The smaller veins branch from and join the main vein, and at one place measurement of the dip shows that a small vein has a dip of 75°S., as compared with 85°S. for the larger veins. On the 3rd level at the west face, which at the time of examination was 400 feet west of the shaft, quartz veins of two ages are present (see Fig. 3). The older quartz veins have a drag-folded form, probably due to the replacement of an original drag-folded structure rather than deformation subsequent to formation. The younger vein cuts across the older and displaces it at two points. The quartz of the older vein is white with some iron-staining along fractures. In the younger vein it is much more glassy in appearance and does

not show much brecciation. Along nearly the whole of its exposed length the younger vein has a thin black selvage. Assay of samples of these two veins and of the wall rock gave the following values in gold:—

	Ounces per ton
Older vein	2.10
Younger vein	.10
Wall rock	.04

On the 5th level, 72 feet west of the shaft, the face showed a thin, nearly horizontal vein of calcite. Two nearly vertical large quartz veins and some smaller ones are offset to the north on the upper side of this seam. The quartz is continuous through the calcite, so that the offset is not due to movements later than the introduction of the quartz, but is rather an offset of the fractures

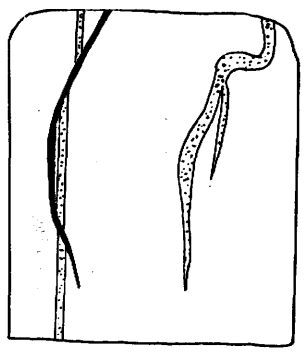


Fig. 3—Sketch of face of drift on the 3rd level, 400 feet west of the shaft, Little Long Lac mine. The stippled areas represent the older veins, and the solid black represents the younger vein. Scale, 4 feet to the inch.

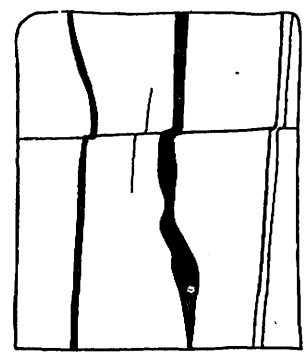


Fig. 4—Sketch of face of drift on the 5th level, 72 feet west of the shaft, Little Long Lac mine, showing quartz veins (solid black) cutting through a calcite seam (horizontal) and offsetting along it. Scale, 4 feet to the inch.

in which the quartz was later deposited (see Fig. 4). At the east end of the drift on this level, 70 feet from the shaft, the north half of the face showed three quartz veins, each about 1½ inches wide, separated from each other by one foot of sheared rock. The south half contained little quartz, but there were several widely spaced, flat calcite veins of knife-edge thickness. At the station on the 700-foot level the vein structure is as follows: The main zone of narrow, parallel quartz veins is in the shaft and has the regular steep southerly dip. In the wall of the station there is a vein with a striking anticlinal form (see photograph on page 38). This probably follows the bedding of the greywacké along a minor fold, whereas the regular vein zone as usual follows the shearing. As a result of this subsidiary structure the lode width at this point is increased to 18 feet. If it be assumed that the folded structure which this vein follows plunges westward at 30 degrees as other drag folds do, then the same type of occurrence may be expected on the upper levels to the east of the shaft and on the lower to the west of it.

Flat faults, along which there was an abundant flow of water, were encountered in the shaft of the Little Long Lac mine at 217 feet, 275 feet, and

500 feet, and caused much trouble during mine development. The following excerpts from an article by A. A. Barton[1] indicate the conditions:—

> At a depth of 212 feet, a considerable flow of water was encountered while drilling. . . . The water course appeared to be a flat-lying fault at about 217 feet. Drill steel was forced from some of the holes with considerable pressure, indicating a large flow with maximum pressure for that head. . . .
>
> At 35 feet north of the shaft, water was again encountered in drilling lifters. This proved to be the same flat-lying seam encountered in the shaft. . . .
>
> In driving west on the 2nd level, it was found that the main water course was a flat-lying fault, pitching to the south 15 degrees. The vein was cut and displaced 2 feet.

On the 2nd level (204 feet), 45 feet north of the shaft, the fault is at the drift floor at the north side. Ninety-five feet west it is 3 feet above the floor



Vein with anticlinal form showing in the west wall of the station, 700-foot level, Little Long Lac mine. The offset on the north limb of the structure is not a post-vein fault. The triangular piece of quartz below it contained spectacular occurrences of gold. The main shear zone is in the shaft immediately to the left of the picture. The area shown is 11 feet 4 inches by 8 feet 6 inches.

on the north side; at 140 feet west a curve in the drift again brings the intersection of the workings with the fault plane, at the floor. At 170 feet west of the shaft it is 6 feet above the floor of the drift. No doubt the fault surface is not uniform in dip and strike, but these known points indicate a strike of approximately N.75°E. and a dip of 15° to 17°S. It should reach the surface 670 feet N.15°W. of the shaft and hence beneath the lake. In some places the fault surfaces are so close together that the fault is barely noticeable; in others there is a wide fissure, which admitted so much water that it was impossible to cope with the flow, with equipment available during mine development, and the workings were bulkheaded. The face was completely sealed, the water course was tapped by drill-holes, and cement was forced in under pressure. One drill-hole alone required 700 bags of cement to form a seal, and cement was

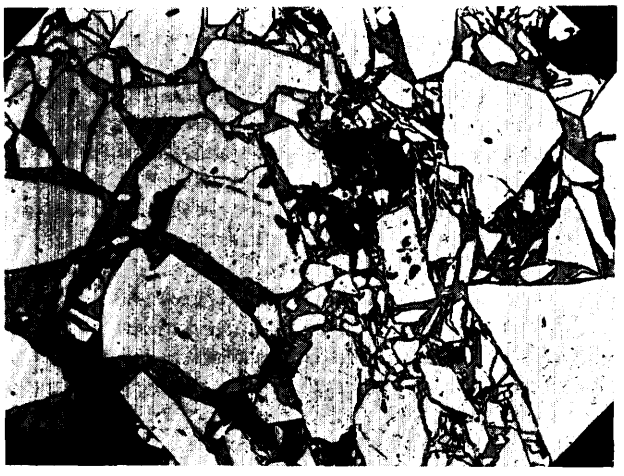
[1]A. A. Barton, "Cementation," Can. Min. Jour., Dec., 1934, pp. 529, 530.

forced along the fissure so that a thickness of 2 inches of it was found at a distance of 100 feet from the shaft.[1] Thus the fault fissure must have been fairly open.



Photomicrograph of vein quartz, Little Long Lac mine, showing brecciation. (Crossed nicols, ×22.)

This fault is later than the vein, but it shifted the ore less than 2 feet, the upper part having an apparent movement to the north relative to the bottom. There is no evidence as to what component the movement may have had in a



Photomicrograph of Little Long Lac ore showing brecciated pyrite (white) cemented by bournonite (grey). (×150.)

direction parallel to the strike of the vein. No information has been obtained about the second flat fault except its position at 275 feet in the shaft. The fault at 500 feet has a dip of 20°E.

[1]A. A. Barton, op. cit., p. 530

To summarize, the rock deformation consists of rather severe folding, followed or possibly accompanied by an east-west shearing. Flat faults, along which there was apparently little movement, developed and were filled with calcite. Then came the deposition of the quartz veins with which most of the gold is associated. Another period of slight movement was followed by a second period of quartz deposition with only a small amount of gold. Finally, flat faults of small displacement left fissures either open or possibly filled with easily soluble material.

Microscopic examination of the vein quartz corroborates the evidence for two periods of deposition. Quartz of the first period has been fractured, and the fragments have been recemented by finer-grained quartz of a second period (see upper photomicrograph on page 39). The veins contain only a small amount of minerals other than quartz. Those observed were arsenopyrite, pyrite, bournonite, stibnite, and gold. Undoubtedly the ore contains other minerals not recognized in the specimens examined, as is shown by the following analysis of a composite sample of mill heads made by the Mines Branch Laboratory, Ottawa:—

	Per cent.
Arsenic	0.30
Antimony	.01
Bismuth	.02
Silica	67.00
Alumina	12.55
Iron	5.15
Lime	2.70
Magnesia	1.85
Sulphur	.60
Carbon dioxide	4.70
Graphitic carbon	.23
Manganese	.06
Copper	.01
Zinc	.02
Potassium and sodium oxide	3.15
Lead	.02

Probably bismuth is present as bismuthinite. Some specimens of stibnite give faint traces of lead before the blow-pipe, possibly owing to small quantities of bournonite intergrown with it. It may be that bismuthinite also occurs with the more abundant stibnite and has not yet been detected. Arsenopyrite generally occurs in well-formed, elongated crystals less than a sixteenth of an inch in length. Pyrite occurs in small granular masses, which, under the microscope, are seen to be fractured. In places brecciated pyrite is cemented by a grey mineral (see lower photomicrograph on page 39). This is soft and weakly anisotropic; at first it was thought to be stibnite, which has been found in local concentrations, but it is not attacked by any of the standard etching reagents. It is attacked by concentrated silver nitrate. These properties, together with the presence of copper in the ore and the absence of chalcopyrite, suggest that the mineral is bournonite. On treatment with a mixture of azolitmin and potassium dichromate for 90 seconds at a temperature of 95°C., it developed an iridescent tarnish, as described by Head and Loofbourow.[1]

Gold can be seen commonly in hand specimens that contain quartz veinlets. It seems to be most abundant along the margins of the veins but is also to be seen along dark cracks in them. In thin sections and polished specimens of the ore it is found filling tiny fractures in quartz, as isolated grains in quartz that

[1]R. E. Head and R. W. Loofbourow, "A Microchemical Method for the Determination of Bournonite," Econ. Geol., Vol. XXIX, 1934, pp. 301-305.

shows no fractures (see photomicrograph below), and as rounded blebs in both pyrite and bournonite (see photomicrographs on pages 41 and 42). It



Photomicrograph of Little Long Lac ore showing gold (white) in fractures in quartz (grey) and also as grains in quartz with no visible fractures in it. (×150.)

thus seems that some of the gold is definitely later than the quartz vein-filling, but its period of deposition probably overlaps that of both the pyrite and



Photomicrograph of Little Long Lac ore showing gold (Au) in bournonite. (×100.)

bournonite, since it occurs in exactly similar relations to each of these, notwithstanding the fact that pyrite was formed and fractured prior to the deposition

of bournonite. All of the metallics seem to be most abundant where there has been fracturing of the quartz. Fig. 5 indicates the probable time relations of the formation of the minerals observed.

Arsenopyrite is placed before pyrite because of the relations between those minerals as observed in ore from the Bankfield mine.



Photomicrograph of Little Long Lac ore showing grains of gold (Au) in pyrite. (×150.)

The wall rocks of the Little Long Lac veins are but little altered. Greywacké along the margins of quartz veins does not differ in appearance from that at some distance from the vein. In places there is a little pyritization. Veinlets of carbonate cut through the greywacké (see photomicrograph on page 14), and

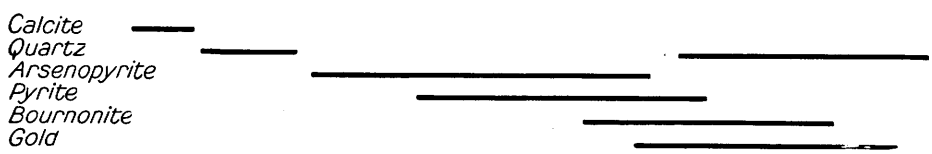


Fig. 5—Diagram showing the sequence of deposition of the vein minerals, Little Long Lac mine.

there is some carbonate in the wall rocks that may be due to vein solutions, but the feldspars are quite fresh and unaffected.

The gold content of the quartz veins taken by themselves is indicated by the assay given on page 37. The amount of visible gold in the quartz is phenomenal. The width that can be mined depends upon the size and spacing of the quartz veins, and the tenor of the ore depends upon the width sampled.

Values and widths indicated by development work, up to the time of the beginning of mill construction, are shown on the longitudinal section (see Fig. 6). Recently, crosscuts to the north and south on the 4th level have shown the existence of parallel vein zones. Production for the first month of operation averaged 0.7 ounces per ton. Mill feed was obtained from the dump accumulated during exploration.

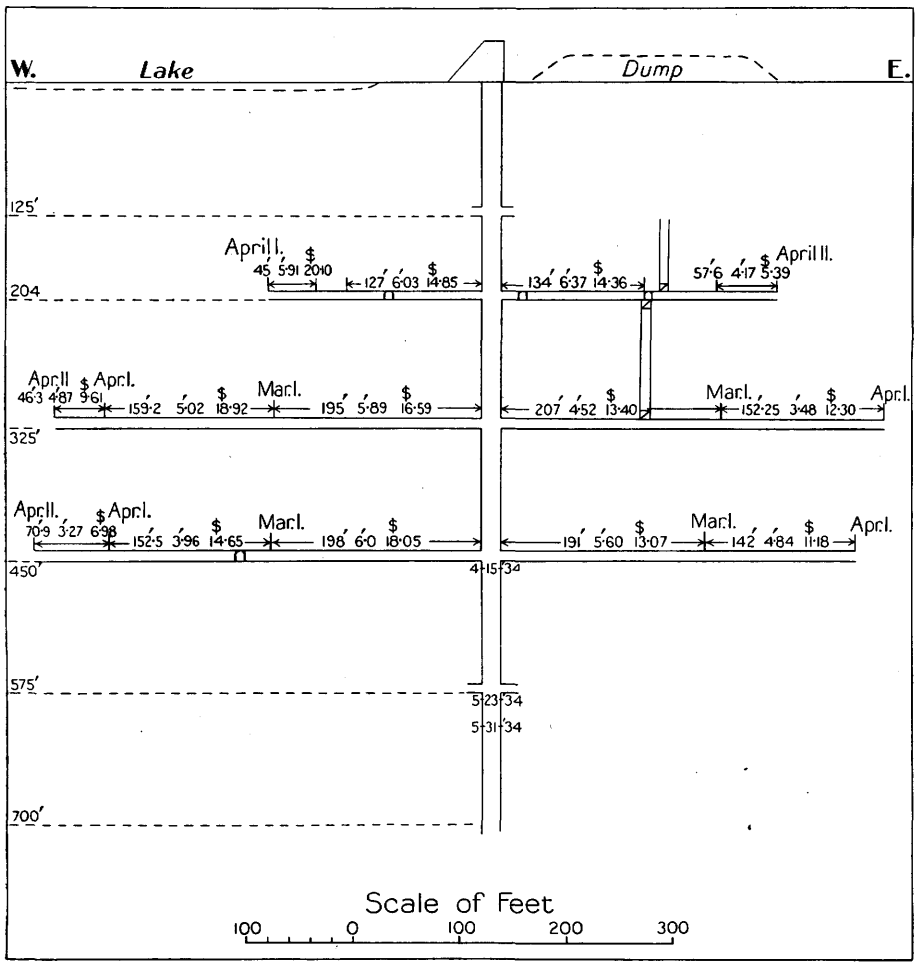


Fig. 6—Longitudinal section, Little Long Lac mine.

Development has now reached the 700-foot level with drifts at 200, 325, 450, 575, and 700 feet and a crosscut north and south on the 4th level. The 3-compartment, vertical shaft enters the vein zone just above the 700-foot level. The mill, planned to treat 200 tons of ore per day, began operations early in December, 1934. Hydro-electric power is available, and the road, a mile and a half in length, now completed from Geraldton to the mine, will facilitate transportation. The mine has a complete plant and adequate accommodations for employees.

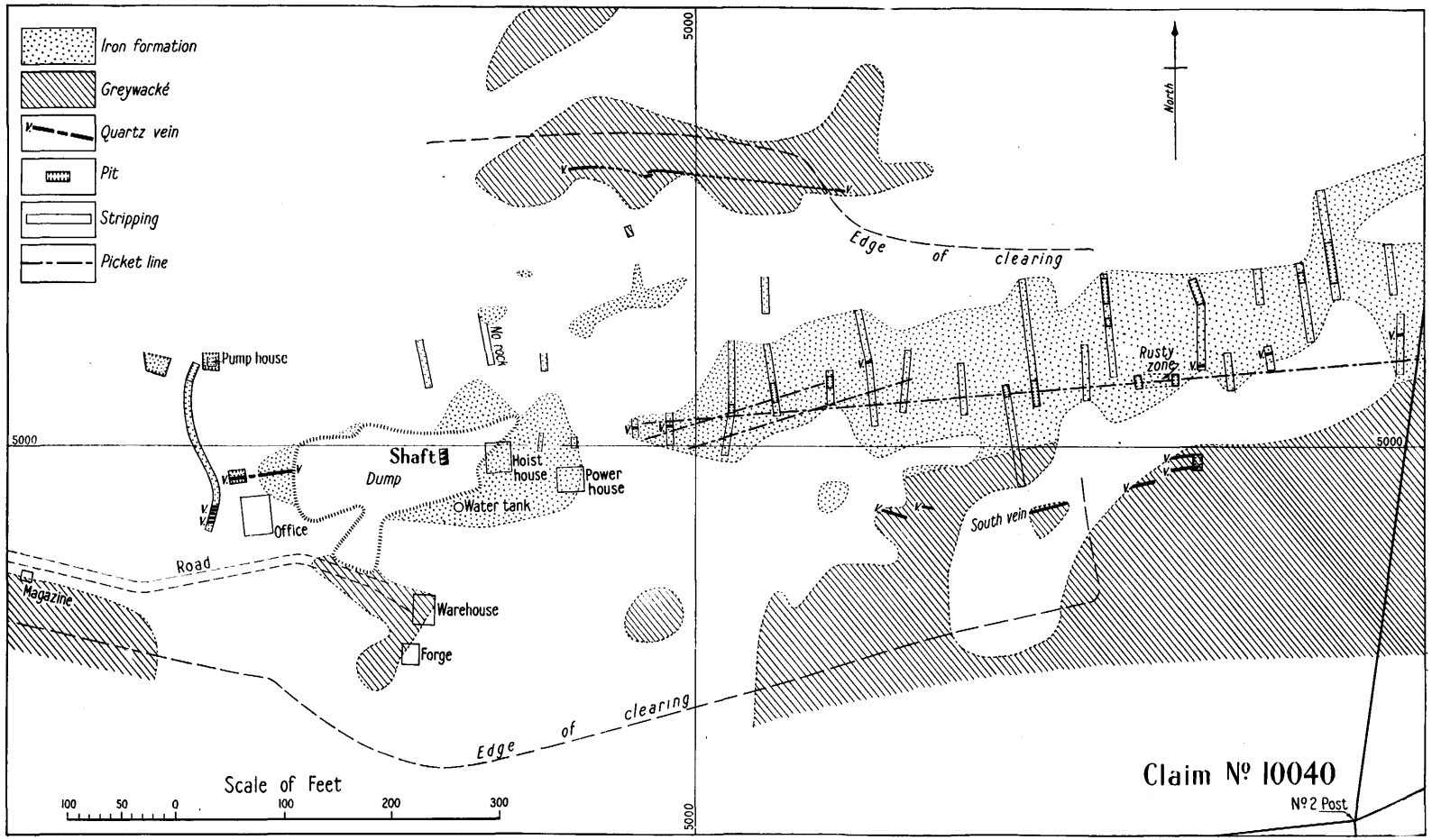


Fig. 7—Geological sketch map of the property of MacLeod-Cockshutt Gold Mines.

MacLeod-Cockshutt Gold Mines

The MacLeod-Cockshutt mine is situated a mile and a half south and somewhat east of the Little Long Lac mine. The group of 22 claims comprising the property extends from the shore of Little Long Lac southward for a depth of five claims.

Rock is exposed mainly in the central part of the group, where a band of iron formation from 200 to 225 feet in width lies between beds of greywacké (see Fig. 7). The proportion of iron oxide in the central part of the band is comparatively small, so that instead of one single bed it may be considered as two rather thin beds of iron formation separated by greywacké containing some lenses of iron oxides. The dip of the formations is steep to the north, and drag folds in the iron formation indicate that the tops of the beds face in that direction (see photograph below).



Iron formation showing drag fold, MacLeod-Cockshutt mine.

Gold occurs in two types of deposits: (1) fractures filled with quartz and pyrite in massive beds of iron formation, and (2) small and somewhat irregular lenses of quartz in greywacké. A lens of the first type was trenched for a distance of 225 feet. Diamond-drilling showed that the fractured zone had a true width of several feet. Underground work, diamond-drilling, and trenching have shown that the gold content is low. The occurrences of the second type are rather erratic, and the lenses are narrow and short, but commonly where one ends a second, arranged *en échelon*, begins. The quartz contains only small quantities of metallic minerals, mainly pyrite, but in some places gold is present in visible quantities.

A 3-compartment vertical shaft has been sunk, and crosscuts have been carried north and south on the 1st level to intersect the gold-bearing lenses. Gold in visible quantities was found in two of the zones intersected. In the south zone, which is of the second type listed above, the mineralization has proved to be very irregular. The lens in the iron formation indicated by preliminary exploration has been found to be low-grade. Even should none of

these occurrences prove to have any lenses of ore-grade in them, there is still a large area of ground not as yet thoroughly examined. Much of it is heavily drift-covered.

Bankfield Gold Mines

The Bankfield Gold Mines, Limited, holds a group of 22 claims surrounding the south end of Magnet lake (see photograph on page 7). The original discovery was made on a reef of rock in the southern part of the lake by T. A. Johnson in October, 1931. Some drilling was done on the ice during the following winter, but information concerning this zone is still incomplete. In May, 1932, zone No. 2, a quarter of a mile south of the lake on claim T.B.10,201,



Photomicrograph of sheared greywacké, south ore zone, Bankfield mine.
(Crossed nicols, ×100.)

was discovered by Johnson, and most of the work done since that time has been concentrated there.

The rocks on these claims are sediments intruded by diorite and dikes of feldspar porphyry (see Fig. 8). The sediments are mainly uniform greywackés made up of rounded fragments of quartz and angular ones of plagioclase with some chlorite and sericite (see photomicrograph above). One narrow lens of conglomerate occurs in the series. The diorite is a fine-grained greenish rock made up chiefly of plagioclase feldspar, which is andesine in composition, and chlorite. It occurs in irregular masses, the maximum diameter of any one of which is about 200 feet. The character of this rock has been discussed previously. One small dike of diabase has been found.

Four zones of mineralization have been discovered, the most northerly being that on the reef in the lake, where greywacké has undergone shearing, which strikes somewhat south of east. Quartz veins, in which visible gold has been found, fill the shear planes. Carbonate occurs fairly abundantly in the wall rocks. The zone seems to be narrow.

In a polished specimen of ore from this zone, arsenopyrite, pyrite, chalcopyrite, pyrrhotite, and gold have been recognized. Arsenopyrite and pyrite are disseminated through the greywacké in well-formed crystals, some of which have skeletal outlines. Where these two minerals occur together, the arsenopyrite appears to be older, as unfractured pyrite crystals enclose arsenopyrite crystals, which show cracks. Chalcopyrite fills fractures in pyrite and occurs also as disseminated grains among the silicates. Pyrrhotite is present as tiny inclusions in pyrite. The gold observed is included in arsenopyrite; in hand specimens it can be seen in fractures in quartz.

The ore in Nos. 2 and 4 zones occurs either in sheared greywacké or sheared porphyry. There seems little difference in the type of mineralization in the

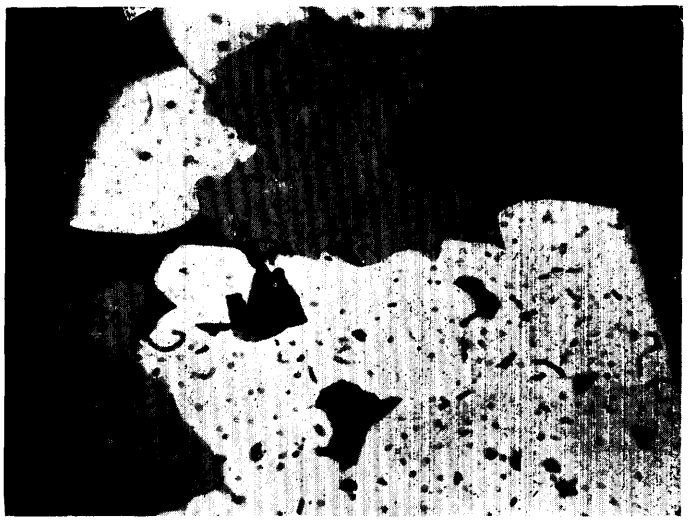


Photomicrograph of ore from drill core at 119 feet in hole No. 27, No. 2 ore zone, Bankfield mine, showing arsenopyrite and pyrite impregnating fractured rock. Note the skeletal nature of the diamond-shaped crystals of arsenopyrite. The other white crystals are pyrite. (× 40.)

two rocks. Diorite also occurs near the ore zones but does not seem to have been much affected either by the shearing or the ore solutions.

The following details of the material occurring in some of the trenches along zone No. 2 will indicate the general character of the deposit. In trench No. 1 the ore zone is mainly in greywacké, which has undergone rather severe shearing. In the steeply dipping shear planes there are quartz veins, generally less than a quarter of an inch wide, and similar veinlets fill fractures oblique to the vertical ones. Pyrite and a little chalcopyrite can be recognized in the hand specimen. They occur in the quartz but are more abundant in the wall rock. In trench No. 2 the shear zone is partly in sediments, partly in porphyry. There are fewer quartz veinlets. Pyrite occurs as disseminated grains in both porphyry and greywacké. In trench No. 4 sediments are in contact with porphyry, which breaks into small blocks owing to the two sets of joint planes, which strike northwest-southeast and northeast-southwest. In a quartz vein 2 inches wide in strongly sheared sediments at the north end of this trench, gold was found in visible quantities.

In pit No. 2, zone No. 4, the rock is mainly sheared porphyry sparsely impregnated with pyrite and a little chalcopyrite. There are a few narrow stringers of quartz. A thin section of the ore shows a rock, the typical fragmental character of which is somewhat masked by mosaics of introduced quartz. Pyrite occurs abundantly in small, well-formed crystals. Calcite is present in sufficient quantity to cause the rock to effervesce freely with cold hydrochloric acid. A little chlorite surrounds the pyrite grains, possibly the result of the effects of the same solutions that brought in the pyrite. Several polished specimens of ore from drill-cores were examined. A specimen of slaty sediments from 119 feet in hole No. 27, from which an assay of 0.145 ounces per ton of gold was obtained, shows, in polished sections, arsenopyrite, pyrite, pyrrhotite,



Photomicrograph of ore from drill core, south ore zone, Bankfield mine, showing ilmenite (grey) replacing pyrite (white), in which there is an apparently isolated grain of chalcopyrite (dark-grey); the rock is black. (× 300.)

and chalcopyrite disseminated through the rock. Arsenopyrite occurs as skeletal crystals (see photomicrograph on page 47), and in places crystals of arsenopyrite show tiny cracks, which terminate against unfractured pyrite surrounding the arsenopyrite. A specimen taken from 145 feet in diamond-drill hole No. 2 contains pyrite, pyrrhotite, chalcopyrite, and a hard grey mineral anisotropic in polarized light but negative to all etching reagents. It may be ilmenite. It surrounds the pyrite crystals and seems to have partially replaced them (see photomicrograph above). In the same specimen a grain of chalcopyrite with smooth boundaries is completely enclosed in pyrite; but in other specimens from the same drill-hole, veinlets of chalcopyrite occur in fractured pyrite (see photomicrograph on page 49).

The sections examined indicate that the ore zone is mainly sheared and fractured greywacké and porphyry impregnated by silica and a small amount of metallic minerals. To a lesser extent there are definite quartz veins in the ore zone. The earliest metallic mineral seems to have been arsenopyrite, which was followed by pyrite. The pyrite may have held some pyrrhotite in solution, which later separated as small inclusions within the pyrite grains. Chalco-

pyrite and ilmenite are younger than arsenopyrite and pyrite, but their relation to each other is not yet determined, as they have not been found in contact.

In addition to the zones that contain considerable amounts of sulphides there are others in which there are no sulphides but a large amount of introduced quartz. None of these is known to contain gold values of any importance.

Weathering has been deep in this locality and may be pre-glacial. In the trenches fresh grey boulder clay is in sharp contact with the deep-red gossan of the weathered surface of the ore zones. Oxidation of the pyritized rock was observed to extend downward for several feet. In trench No. 2 on zone No. 2, unoxidized rock was reached at a depth of 2½ feet. In trench No. 3, at a depth of 10 feet, the rock is not entirely free from oxidation, but toward the bottom the iron stain is only on joint surfaces. In some places the gossan is deep-red,



Photomicrograph of ore from drill core, south ore zone, Bankfield mine, showing chalcopyrite (ch) as veinlets in fractured pyrite (white). (×150.)

in others yellowish. The difference in colour is, no doubt, due rather to the proportion of sulphides in the rock than to the kind of sulphide present, since arsenopyrite has been recognized in this zone only under the microscope and is probably not sufficiently abundant to affect the colour of the oxidation products.

No. 2 zone has been traced by trenching for a length of 300 feet with a possible extension, indicated by a trench exposing a shear zone approximately along the strike of No. 2, for an additional 280 feet to the east. Diamond-drilling has shown that the zone apparently dips steeply to the south (see Fig. 9). To the west, the high ridge of glacial material upon which the mine buildings are located has prevented surface exploration in that direction, but a diamond-drill hole projected in a direction oblique to the strike of the zone intersected it at some distance to the west of the most westerly trenches.

In the trenches the gold-bearing zone was found to have in places a width of as much as 20 feet. Assays show that the average gold content is low across the total width, but in certain parts fairly high assays were obtained. Thus in trench No. 2 on zone No. 2, the average value across 17 feet is 0.113 ounces per ton, but a width of 2 feet near the north end gave an assay of 0.60 ounces per ton. In trench No. 4 on the same zone, the average gold content for a width of

20.6 feet is 0.184 ounces per ton; the maximum assay obtained was 2.15 ounces per ton across a width of one foot in the central part of the ore zone. Results from diamond-drilling corroborate fairly well those obtained by trenching. The maximum true width reported is 16 feet. So far as exploration has gone, the average gold content of zone No. 4 seems to be somewhat lower than that of No. 2.

Whether the high-grade portions mentioned above are in one fairly continuous lens or are in small lenses erratically distributed through the sheared

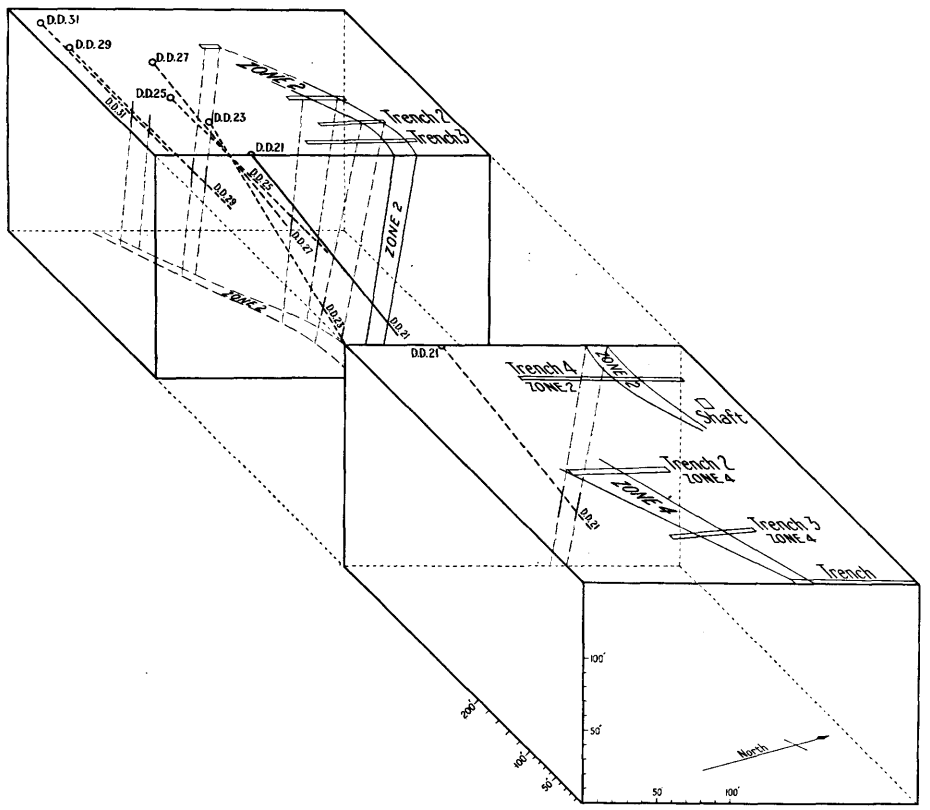


Fig. 9—Block diagram of parts of the Nos. 2 and 4 ore zones, Bankfield mine, showing the location of trenches and diamond-drill holes mentioned in the report.

zone cannot be definitely determined, except by actually tracing them underground. It is likely that the zone in which the ore lenses occur will be found to continue to considerable depths. The problem is rather as to the occurrence of satisfactory values over workable widths in fairly continuous lenses. The alternative to selective mining of the higher-grade lenses is the mining of the whole mineralized zone, for which the grade indicated by drilling and trenching is low. The decision must await the evidence of underground exploration.

A vertical 3-compartment shaft is being sunk just north of zone No. 2, and it is planned to crosscut to the ore zone at two levels. Comfortable mine buildings have been constructed on the ideal site offered by the glacial ridge west of Magnet lake; a road connects the property with the railway at a point 1½ miles west of Bankfield station.

Hard Rock Gold Mines

The claims of the Hard Rock Gold Mines lie east of those of the MacLeod-Cockshutt Gold Mines. Before any discoveries were made at the Little Long Lac mine, gold was found in a shear zone, practically at water level, on a point projecting into the bay south of the West narrows. The group of claims staked around this discovery were under option at one time to the Homestake Mining Company, and a considerable amount of work was done in the way of thorough rock trenching.

The only rocks exposed on the northern claims of the group are the small outcrops along the shore on claims T.B.9,981, 9,984, and 9,985. The largest area of rock to be seen on any part of the property is that on T.B.9,991. At the shaft, on the small island immediately east of it, and along the shore on claims T.B.9,986 and 9,983, the rocks are greywackés, some of which are well bedded. South of the large bay south of the shaft, massive diorite is found. Most of the rock exposed on T.B.9,991 is white to greyish in colour and massive. In the field it was thought to be an arkose, but thin sections show conclusively that it is a porphyry. A large diabase dike cuts the sediments on the prominent point on claim T.B.14,486 and extends across to the tip of the long point on the north shore.

The porphyry on T.B.9,991 in thin section shows abundant phenocrysts of plagioclase and quartz.[1] Along the south side of the porphyry are thinly bedded sediments, but no actual contact was seen and the intrusive character of the porphyry can be inferred only from its lithological character and its similarity to the porphyry dikes on the Bankfield property.

A shear zone in greywacké near the shaft is now being explored; it extends eastward beneath the lake and has been traced by diamond-drilling for some distance. It is somewhat similar in type to that of the Bankfield. Pyrite occurs disseminated through the fractured rock, and there are narrow quartz veinlets, some of which contain visible gold. The porphyry mass mentioned above has been fractured, and contains numerous quartz veinlets. Some pyrite is present. The trenching done by the Homestake Mining Company is said to have shown rather uniform values of about 50 cents per ton for the whole body. The diamond-drilling done during the present development located the continuation of the porphyry westward beneath the marsh bordering the lake and beneath the bay. It outcrops farther east only as small dikes.

A shaft is now being sunk for the purpose of exploring by diamond-drilling the zone of quartz-pyrite-gold mineralization indicated beneath the lake.

Mosher Long Lac Gold Mines

The claims of the Mosher Long Lac Gold Mines lie immediately south of those of the Little Long Lac Gold Mines. In this part of the area consolidated rocks are more extensively exposed than in most other parts, and stripping and trenching have added to the natural exposures. The rocks are sediments intruded by diorite.

During 1933 most of the work was concentrated on claims on the north side of Mosher lake, where a quartz vein 3 feet in width was uncovered. The gold values in this were disappointing, and during 1934 attention was turned to the claims south of Mosher lake. On claim T.B.10,046 a shear zone was discovered in what was thought to be an impure quartzite or arkose but is probably a

[1] A detailed description of this rock is given on page 23.

porphyry similar to that on the Hard Rock claims to the east. The zone is 7 to 8 feet in width and has been traced 1,700 feet. The sheared rock is impregnated with quartz containing pyrite and arsenopyrite. Another sheared zone in iron formation lies parallel to this 125 feet to the north. The sheared material contains abundant pyrite, and samples show that there is a variable gold content. Drilling on these zones has not given encouraging results.

Oro Plata Group

The Oro Plata Mining Company is the holding company for several subsidiaries in the Little Long Lac area. These include the Langmuir Long Lac Gold Mines, Longlac Lagoon Gold Mines, Lake Maron Gold Mines, Jellicoe Gold Mining Company, and Magnet Lake Gold Mines. The claims of all these groups, except the Langmuir Long Lac, lie in sedimentary rocks.

The Longlac Lagoon Gold Mines hold a large block of claims southwest of the Little Long Lac mine and west of the Mosher mine. The rocks are mainly sediments, but interbedded with the greywackés there are some bands of chloritic schist, which may be sheared diorite. Lenses of conglomerate are traceable for considerable distances, and heavy beds of iron formation occur in the northern part.

Diamond-drilling was carried on throughout the summer in an attempt to trace the continuation on to this property of the mineralized zones found to the east. Some gold values were encountered in a broad zone beneath the marshy southwest extension of the lake, but exploration has so far failed to determine the presence of a continuous ore shoot. Exploration is still proceeding in this section of the property. A great deal of surface exploration has also been done, and at one place a fractured porphyry dike was uncovered. A quartz vein 3 inches in width in one of the fractures contains gold in visible quantities.

The Lake Maron claims lie south of the Longlac Lagoon group. They have been under exploration by trenching, but no important discoveries have yet been reported.

The Magnet Lake Gold Mines hold a group of claims lying south of Magnet creek and east of Magnet lake. The rocks are mainly sediments intruded by irregular masses of diorite and small dikes of rather basic feldspar porphyry. Exploration work during the summer consisted of trenching.

The Jellicoe Gold Mining Company holds a large group of claims lying west of Magnet lake and extending westward to Wild Goose lake. The extensive stripping done, especially on those claims lying immediately west of Magnet lake, has indicated the occurrence of a mass of very acidic intrusive, in which traces of gold have been found. Some diamond-drilling has been done along the margins of this mass where it is in contact with sediments.

Longacre Long Lac Gold Mines

The Longacre Long Lac claims lie south of Magnet creek and west of the Longlac Lagoon property. The rocks are sediments of the Timiskaming series intruded by irregular masses of diorite. Work was done on some of these claims prior to the organization of the present company. That work together with recent trenching and diamond-drilling has indicated the presence of three gold-bearing zones. The southern zone is exposed in one place on claim T.B.10,769 and has been traced by drilling for a length of 560 feet. The rock is chlorite schist. In another drill-hole, 35 feet south of this, chlorite schist is found associated with iron formation. The mineralized zone contains a good pro-

portion of pyrite, which occurs in cubes with average diameters of one-sixteenth of an inch. Quartz veinlets cut through the schist and the pyrite cubes. Plans furnished by the company indicate that the width of the zone averages about 18 feet; assay values are comparatively low. The chief gold values are associated with pyrite; visible gold has been reported, occurring in fine particles along with pyrite at the edge of a quartz veinlet.

To the north of this zone, another zone of rusty rock has a width of 10 feet, in which there are veinlets of quartz up to 2 inches in width. Carbonate and a little pyrite occur commonly along the margins of the veins.

Along the general strike of the zone, 500 feet east of this exposure, is a pit in which sheared sediments contain quartz lenses with pyrite and arsenopyrite sparingly present. A third zone, which is traceable for 500 feet, occurs in brown-weathering, equigranular basic rock occurring as a dike 15 feet in width intruding sediments. In places it contains abundant carbonates. In a pit on this zone there is a width of 5 feet of slightly rusty rock, in which there are three veins of quartz. The central one is 8 to 10 inches wide; the southern one, 3 inches wide; and the northern one, 2 inches wide. The outer veins are separated from the central vein by one to two feet of rusty carbonate rock intersected by quartz veinlets. A little pyrite is present, mainly in the wall rock. Ankerite forms a selvage one-quarter of an inch thick along the quartz veins.

Wells Longlac Mines

The claims of the Wells Longlac Mines lie east of Magnet lake and adjoin those of the Bankfield Gold Mines. The strike of the north zone of mineralization of the Bankfield, exposed on the reef in Magnet lake, should carry it, if it is sufficiently continuous, on to the Wells Longlac property. Diamond-drilling is now proceeding to test that possibility.

Kenogamisis Exploration Syndicate

The Kenogamisis Exploration Syndicate has had under development a group of claims lying immediately east of the southern claims of the Hard Rock Gold Mines. Most of the rock is thinly bedded greywacké, and there are recognizable intrusive bodies of diorite. Certain chlorite schists, interlayered with sediments, may be sills of diorite, which have been severely deformed. A sheared zone in one of these has a maximum width of 16 feet and contains quartz veins, abundant arsenopyrite, and a little pyrite, both in the wall rocks and in the quartz. The mineralized zone is heavily iron-stained, the gossan being in such sharp contact with glacial material that it seems possible that some of the weathering may have been pre-glacial. The sheared zone has been traced for several hundred feet, but the values so far discovered are low. One hundred feet south a lens of fine-grained white quartz contains visible gold. It has a width of 3 feet, but has not been traced far.

Other Properties

Several other companies have been doing development work on claims in the sediments. Assessment work has been done on a group known as the Johnson claims, which lie directly across the bay from the Little Long Lac mine. East of Eldee lake, the Killoran Long Lac, the Dunlop Consolidated, and the Central Long Lac companies have been working on their claims, but on most of these the work was begun late in the season, and no reports of any important discoveries have been forthcoming. In the western part of the map area the Oro

Plata Mining Company did some diamond-drilling on claims south of Wild Goose lake, and assessment work was being done by other companies in that area during the latter part of the season. Diamond-drilling done during the winter on the Johnson claims immediately west of the Bankfield is reported to have indicated an ore zone of some importance.

Properties in Keewatin Rocks

Roche Long Lac Gold Mines

The claims of the Roche Long Lac Gold Mines, Limited, lie east of the north end of Eldee lake. The rocks exposed on the property are greenstone intruded by diorite and dikes of feldspar porphyry. The main vein occurs in a sheared zone in diorite. It strikes N.70°E. At the point where the shaft is being sunk the zone is 10 feet in width. In the centre of it there is a quartz vein 18 inches wide with a parallel vein 3 feet to the north, which has a width of 2½ inches. The rock between the two veins shows some shearing. At a depth of 15 feet in the shaft the vein develops a ribboned structure in contrast to the massive character that it has at the surface. The quartz contains some pyrite and a little galena. A pit 10 feet deep, 175 feet east of the shaft along this zone, shows a large proportion of quartz occurring as intersecting veinlets up to 2½ inches in width. Abundant pyrite in small cubes occurs in the quartz and in the schistose rock. Samples from this vein give some values by assay, but the average gold content reported is not high. The vein has been traced for 500 feet west of the shaft.

Another vein 100 south of the main vein ranges in width from a fraction of an inch to 3 inches with parallel stringers in the wall rock in some places. Along its south side there is a porphyry dike, and in some of the trenches porphyry dikes 10 to 15 feet in width are exposed. These cut the diorite and are themselves cut by the vein. The quartz is fine-grained and contains pyrite and galena. Gold is reported from assays of samples. This vein has been traced for 300 feet.

Lac Development Company

The Lac Development Company holds claims lying between Little Long Lac and Eldee lake and extending beneath the water of the part of Little Long Lac that is south of the Main narrows. The rocks of the northern claims are greenstone. Conglomerate lies south of this, and greywacké with many bands of iron formation is exposed on the point on the east side of Eldee lake. On the claims between Little Long Lac and the creek out of Eldee lake, masses of diorite intrude the greenstone and conglomerate, and a narrow porphyry dike is exposed in the stripping and trenching on claim T.B.10,971.

Twenty feet north of the north line of this claim a quartz vein has been stripped for a length of 100 feet. Its strike should carry it across the claim line on to the claims of the Lac Development Company a short distance west of the exposure. It should also cross the boundary line at a shallow depth as it dips 70° to 80°S. Seventy feet south of the north line of T.B.10,971 an east-west vein 6 inches in width has been exposed by stripping the shallow overburden for a length of 170 feet. Farther south, near the edge of the outcrop of greenstone, is a sheared zone containing pyrite.

The vein lying north of the claim line has a width of about a foot of quartz with little alteration along the walls. The following is a report of the examination of a polished specimen of vein material made by J. Ellis Thomson:—

The chief metallic minerals in this section are pyrrhotite and chalcopyrite, but it contains also considerable pyrite. These metallic minerals are associated with a quartz gangue. The chalcopyrite and the pyrrhotite occur as fillings of small veins cutting across the gangue material. Pyrite occurs as ragged remnants of crystals or aggregations of crystals scattered through the larger areas of pyrrhotite and chalcopyrite or as small crystals scattered sparsely through the gangue. The order of deposition appears to have been: (1) earlier pyrite, (2) quartz, (3) pyrrhotite and chalcopyrite, (4) later pyrite.

The 6-inch vein 70 feet south of the north line of the claim strikes N. 72° E. The dip is rather variable. Metallic minerals in the quartz are pyrite, chalcopyrite, arsenopyrite, and gold. The gold was seen in several places and occurs in rather coarse grains. Specimens from an irregular quartz vein occurring in the porphyry dike were examined by Professor Thomson, who reported as follows on thin sections and polished sections of the vein material:—

The thin section consists mainly of quartz but contains also considerable tourmaline and carbonates as well as minor quantities of apatite. The chief metallic minerals in the section are pyrite and pyrrhotite, but it contains also minor quantities of chalcopyrite and magnetite. Pyrite occurs as granular aggregates or isolated crystals in cracks in the quartz gangue. Pyrrhotite and chalcopyrite in vein-like forms occur along with carbonate in later fissures in the first gangue material. The order of mineral deposition appears to be: (1) quartz; (2) pyrite, magnetite, and quartz; (3) carbonate and pyrrhotite; (4) chalcopyrite.

The report on the wall rock and vein material in the sheared zone near the south edge of the greenstone outcrop is as follows:—

The thin section shows a fine-grained rock consisting chiefly of plagioclase badly altered to white mica and of chlorite but containing also considerable secondary carbonate as well as minor quantities of biotite, epidote, pyrrhotite, chalcopyrite, and magnetite. This is an altered igneous rock of intermediate to basic composition, probably originally an andesite.

The examination of the polished section shows that the chief metallic mineral is pyrrhotite, but the section contains also fair quantities of magnetite as well as minor amounts of chalcopyrite. These metallic minerals are associated with a mixed carbonate and quartz gangue, the former predominating. Pyrrhotite and chalcopyrite occur as small blebs or in short vein-like forms. Magnetite occurs as ragged remnants of small granular aggregates partly replaced by the gangue material. The order of deposition appears to have been: (1) magnetite, (2) quartz, (3) carbonate, (4) pyrrhotite and chalcopyrite.

Trenching and stripping on the claims east of Eldee lake have shown a band of iron formation in which there is a lens of rather massive pyrite. From its appearance it seems unlikely that it contains more than a small amount of gold.

During the winter of 1934–35 the Lac Development Company was carrying on diamond-drilling beneath Little Long Lac, in an attempt to locate an extension of the shear zone located to the west on the claims of the Hard Rock Gold Mines.

Langmuir Long Lac Gold Mines

The Langmuir Long Lac Gold Mines hold groups of claims at the east end of the area. Most of the work has been concentrated on claims lying southeast of the main part of the lake. On claim T.B.12,687, which is three-quarters of a mile east of Crabtree lake, stripping has exposed a narrow quartz vein, lying in a schistose zone in a fine-grained rock, which is possibly an andesite or dacite. It strikes northeast and dips 60°S.E., and ranges in width from a fraction of an inch to 14 inches. The quartz contains some tourmaline along the vein margins and a small proportion of metallic minerals scattered through it. Chalcopyrite, pyrite, a little native copper, and some gold have been recognized. The occurrence of native copper is unusual; it forms tiny fernlike forms in the quartz. Gold values are reported from the schist as well as from the quartz. The vein has been stripped for a distance of over 400 feet.

Lafayette Long Lac Gold Mines

The claims of the Lafayette Long Lac Gold Mines lie west of the road from Geraldton to Little Long Lac. The rocks exposed on the claims are volcanics, mainly lavas, with some tuffaceous beds. Diorite intrudes the volcanics. Work has been concentrated on two parts of this group of claims. On claim T.B. 11,321 there is an east-west shear zone in diorite. The zone is 8 feet in width, shows some silicification, and contains a considerable amount of fine-grained pyrite with a little chalcopyrite. Quartz veins up to an inch in width cut through the shear zone; and in one of these, which is an eighth of an inch in thickness and cuts transversely through the shear zone, gold occurs in visible quantities in several places. To the west of this occurrence, massive diorite contains irregular quartz lenses, which are cut transversely by veins containing calcite and ankerite. The quartz veins have widths up to 18 inches; the carbonate-bearing veins are less than half an inch wide. On T.B.10,943 a rather continuous east-west shear zone, 3 to 4 feet in width, contains lenticular quartz veins up to a foot in width. There is considerable pyrite. The wall rocks are lavas showing fragmental flow tops. The zone has been traced for 700 feet. Parallel to it is another about 8 feet in width, of which nearly one-half is quartz with some ankerite. The wall rock of this zone contains abundant crystals of arsenopyrite. Low values in gold are obtained by assay.

Other Properties

A few other groups of claims lying in the area of greenstones have had some work done on them or are being explored at present. A group of claims lying southwest of Hardrock and extending west and south to Barton bay have been under examination by the Hollinger Consolidated Gold Mines. To the west of them and east of the Geraldton road is the Bur-Ley Long Lac group of claims. Immediately south of the railway west of Hardrock station are the claims of the Vanguard Long Lac Mining Company. As can be seen from the map, rock outcrops are small and few in number in that part of the area. Hence exploration is slow and difficult.

INDEX, PART III

A

PAGE

Access to area 2, 3
Acidic intrusives.
  Analyses; petrography 21, 22
  Quartz veins in 30, 52
Acknowledgments 1
Agglomerate 10, 32
Agriculture 9
Altitudes 26
Amygdaloidal structure 10
Analyses, acid intrusives 21, 22
Andesite 10, 21, 55
Ankerite 53, 56
Anticlines 18, 27
  Little Long Lac g.m. 34
    in quartz veins, photo 38
Arkose 10
  Favourable for gold deposits 29, 31
  Porphyry mistaken for 51
Arsenopyrite 30, 40, 47, 56
  Photomicrograph showing 47
Ashmore tp. 2
  Ellipsoidal lava 10, 11
  Topography 6
Atigogama lake 4

B

Bain, J. W. 4
Bankfield 3
  Cut in esker, photo 26
Bankfield gold m.
  Gold discovery 5
  Photo 7
  Porphyry, analyses, notes, photomicrographs 21-24
  Property described 46-50
  Road to 3, 50
  Sketch map ..... *facing* 46
Bankfield Gold Mines, Ltd. 46
Barkley, S. J. 2
Barton, Alan A. 1, 38
Barton bay.
  Anticline near 27
  Gold discovery 4
  mining 56
    see also Johnson g. claims; Little Long Lac g. m.
  Rocks 20, 34
Basic lavas 10, 11
Batholith 31
Beardmore 4
Beardmore-Nezah area 19, 20
Beatty, Walter 4
Beatty lake 19
Bell, Robert 3, 4
Bismuthinite 5, 40
Boulder clay 25
Boulder creek 3
Bournonite 40-42
  Photomicrographs 39, 41

PAGE

Building materials 1, 10, 32
Burley Long Lac gold claims 56
Burrows, A. G. 3, 11, 19, 29
Burwash, E. M. 4

C

Calcite, in diorite 21, 56
Canadian National Railways 2
Central Long Lac gold claims 53
Chalcopyrite 31, 47, 55
  Photomicrograph showing 49
Chlorite 16, 21, 31
Chlorite schist 10, 11, 17
  Gold associated with 29, 52
  Origin 15, 16, 52, 53
Claims. *See* T. B. gold claims.
Clay, stratified, absent 26
Climate 9
Cockshutt, A. 1
Coleman, A. P. 3, 4, 19, 32
  Early mention of quartz by 5
Conglomerate 10
  Petrography 12-14
  Structure 16, 17
Connell, W. H. 1
Construction materials 1, 10, 32, 33
Copper, native 55
Coutchiching series 19
Crabtree lake 55
Creelman, E. F. 1

D

Dacite 55
Devilfish bay 2
Diabase 10, 18, 25, 28, 31
Diagrams.
  Mineral deposition, Little Long Lac g. m. 42
  Ore zones, Bankfield g. m. 50
Diorite 10, 12, 15, 16, 18, 46
  Distribution; petrography 20, 21
  Quartz veins in 29, 30, 32, 56
Diorite porphyry 10
Drag folds 16-18, 29
  In iron formation, photo 45
  Little Long Lac g. m. 29, 36, 37
Drainage systems 5, 6
Dunlop Consolidated gold claims 53

E

Economic geology 28-33
Eldee creek 3
Eldee lake 9
  Gold claims near 53, 54
  Rocks near 11, 54
Electric power 10

PAGE
Elevations 6, 26
Ellipsoidal lava 10-12
Erosion, glacial 25, 28
Errington, Joseph 1
Errington tp. 2
Glacial topography 6, 7
Eskers 6, 7, 26
Railway cut through, photo 26
Transverse channels through 7, 28
aerial photo 8
Explorations, early. *See* Historical notes.

F

Faults 16, 27
Little Long Lac g. m. 37-40
Feldspar porphyry 10, 18, 20, 54
Distribution and petrography 21-25
Gold associated with 29, 30, 46, 48
Flynn, John 1
Flynn, Miles 1
Folding 15, 16, 27
See also Drag folds.
Little Long Lac g. m. 34
Fractures. *See* Shear zones.
Fragmental rocks 10, 11
See also Agglomerate; Tuff.
Fur 9

G

Galena 54
Geology, economic 28-33
Geology, general 10-27
Geology, historical 28
Geology, structural 27
See also Faults; Folding.
Geraldton.
Road to from Little Long Lac g. m. ... 3
photo showing ..... *frontis.*
rocks on 11
Glacial deposits 6-9, 25-27, 28
Glacial lakes.
See L. Algonquin; L. Ojibway.
Glaciation 6, 9, 25, 28
Gledhill, T. L. 1
Gold.
Deposits, description of 1, 29-32
age 31
rocks favourable to 33
Discovery 1, 4, 5, 51
Mining properties described 33-56
Values, average 33
Bankfield g. m. 48, 49
Little Long Lac g. m. 37, 43
Gossan 49, 53
Granite 28, 31
See also Granite porphyry.
Granite porphyry 10, 18, 20, 22
Analyses 21, 22
Gravel 1, 32, 33
Glacial origin 6, 25
Greenstone 10-13, 18, 54, 56
Identification difficult 11, 13
Quartz veins in 29, 30
Greywacké 10, 16-18, 20
Gold deposits in 29-31, 45
Petrography 14, 15
Photomicrographs 14, 46

H

PAGE
Hard Rock gold m.
Boat transport to 3
Gold, discovery 4, 51
Property described 51
Rocks 20, 25, 51
porphyry, notes, analyses, photomicrograph 21-23
Hardrock station.
Gold claims near 56
Rocks 11, 12
Transportation from 3
Haycock, Maurice 2
Head, R. E. 40
Hematite 1, 28
Historical geology 28
Historical notes 3-5, 29
Hollinger Consolidated Gold Mines, Ltd. 56
Homestake Mining Co. 4, 51
Hopkins, P. E. 5
Houston, Charles 1
Hudson's Bay Co. 3
Hutchison lake 6
Hydro-electric power 10

I

Ice age.
See Glaciation; Pleistocene.
Ilmenite 48, 49
Photomicrograph 48
Iron formation 10
Discovery 4
Distribution; iron content 32, 34
Gold veins in 29, 30, 45
Origin uncertain 12, 18
Petrography 15
Structure 17, 34
drag fold in, photo 45
Iron ore.
Absent in area 1, 10, 28, 32

J

Jellicoe 19
Gold discovery near 4
Jellicoe Gold Mining Co. 52
Johnson, T. A. 5, 46
Johnson gold claims 53, 54

K

Keemle 33
Keewatin series.
Distribution; lithology 10-12
Gold deposits in 29-32
Intruded by post-Timiskaming rocks 20, 21, 23, 25
Mining properties described 54-56
Relation to sediments 16, 18, 19
Term tentative 10
Kenogamisis lake.
See Little Long Lac.
Kenogamisis Exploration Syndicate 20, 25, 53
Keweenawan(?) series 10, 25
See also Diabase.
Killoran Long Lac gold claims 53
Knight, C. H. 2

L

PAGE

Lac Development Co. 23, 24, 54, 55
Lacustrine deposits 26, 27
Lafayette Long Lac Gold Mines, Ltd. . 11, 56
Lake Algonquin 26
Lake Maron Gold Mines, Ltd. 52
Lake Nipigon 4, 6, 32
Lake Ojibway 26, 27
Lakes in area, characteristics 9
Lamprophyre 34
Langford, Geo. B. 19
Langmuir 2, 10
Langmuir Long Lac Gold Mines, Ltd. . 52, 55
Lavas. *See* Keewatin series.
Limonite 23
Lindsley, Thayer 1
Lindsley tp. 2
  Conglomerate 13
  Topography 6, 7
Little Long Lac.
  See also Barton bay; Main narrows.
  Access 2, 3
  Diamond-drilling under 51, 55
  Drainage 5
  Glacial origin 26, 27
  Gold, discovery 1, 4, 5
  Mining properties 33-46, 51-54
  Rocks 4, 10, 17, 19
  Sand and gravel 33
  Seasonal changes 9
Little Long Lac gold m.
  Bournonite 31, 40-42
    photomicrographs 39, 41
  Deposits in shear zones 1, 34
  Greywacké, photomicrograph 14
  Ore, photomicrographs 39-42
  Photo ..... *frontis.*
  Property described 33-43
  Rocks, structure 17, 34
    faults 27, 37-40
  Transportation to 3, 43
Long lake 3, 26, 27
Longacre Long Lac gold claims 3, 52, 53
Longlac Lagoon gold claims.
  Drill cores 15, 21
  Rocks 14, 21, 23, 24
  Workings 52
Longlac Lagoon Gold Mines, Ltd. 52
Loofbourow, R. W. 40
Lower Huronian series 19

M

MacAlpine, C. D. H. 1
McKellar, Peter 4
McKenzie, John W. 1
MacLeod-Cockshutt gold m.
  Anticline near 18, 27
  Deposit described; workings 47, 48
  Iron formation 17, 47
    drag fold, photo 45
  Origin of rocks uncertain 21
  Transportation to 3
McNeill, W. K. 21
Magma 31
Magnet creek 3, 9
  Gold claims near 52
  Rocks at and near 11, 13
Magnet lake
  Gold, discovery 5
  Mining properties 46-50, 52, 53

PAGE

Magnet lake—*Continued.*
  Rocks 13
  Topography near 6-8
Magnet Lake Gold Mines, Ltd. 23, 24, 52
Magnetite 1, 28
Main narrows, Little Long Lac 10, 12, 54
Map, index 2
Map, geological, coloured (No. 44d). *in pocket*
Maps, geological, sketch.
  Bankfield g. m. ..... *facing* 46
  MacLeod-Cockshutt g. m. 44
Matheson, A. F. 1
Maynard, J. E. 18
Meen, V. B. 2
Microphotos. *See* Photomicrographs.
Mining claims. *See* T. B. gold claims.
Mining properties described 33-56
Moore, E. S. 18, 19
Mosher lake.
  Conglomerate near 13, 17
  Gold claims 51
Mosher Long Lac gold m.
  Mineralization; workings 51, 52
  Rocks 14, 21
  Transportation to 3

N

Namewaminikan river. *See* Sturgeon river.
Natural resources 9, 10
Nipigon, Lake 4, 6, 32
Nolan, J. P. 1

O

Oklend, Tony 4, 5
Oro Plata Mining Co.
  Drilling by 52, 53
  Subsidiary companies 52
Overburden, heaviness of 1, 16, 33

P

Parks, W. A. 4
Peat 10, 27
Photomicrographs.
  Drill-cores, Bankfield g. m. 47-49
  Greywacké 14, 46
  Ore, Little Long Lac g. m. 39, 41, 42
  Porphyry 23, 24
  Vein quartz, Little Long Lac g. m. .. 39
Physiography 5-9, 25
Pillow lava 10-12
Pleistocene 10, 25-27
  See also Glacial deposits.
Porphyry.
  See also Feldspar, Granite, Quartz porphyry.
  Analyses 21
  Petrography 21-23
  Photomicrograph 23
Post-Timiskaming intrusives 10, 20-25
Pot-hole lakes 9
Pre-glacial weathering 25, 49
Prospecting, conditions and outlook .. 33
Pyrite 31, 40, 47, 53
  Associated with chlorite 31
  Photomicrographs showing 47-49
Pyrrhotite 31, 47, 55

Q PAGE

Quartz, auriferous, veins.
Forms of; continuity 30-32
Little Long Lac g. m. 34-43
Mode of occurrence; origin 29-32
Rocks favourable to 33
Quartz diabase 10, 25
See also Diabase.
Quartz porphyry 10, 20
Distribution and petrography 23-25
Gold associated with 30, 32
Quartzite 10
Quaternary. *See* Pleistocene; Recent deposits.

R

Raynor, George 1
Rea, John 1
Rea, T. H. 1
Recent deposits 27
Reid, John 1
Rivers in area, characteristics 9
Roads 3, 43, 50
Material for 1, 33
Roche Long Lac Gold Mines, Ltd.
Property described 54
Rocks 11, 23
Transportation to 3

S

Samuel, W. 2
Sand 1, 32, 33
Glacial origin 6, 25
Schists 19, 21
See also Chlorite schist.
Sections.
Little Long Lac g. m., veins 35, 37
width; values 43
Sedimentary rocks.
See also Timiskaming series.
Keewatin slate 10-12
Shear zones 1, 5, 29, 33
Sketches. *See* Diagrams; Maps, sketch.
Slate 10-12
Slate isld., L. Nipigon 4
Smith, W. 1, 4
Soil 9
Spruce 9
Stevenson, John 1
Stewart, Cyril 1
Stibnite 31, 40
Striae 25
Structural geology 27
See also Faults; Folding.
Sturgeon river 4, 17
Sudbury Diamond Drill Co. 5
Sulphides.
See Arsenopyrite; Chalcopyrite; Galena; Pyrite; Pyrrhotite.
Sutcliffe, H. 2
Swamps 6, 9
Synclines 12, 16, 27
Gold deposits in 29

T PAGE

Tanton, T. L. 3, 19
Early mention of gold by 3, 29
T.B.9,981, 9,983-86 g. claims 51
T.B.9,991 g. claim 21-23, 51
T.B.10,022 g. claim 12
T.B.10,045 g. claim 14
T.B.10,046 g. claim 51
T.B.10,054 g. claim 18
T.B.10,162 g. claim 13
T B.10,201 g. claim 46
T.B.10,482 g. claim 7
T.B.10,513 g. claim 10-12
T.B.10,560 g. claim 5, 33
T.B.10,607 g. claim 7
T.B.10,609 g. claim 17
T.B.10,738 g. claim 31
T.B.10,769 g. claim 52
T.B.10 943 g. claim 56
T.B.10,944 g. claim 12
T.B.10,950 g. claim 16
T.B.10,971 g. claim 54
T.B.10 998 g. claim 21-23, 25
T.B.11,321 g. claim 56
T.B.12,687 g. claim 55
Terraces 27
Thomson, J. Ellis 54
Till. *See* Boulder clay.
Timber 10
Timiskaming series 10
Distribution; lithology 12-16
Gold deposits in 29, 30
mining properties described 33-54
Origin; age relations 18-20
Structure 16-18
Term tentative 10, 19
Topography 5-9, 25
Tourmaline 55
Transportation 3
Tuff 10, 12, 16, 32
Tyson, A. E. 1
Tyson gold claim, rocks 13

V

Vanguard Long Lac Mining Co. 56
Veins. *See* Quartz, auriferous, veins.
Volcanics. *See* Keewatin.

W

Warneford 19, 20
Water power. *See* Hydro-electric power.
Water transportation 3
Wells, Robert 5
Wells Longlac Mines, Ltd. 53
West narrows 51
Wild Goose lake.
Access 2, 3
Drainage 5
Gold claims on 52, 54
Topography near 6, 7
aerial photo 8
Windegokan series 19, 20
Windigokan lake 19, 20
Wintering river 17

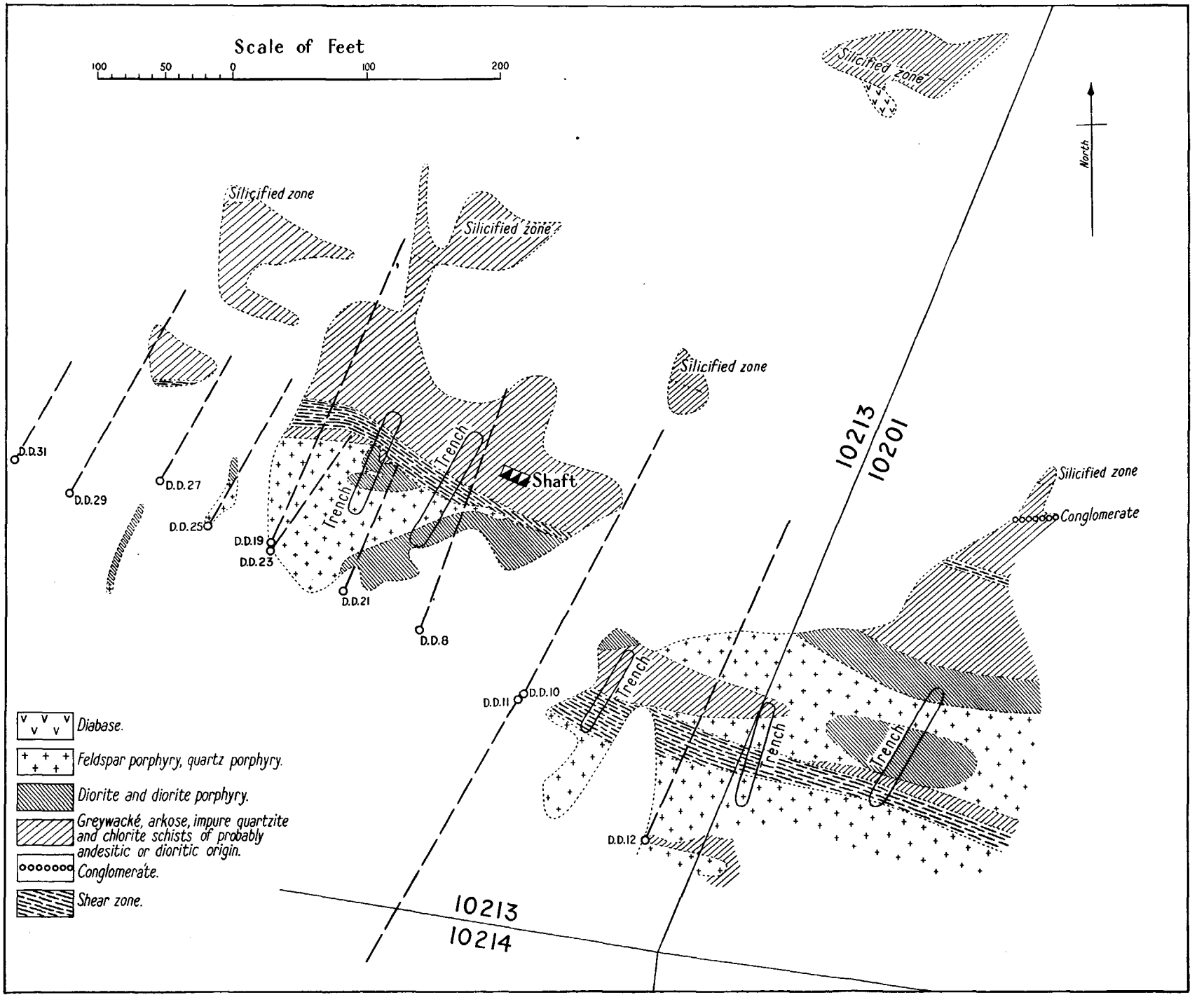
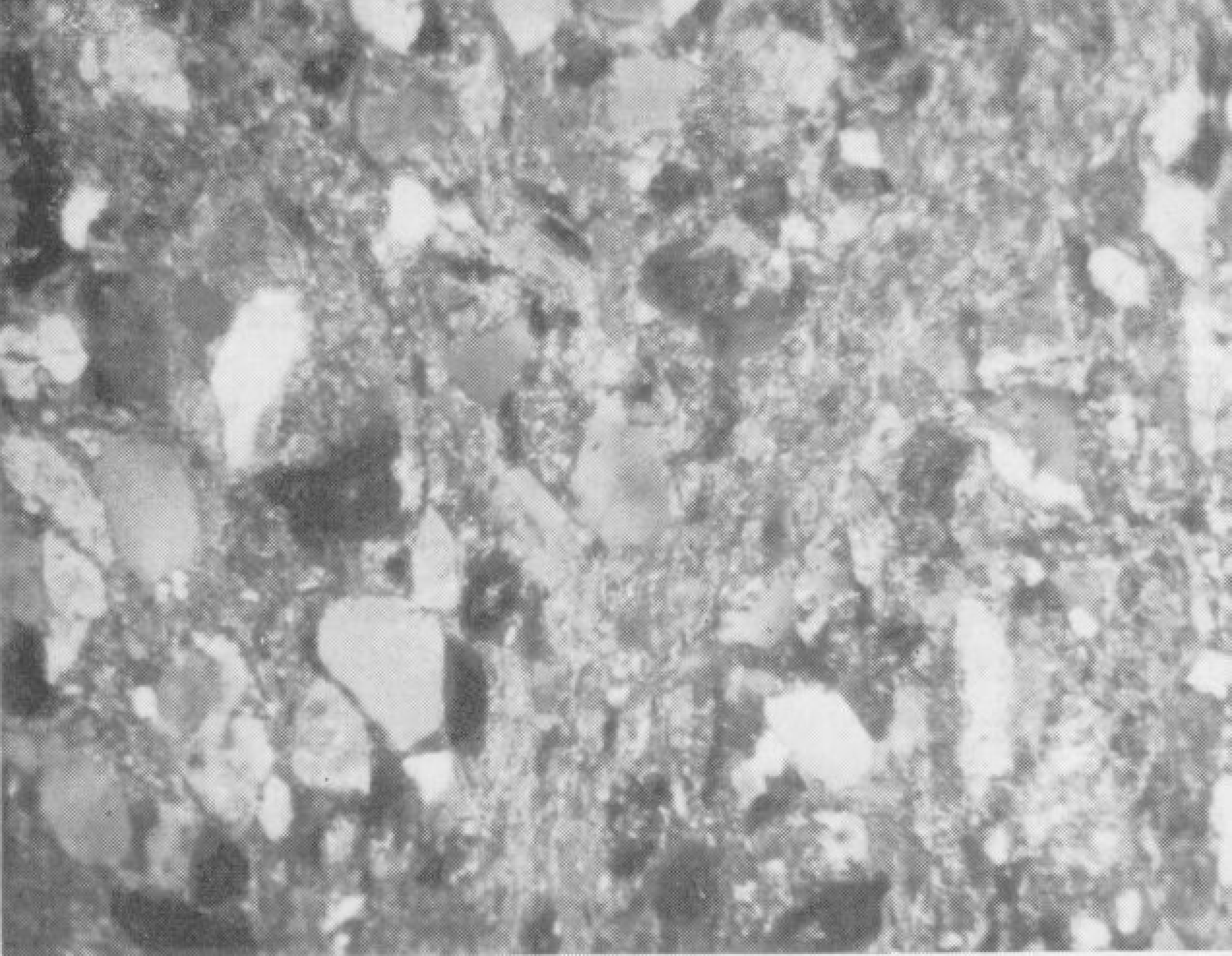
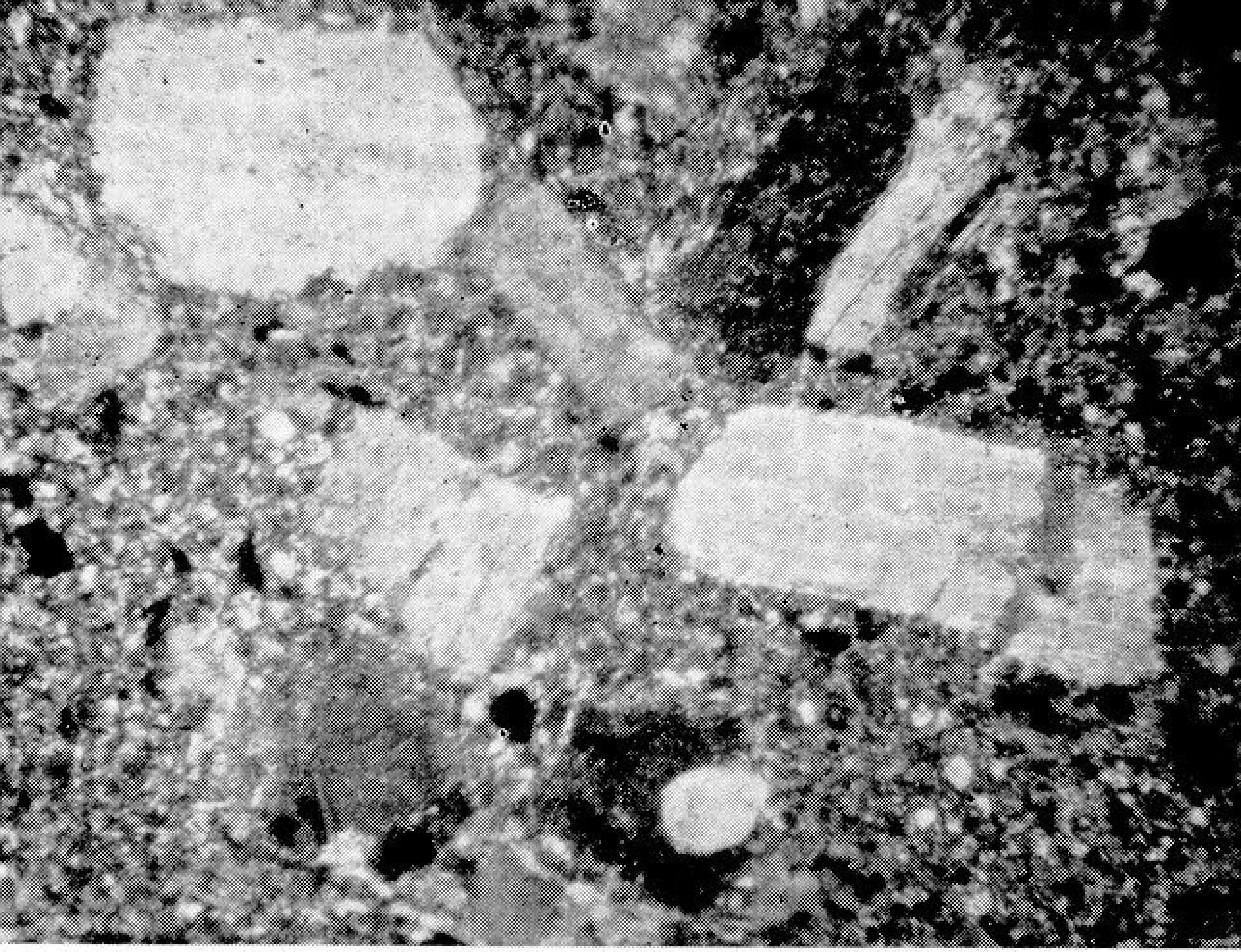
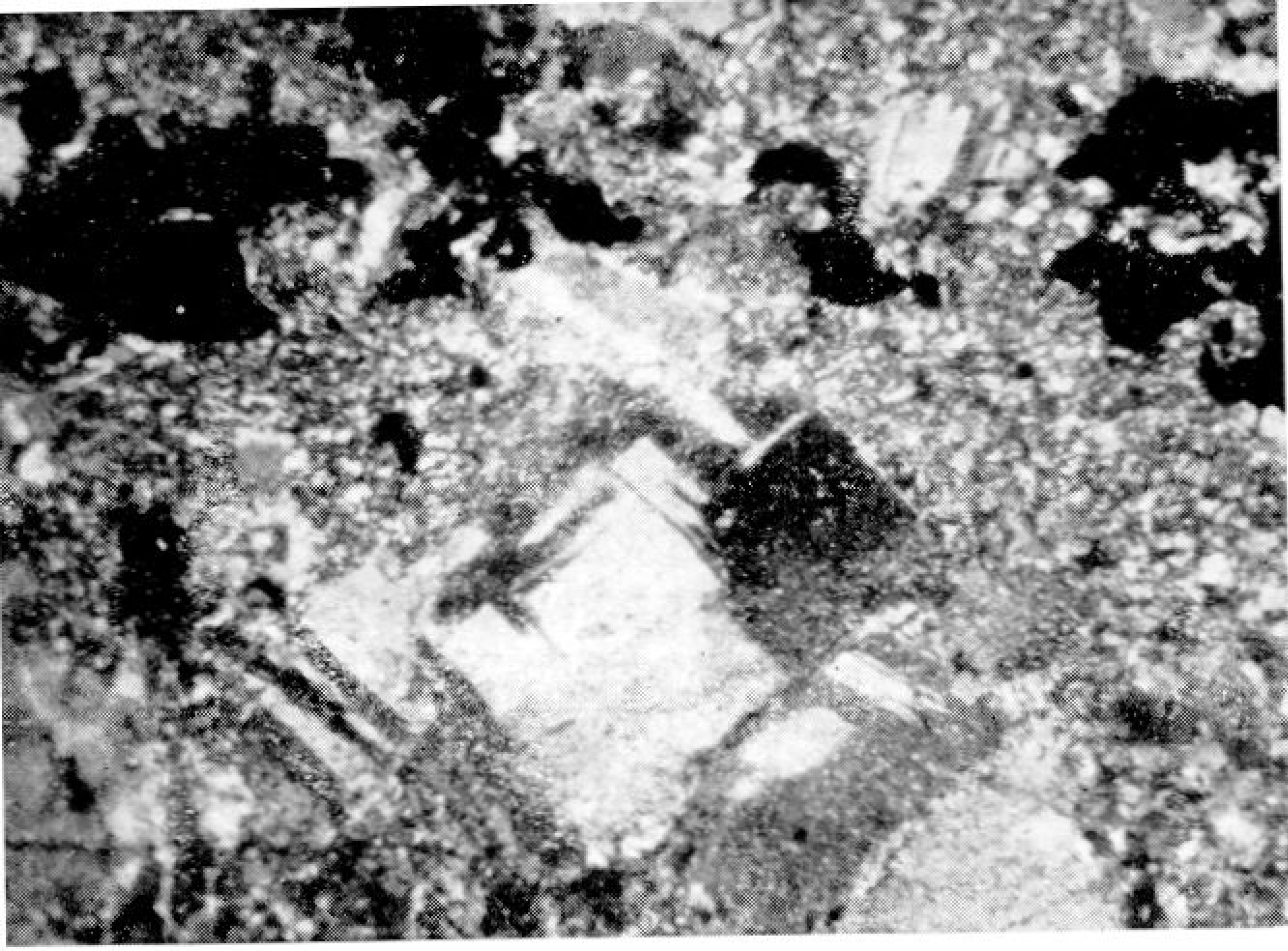


FIG. 8—GEOLOGICAL SKETCH MAP OF THE PROPERTY OF BANKFIELD GOLD MINES.







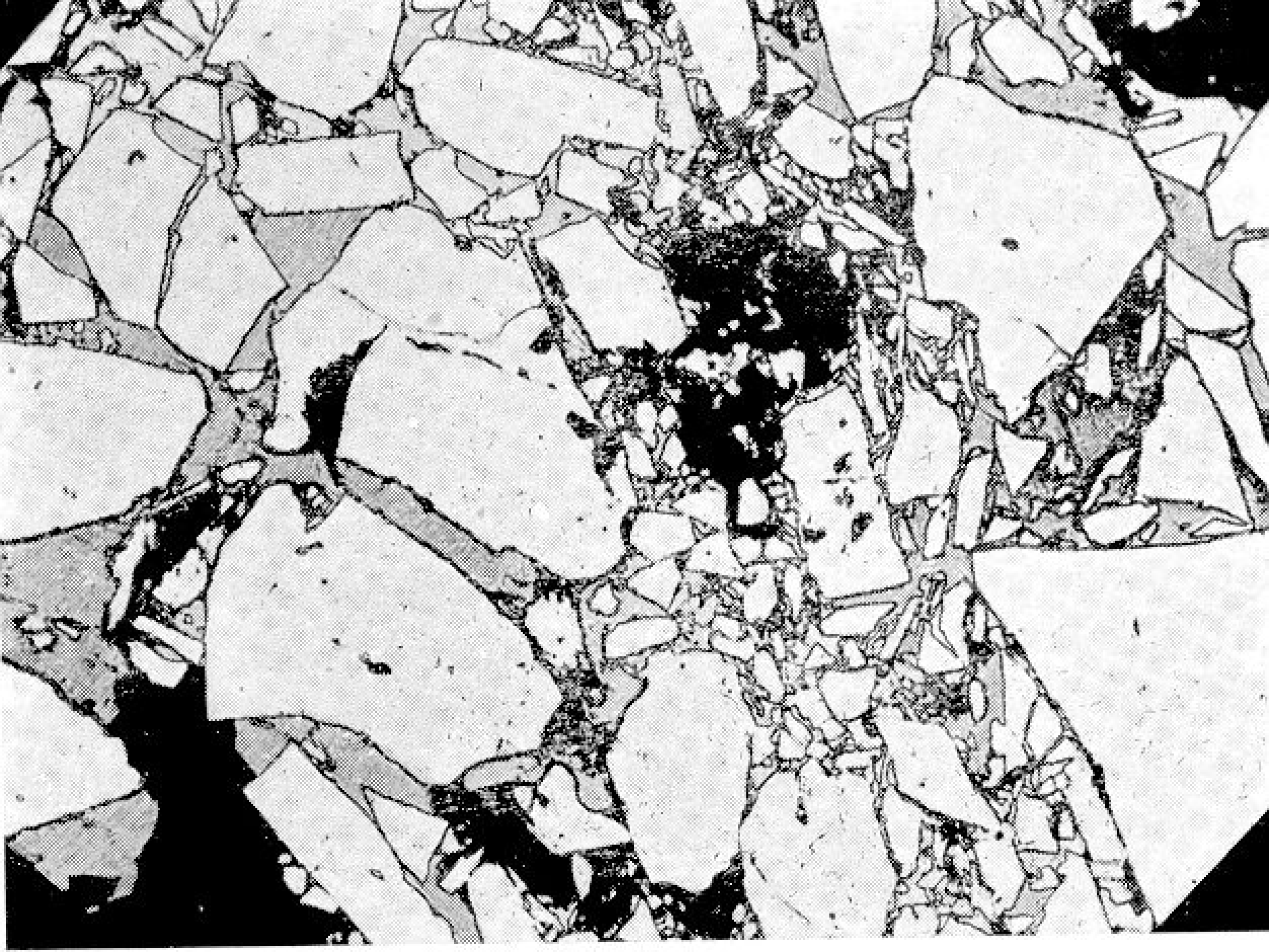


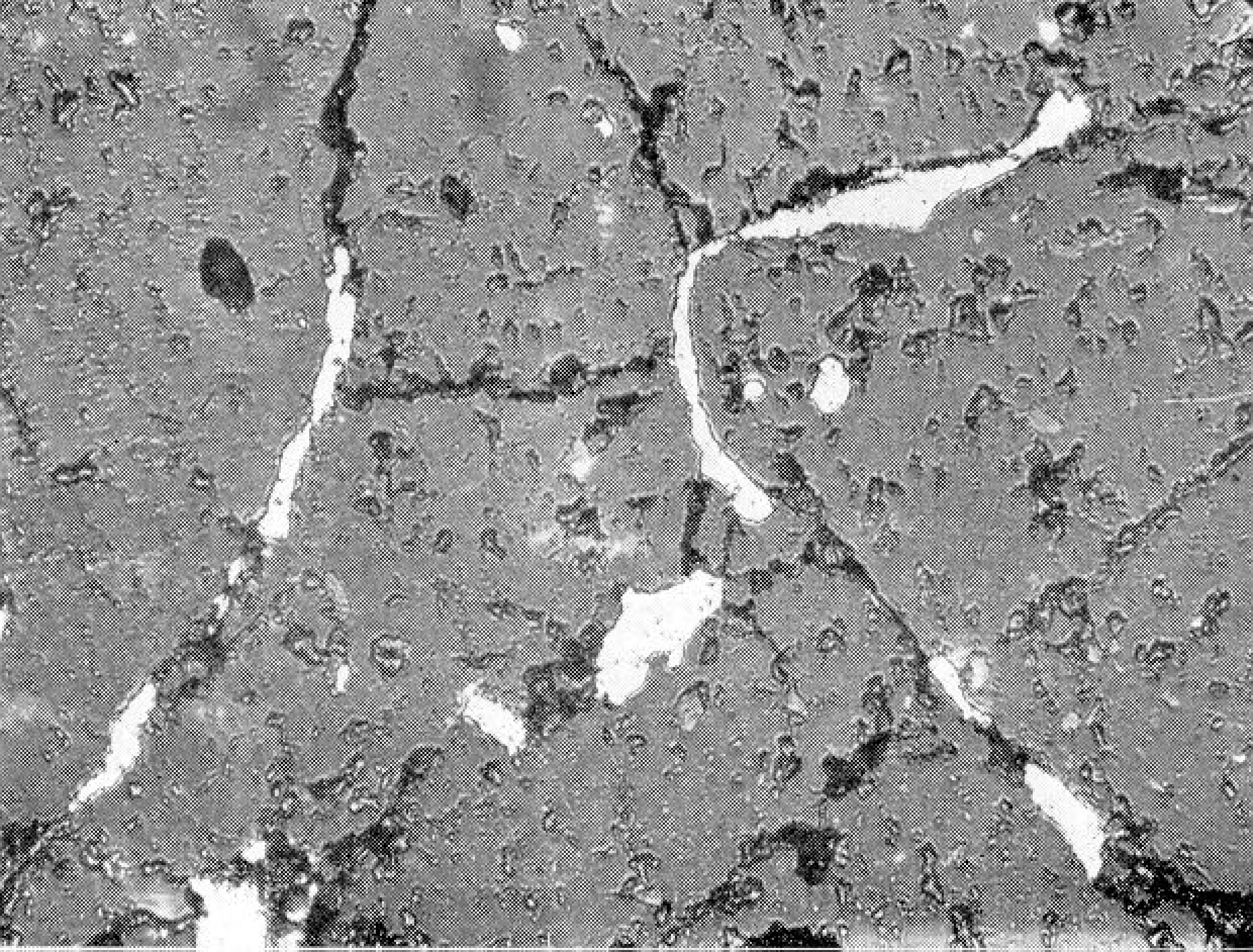


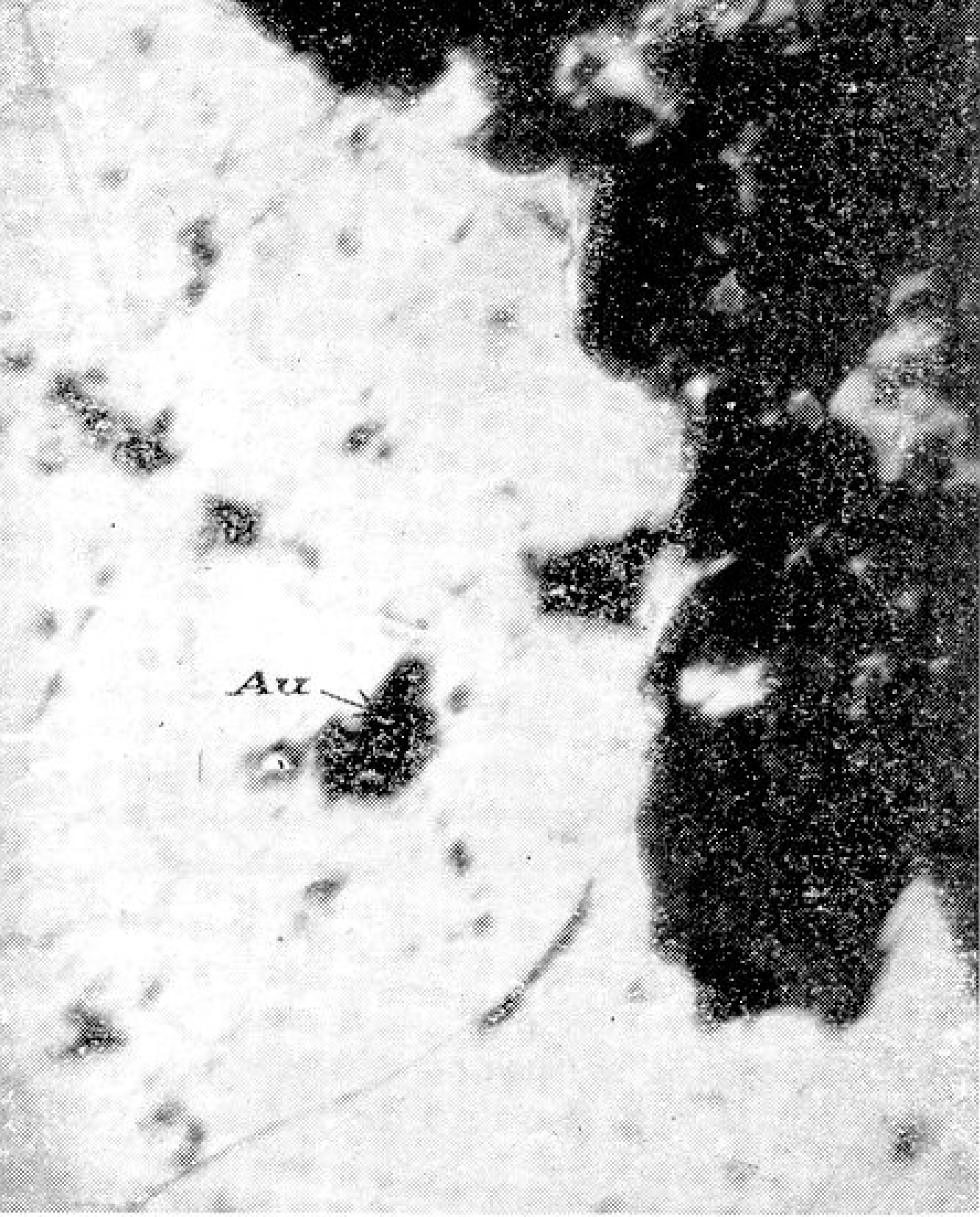


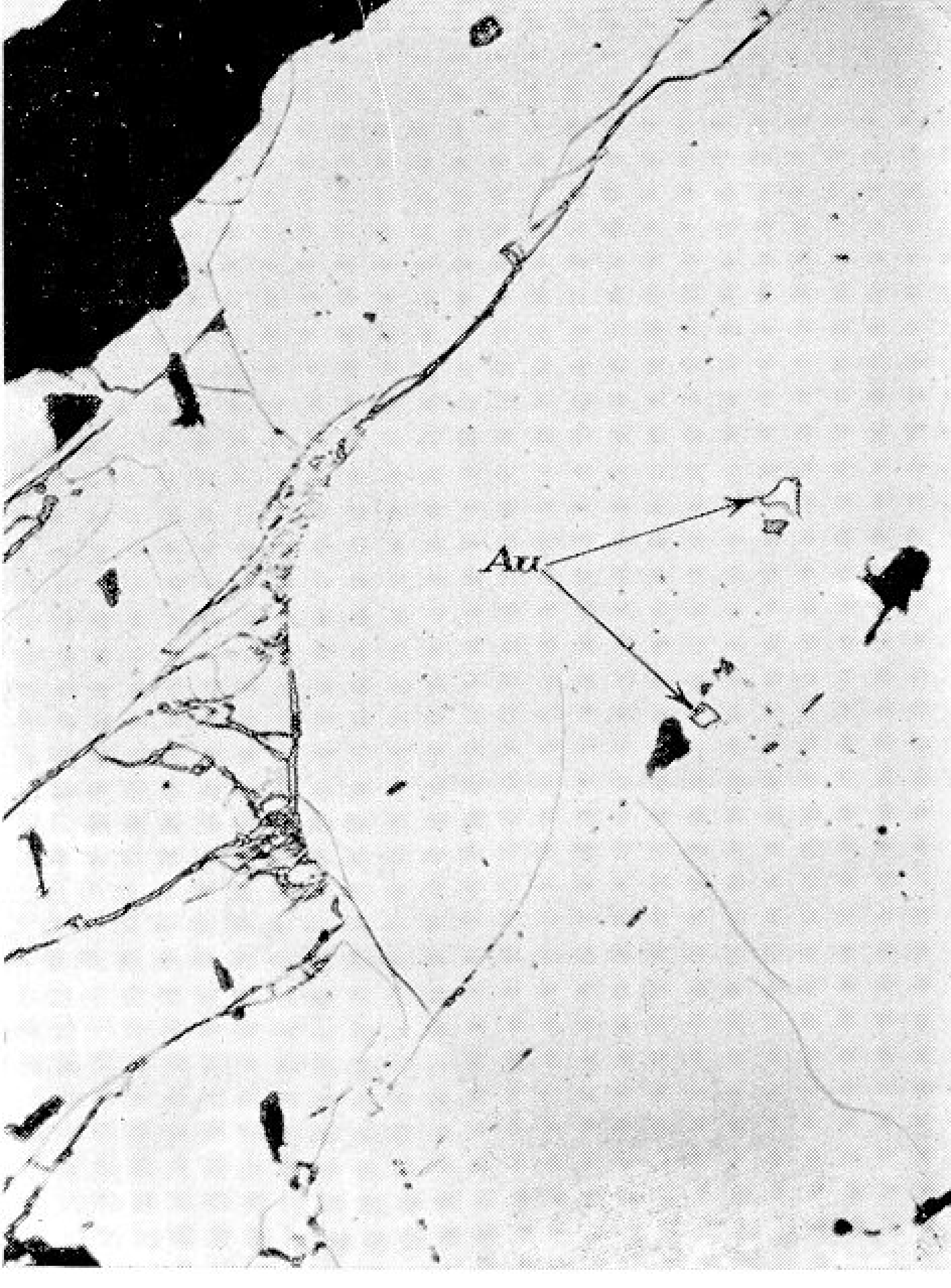






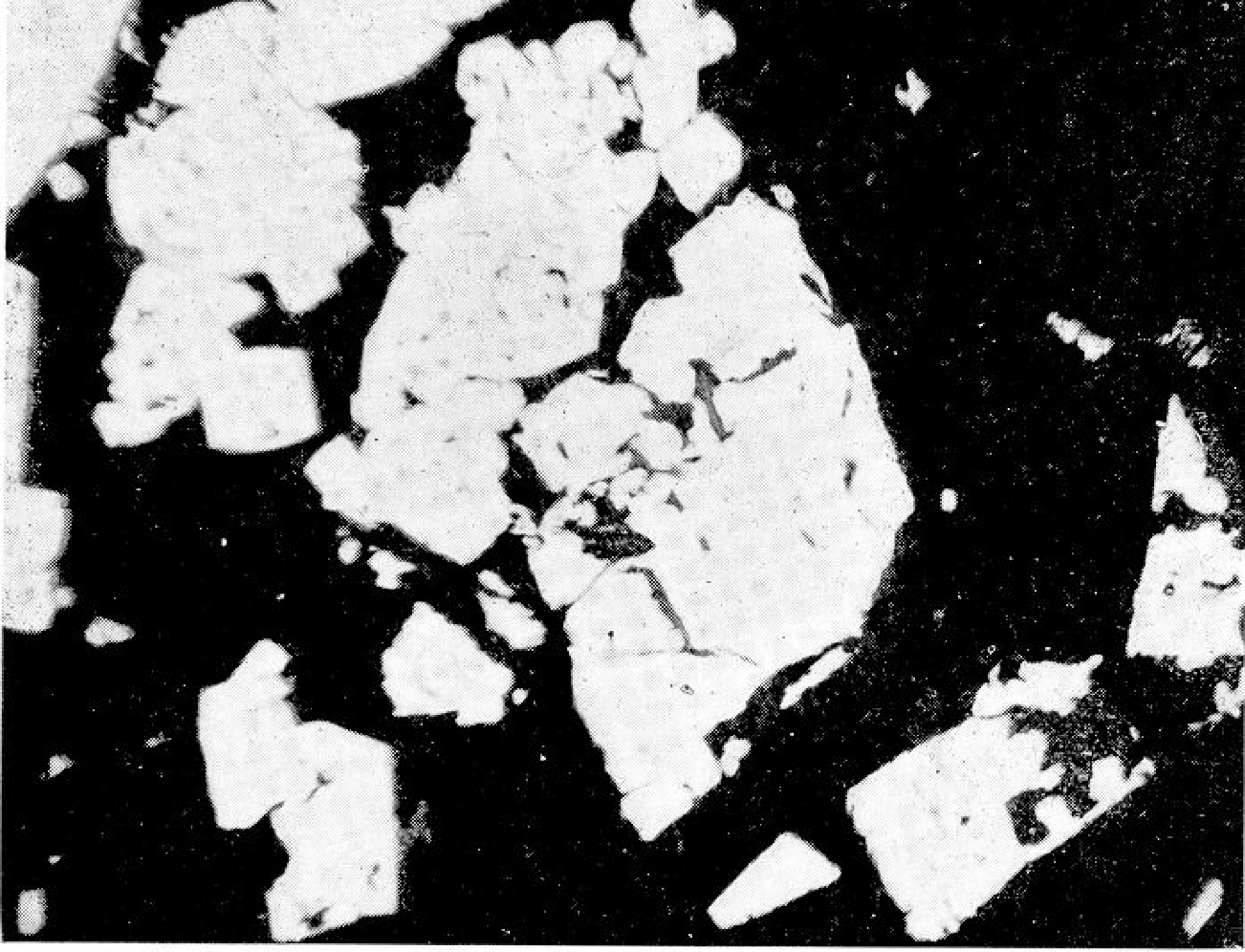


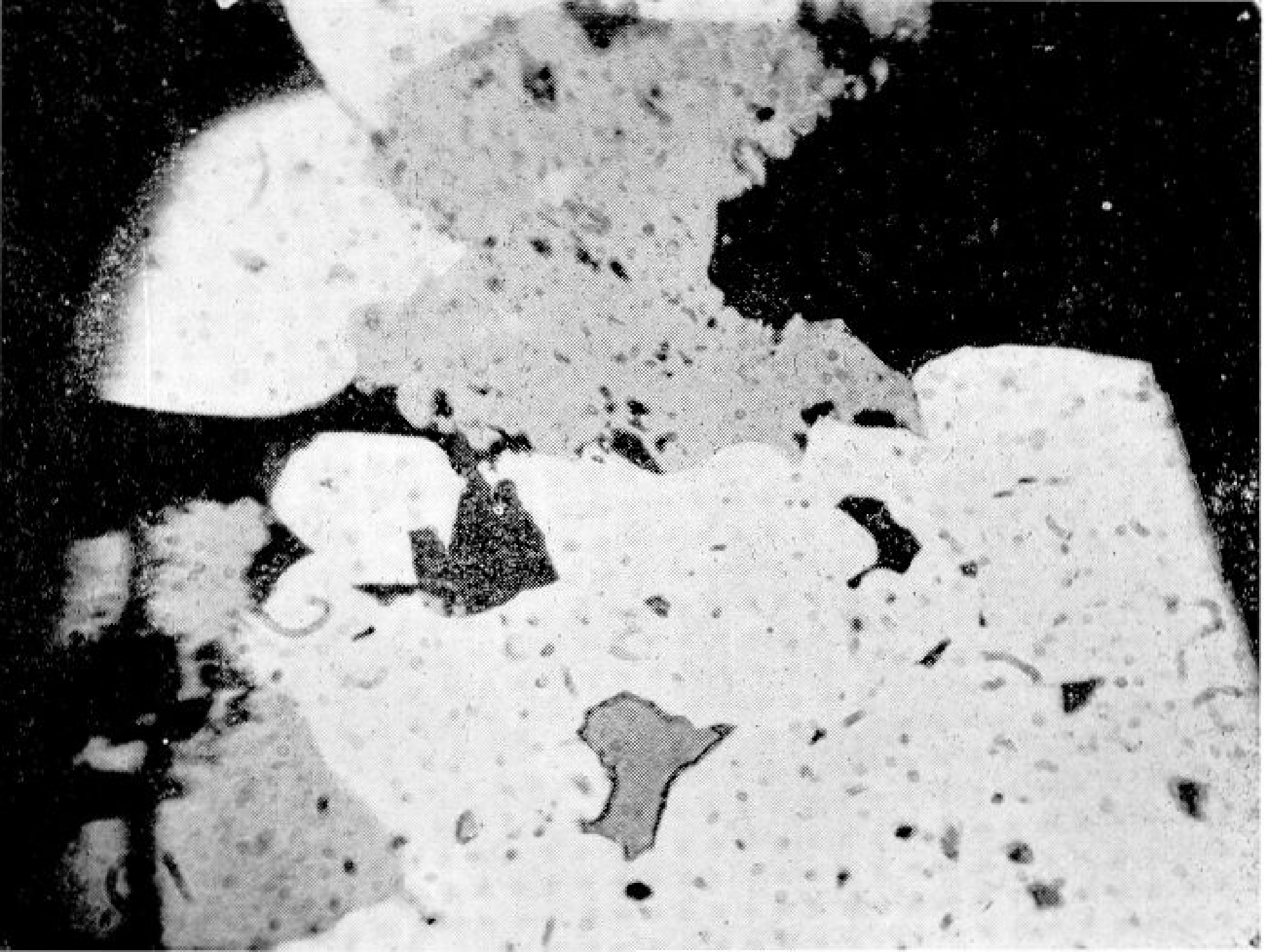

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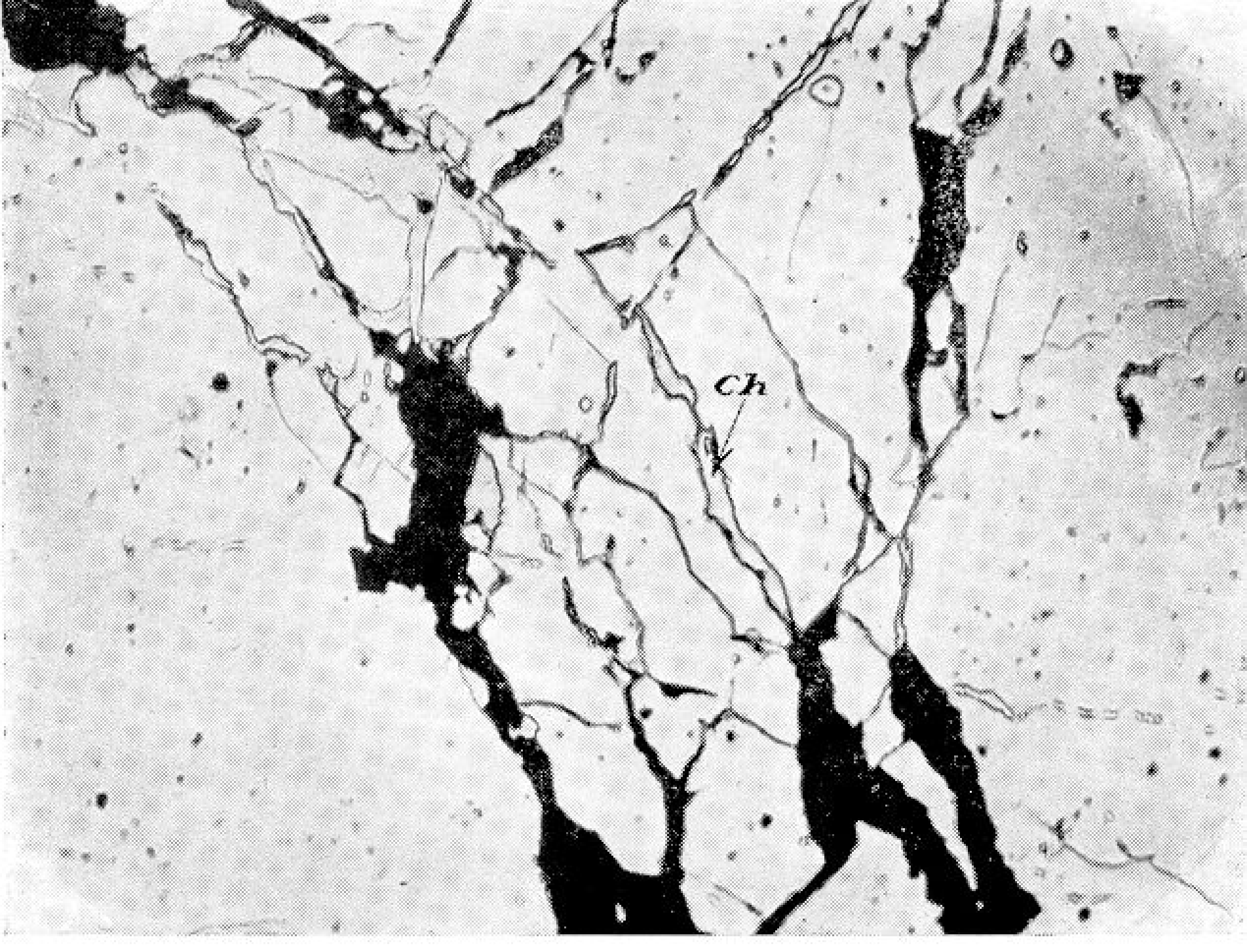

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PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

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Geology of the Rowan-Straw Lakes Area, by Jas. E. Thomson - 1-28

Gold Deposits on the Lake of the Woods, by Jas. E. Thomson - 29-47

Some Gold Occurrences West of Port Arthur, by Jas. E. Thomson 48-52

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TABLE OF CONTENTS

Vol. XLIV, Part IV

GEOLOGY OF THE ROWAN-STRAW LAKES AREA

PAGE

Introduction 1
Acknowledgments 2
Access 2
Previous Geological Work 2
Topography and Drainage 3
Natural Resources 3
Timber 3
Game and Fish 4
Tourist Attractions 4
General Geology 4
Keewatin Series 5
Basic Volcanics 5
Acid Volcanics 10
Iron Formation 11
Clastic Sediments 11
Structure of the Keewatin Series 12
Timiskaming Series 12
Structure 14
Eastern Belt 14
Western Belt 16
Correlation 16
Pre-Algoman Intrusives 17
Algoman 17
Granites and Gneisses 17
Acid Porphyries and Aplite 20
Keweenawan 22
Pleistocene and Recent 22
Economic Geology 22
Nature and Location of the Gold Deposits 22
Prospecting Conditions 23
Description of Properties 24
Monte Cristo Mine 24
Bethune Claims 24
Sullivan-Phinney Claims 24
Prout Claims 24
Straw Lake Beach Gold Mines Syndicate, Limited 25
Konigson Claims 27
Straw Lake Mining Syndicate 27

GOLD DEPOSITS ON THE LAKE OF THE WOODS

PAGE

Introduction 29
Acknowledgments 30
Horseshoe Mines, Limited 30
History and Development 31
General Geology 31
Veins 31
Ore Reserves 33
Abraham Claims 33
Wendigo Gold Mines, Limited 35
General Geology 35
Geological Structures 36
Veins 36
Witch Bay Gold Mines, Limited 39
Stella–Lac La Belle Mines Syndicate 40
Johnson-Nilson Claims 41
Aronek Gold Syndicate 42
Bigstone Bay Gold Mines 42
Kenora Prospectors and Mines, Limited 43
General Geology 44
Veins 44
Duport Mining Company, Limited 44
General Geology 45
Ore Bodies 45
Ore Relationships 47

SOME GOLD OCCURRENCES WEST OF PORT ARTHUR

Introduction 48
Saganaga Lake Area 48
General Geology 48
Description of Properties 49
Powell claims 49
Montgomery-Ackerman claims 49
Properties near Port Arthur 49
Birch Bay Gold Mines, Limited 49
Noranda Claims 52

ILLUSTRATIONS

PAGE

Exposure of pillow lavas on the shore of Hill lake 5
Exposure of porphyritic lava on Hill lake 6
Exposure of agglomerate on Hill lake 7
Tuffaceous rock exposed on the south side of Rowan lake 8
Quartz veinlets in carbonated lava, northwest arm of Pipestone lake 9
Exposure of sediments interbanded with lava flows, north shore of Rowan lake 11
Exposure of well-bedded Timiskaming sediments, northwest arm of Pipestone lake 13
Drag-folded bands of iron formation and Timiskaming sediments, northwest arm of Pipestone lake 14
Faulted lamprophyre dike in Timiskaming sediments, Thomson bay, Pipestone lake 15
Blocks of greenstone in granite, northern part of Lawrence lake 18
Fragments of greenstone in hornblende granite, Lawrence lake 19
Porphyry dikes intersecting Keewatin greenstone, Rowan lake 20
Quartz vein on Prout claims, north shore of Line bay, Pipestone lake 25
Exposure of a gold-bearing quartz vein, Straw Lake Beach mine 26
View of Horseshoe mine, Regina bay 30
View of Wendigo mine, Witch bay 35
Specimen of gold ore from the Wendigo mine, showing heavy sulphide mineralization 38
Polished section of ore from a vein on the property of Bigstone Bay Gold Mines 43
Specimen of chert-rhyolite breccia from the property of Birch Bay Gold Mines, Limited ... 51

SKETCH MAPS, SECTIONS AND DIAGRAMS

PAGE

Key map showing the location of the Rowan-Straw Lakes area 1
Diagram showing the structure of the sediments in the vicinity of Thomson bay, Pipestone lake ..... *facing* 14
Diagram showing the relation of the quartz porphyry to the lava flows, northeast of Line bay, Pipestone lake 21
Geological sketch map of the showings on the claims of Straw Lake Beach Gold Mines ..... *facing* 26
Geological sketch map of the main showing of the Straw Lake Mining Syndicate and part of the Mathieu claim ..... *facing* 28
Key map showing the location of gold properties on the Lake of the Woods and Shoal lake 29
Vertical section on No. 3 vein, Horseshoe mine, showing underground workings 32
Geological sketch map of the claims of Wendigo Gold Mines, Limited 34
Longitudinal section on No. 1 vein, Wendigo mine 37
Geological sketch map of the showings on the east group of claims, Witch Bay Gold Mines, Limited 39
Geological sketch map showing the location of veins on the claims of the Stella-Lac La Belle Syndicate 40
Sketch map of the Johnson-Nilson claims 41
Geological sketch map of Cedar island, Bag bay, Shoal lake, Kenora Prospectors and Miners, Limited ..... *facing* 44
Geological sketch map of Cameron island, Shoal lake, Duport Mining Company, Limited .. 46
Geological sketch map of the main showing, Birch Bay Gold Mines 50

COLOURED GEOLOGICAL MAP
(In pocket at back of report)

Map No. 44e—Rowan-Straw Lakes Area, Districts of Kenora and Rainy River, Ontario. Scale, 1 mile to the inch.

Geology of the Rowan-Straw Lakes Area

By Jas. E. Thomson

INTRODUCTION

This is the third of a series of reports by the writer on part of a large belt of ancient pre-Cambrian rocks that extends across the districts of Kenora and Rainy River between the Canadian Pacific railway and the southern line of the Canadian National Railways.[1] The two previous reports[2] dealt with the part of the greenstone-sedimentary belt that extends from Stormy lake west and south through the Manitou lakes to Straw lake. The area discussed in this report, and called the Rowan-Straw Lakes area, is a westward continuation of the belt and was mapped during the summer of 1934. It adjoins the Kakagi

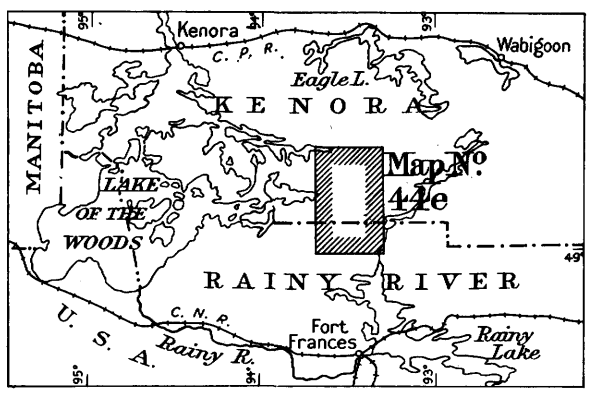


Fig. 1—Key map showing the location of the Rowan-Straw Lakes area. Scale, 50 miles to the inch.

Lake map area[3] on the west and overlaps on the Straw-Manitou Lakes area to the east. The Straw lake section of the Straw-Manitou Lakes map (No. 43a) is reproduced on the accompanying map with some additions and modifications as the result of more detailed mapping in 1934. As the geology discussed in this report is, in general, similar to that of the adjacent areas, it has been found necessary to repeat certain statements and ideas expressed in previous reports in order to make this report a complete unit.

The larger part of the map-sheet lies in the district of Kenora, but the southern part extends into Rainy River. The southern extremity lies approximately 26 miles north of Emo, on the Canadian National railway.

Gold discoveries were made on Straw lake during the summer of 1933, a mild gold "rush" followed, and the favourable prospecting territory in this part of the map area was staked. In 1934, two of the three gold discoveries on Straw lake were actively developed and underground work was commenced

[1]See Kenora Sheet, Geol. Surv. Can., map 266A, 1933.

[2]Jas. E. Thomson, "Manitou-Stormy Lakes Area," Ont. Dept. Mines, Vol. XLII, pt. 4, 1933; "Straw-Manitou Lakes Area," Ont. Dept. Mines, Vol. XLIII, pt. 4, 1934.

[3]E. M. Burwash, "Kakagi Lake Area," Ont. Dept. Mines, Vol. XLII, pt. 4, 1933.

on one of them. During the field season there were a few prospectors in the area, most of whom were doing assessment work on previously acquired ground. A small gold discovery was made on Line bay in Pipestone lake, but no new gold discoveries of any importance were made at Straw lake.

The accompanying geological map (No. 44e) covers an area of approximately 300 square miles. The Dryden sheet (No. 52F), issued by the Topographic Survey of Canada, is an excellent aerial map of the region and was used as a base map in the preparation of the geological map. Some slight alterations and additions have been made to this topographic map. These corrections deal largely with the drainage of small lakes and the location of portages. The geological data were obtained by study of the outcrops on the shores of as many lakes as possible and by making pace-and-compass traverses about a quarter of a mile apart through the bush.

Acknowledgments

The writer wishes to express his appreciation to the various individuals who provided assistance and information during the summer. Special acknowledgment is due James Graham and Leslie Cooper, of Emo, and Geo. L. Sullivan, of Burditt lake, for transportation of supplies. Able assistance was rendered in the field by B. T. Wilson, W. R. Newman, and M. W. Bartley. Mr. Wilson acted as senior assistant and did a considerable part of the geological mapping; he also examined the country between Dash and Katimiagamak lakes. The geology of the southern part of Pipestone lake and in the vicinity of Nightjar and Bethune lakes was done in October by Mr. Bartley, assisted by Alex. Bethune, of Emo. Assays were made by the staff of the Provincial Assay office.

Access

The area is easily reached from Emo, a station on the Canadian National railway. A motor road leads from Emo to tourist camps located near the south end of Burditt lake. It is possible to travel by canoe from this point to the north end of Pipestone lake without a portage. Rapids are encountered at the foot of Feather, Weld, and Pipestone lakes, but these offer no special difficulties to canoes and small boats.

When the Kenora–Fort Frances highway is completed, the northern part of the area may be entered by canoe routes leading east from Kakagi or Dogpaw lakes. A wagon road extends from Kakagi lake to Brooks lake and is used for transportation during the tourist season. All the larger bodies of water between Pipestone and Lawrence or Rowan lakes are easily reached by the canoe route through Yoke, Crossroute, and Asheigamo lakes. An alternative route from Crossroute lake northward to Rowan lake by way of Fog lake involves a number of small lakes and short portages. North of Lawrence and Rowan lakes, there is a good route through Hector, Priam, Ajax, and Basil lakes. During the high water season, the best canoe route from Pipestone lake to Katimiagamak lake is by way of Dash and Phinney lakes; but in the summer the creek that drains Phinney lake often dries up, making it necessary to use the portages leading north from the central part of Dash lake.

Previous Geological Work

The northern part of the map-sheet is included in the Manitou Lake sheet, prepared by McInnes,[1] and published in 1902. The southern part was mapped

[1]Wm. McInnes, Geol. Surv. Can., map No. 720, 1902.

by Lawson and discussed in his first report on the Rainy Lake region in 1887.[1] Both of these geological surveys were of a reconnaissance nature. This geology is shown on the recently compiled Kenora sheet (map No. 266A) of the Geological Survey of Canada. The Kenora sheet also indicates the general relationship of the geology in the area to other parts of northwestern Ontario.

A. P. Coleman[2] made a geological reconnaissance through the area in 1894 and 1896.

Topography and Drainage

The topographic features of the area are similar to those observed in most parts of the pre-Cambrian shield. From any elevated point a panoramic view of the horizon would show a monotonous continuity of rounded hills and ridges of almost equal elevation, although an occasional monadnock may stand out above the general level of the peneplain. Locally, some ridges give a rather rugged aspect to the topography, although the relief is probably not more than 200 feet at any point. In almost every part of the area rock outcrops are abundant, but a thin veneer of glacial deposits is everywhere in evidence in the depressions. The shore-line of most of the lakes is rocky, and the water of the larger lakes is beautifully clear. The level of some of the lakes has been either raised or lowered in the course of lumbering operations. Raised beaches are to be observed on Kaiarskons, Furlonge, and Hector lakes and were formed by this artificial lowering of the outlet.

An outstanding topographic feature is the abundance of lakes. In certain parts of the area it is interesting to note how the shape and pattern of these lakes has been controlled by the nature and structure of the bed rock. Pipestone lake is an example of this relationship. Its V-shaped outline is due to the fact that the two long arms are located along the converging axes of two synclinal folds, which are so oriented that they merge in the vicinity of Thomson bay at the northeast end of the lake. From Thomson bay, one major axis of folding trends a little north of west through the infolded remnants of Timiskaming sediments on Schistose lake and the northwest arm of Pipestone lake. The other synclinal axis runs southwestward, parallel to the elongation of lower Pipestone lake and Burditt lake. In other parts of the area where the lakes are located on massive greenstones or granitic rocks they have no such regularity of outline.

A divide passes in a general east-west direction across the central part of the map-sheet. North of this line the drainage is westward into Whitefish bay of the Lake of the Woods. The lakes in the southern part of the area drain southward into Rainy lake.

Natural Resources

Timber

The forest trees in the area are principally spruce, balsam, poplar, birch, cedar, red and white pine, and jackpine. It is evident that the country once contained much valuable timber. Old log chutes, dams, and logging camps are found everywhere and indicate the extent of lumbering activity in the past. Most of the timber taken out was red and white pine. A few rather small and

[1] A. C. Lawson, Geol. Surv. Can., Vol. III, pt. F, 1887.
[2] A. P. Coleman, Ont. Bur. Mines, Vol. IV, 1894, pp. 60, 61; Vol. VI, 1896, p. 88.

scattered stands of pine still remain in the more inaccessible sections of the area, but the greater part contains second growth of little economic importance.

Forest fires have passed through certain parts of the area, but the extent of recently burnt-over country is not great. In 1933 the country east of Denmark lake and north of Rowan lake was burnt. Brulé is found around the central part of Pipestone lake, and in the vicinity of Lawrence and Loonhaunt lakes.

The Ontario Forestry Branch had a fire rangers' station on Straw lake in 1934.

Game and Fish

The area abounds in game, principally deer, moose, bears, porcupines, weasels, skunks, and rabbits. Partridges and ducks are plentiful in season. An area bounded by Pipestone lake on the east and Schistose and Kakagi lakes on the north has recently been converted into a game preserve.

The larger lakes contain lake trout, whitefish, pike, and pickerel. Many of the smaller lakes provide excellent black-bass fishing, and maskinonge are caught in several lakes, particularly Pipestone lake. Commercial fishing is carried on in Lawrence and Rowan lakes.

Tourist Attractions

The tourist business has probably provided the greatest revenue of the area in recent years. Canoe trips can be made through all parts of the area with considerable ease during the summer months. Tourist camps are located on Pipestone and Brooks lakes. The great natural beauty of this country, the abundance of game and fish, and the easy accessibility to tourists from the midwestern States, makes this section of Ontario particularly attractive to lovers of the outdoors. Travel permits must be obtained from fire rangers by all who visit the area.

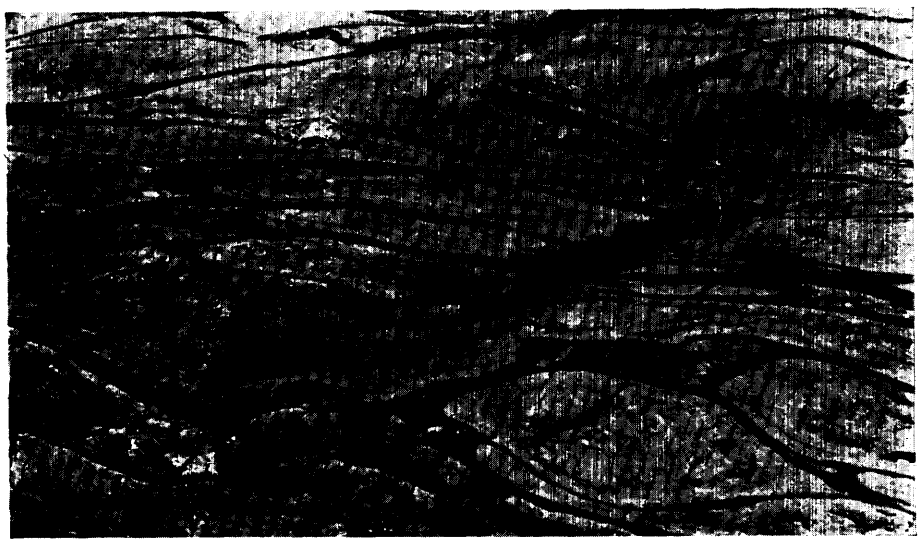
GENERAL GEOLOGY

The geology of the Rowan-Straw Lakes area may be summarized as follows: The consolidated rocks are almost entirely of early pre-Cambrian (Archean) age. The greater part of the area is underlain by Keewatin lavas and pyroclastics with which are associated small amounts of clastic sediments and iron formation. Sedimentary rocks of Timiskaming age lie stratigraphically above the Keewatin series and are probably separated from it by an unconformity. Both lavas and sediments are steeply folded and are intruded by Algoman granites and porphyries. A few diorite dikes intersect all other rocks and are presumably Keweenawan in age. Certain areas of basic igneous rocks are associated with the Keewatin lavas and are classed as pre-Algoman intrusives.

The various formations may be classified as follows, the oldest rocks being placed at the bottom:—

QUATERNARY	
PLEISTOCENE and RECENT:	Boulder clay, sand, gravel, peat.
	Great unconformity
PRE-CAMBRIAN	
KEWEENAWAN:	Diorite.
	Intrusive contact
ALGOMAN:	Quartz, feldspar, and granite porphyry; aplite. Hornblende and biotite granite and gneiss.

	Intrusive contact
PRE-ALGOMAN:	Gabbro, diorite, quartz diorite, lamprophyre.
	Intrusive contact
TIMISKAMING:	Conglomerate; arkose, quartzite, slate; iron formation; and some associated agglomerate, tuff, and lava flows.
	Unconformity
KEEWATIN:	Clastic sediments, chiefly arkose and slate, interbedded with lava flows. Iron formation. Acid volcanics: rhyolite, trachyte, felsite; acid agglomerate and tuff; sericite schist; carbonated acid lavas and schists. Basic volcanics: andesite, basalt, and pillow lava; porphyritic lava; basic agglomerate and tuff; chlorite and hornblende schist; amphibolite; carbonated basic lavas and schists.



Exposure of pillow lavas on the shore of Hill lake.

Keewatin Series

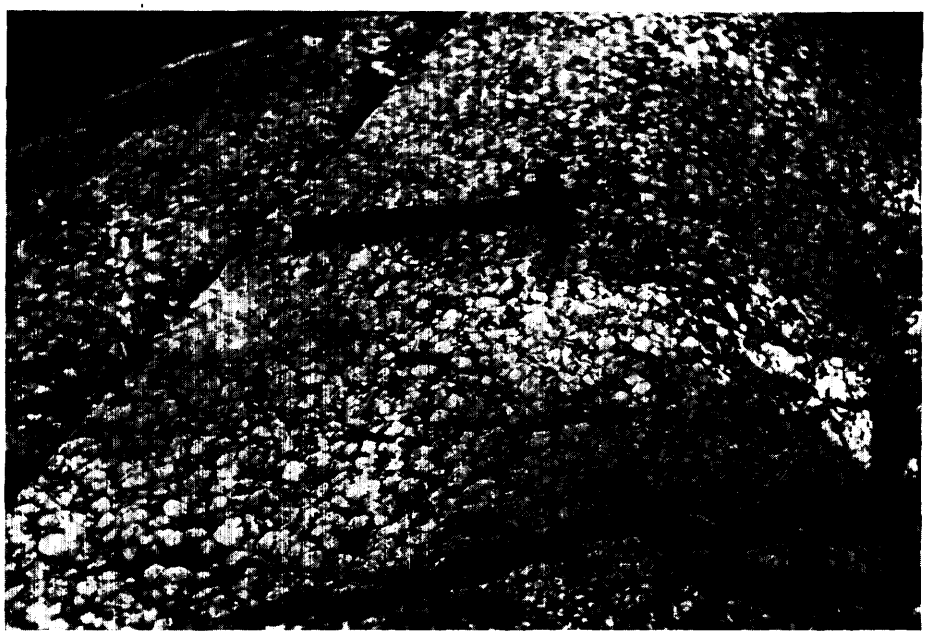
Basic Volcanics

Lavas.—The greater part of the Keewatin series consists of lavas ranging from andesite to basalt in composition. They are generally fine- to medium-grained, dark-green rocks but sometimes show considerable variation due to the degree and type of alteration to which they have been subjected. These altered basic lavas are generally referred to as "greenstones" in the field. In several parts of the area the lavas are so massive in appearance and present so little variation over considerable distances that individual lava flows are scarcely ever recognized and practically no information about their structural relationships was obtained.

In certain localities, however, different types of lavas, pyroclastics, and other rocks are intimately associated with these basic flows and would be of considerable importance as "horizon markers" in a detailed study of a selected area. These recognizable horizons in the complex include (1) pillow lavas,

(2) porphyritic lavas, (3) bands of coarsely-textured greenstones, (4) fragmental tops of flows, (5) bands of agglomerate and bedded tuff interbedded with the flows, (6) alternation of acid and basic flows, and (7) narrow bands of clastic sediments and iron formation interbedded with the basic lavas. In a section across the formation it is possible that any one of these features may be repeated by close folding or faulting.

Pillow structures are often observed in the basic lava flows, but only in rare instances was it possible to find exposures of rock sufficiently continuous for a complete section across several successive flows to be studied. Probably the best exposures in the area occur on the bare hills southeast of Gates Ajar narrows in Pipestone lake. This is the only location where the attitude of the



Exposure of porphyritic lava ("leopard rock") on Hill lake.

flows could be established with any degree of certainty. Here the pillows are from a few inches to 5 feet in maximum dimension and are generally flattened so that the long axis of the pillow is parallel to the flow contact. An idealized section across a flow would show a narrow band of fragmental lava at the top. This merges downward into a zone of pillows, each of which fits into the surface irregularities of the lower and earlier-formed pillows. The lower part of the flow is generally medium- to fine-grained lava. At some points on the shore of Brooks, Hill, and Rowan lakes exposures of pillow lavas exhibit the characteristic projections that fit into the triangular space between two older pillows, but this information was not considered sufficient in itself to establish the attitude of the lava flows.

The porphyritic lava consists of crystals of feldspar arranged irregularly in a matrix of andesitic or basaltic lava. These rocks are easily distinguished on account of the sharp contrast in colour between the grey feldspar and the dark-green lava. In some exposures on Hill lake the phenocrysts occupy most

of the rock mass, but generally they are quite subordinate to the lava matrix. Well-formed crystals of feldspar, up to 2 inches in length, are observed, but often they are rounded in outline, suggesting either movement in the flow or some sort of chemical reaction with the matrix. The porphyritic rock seems to constitute either an entire flow or a certain horizon in a flow. A band of this material may often be traced a considerable distance along the strike. In most cases the bands grade laterally into the ordinary lava by gradual diminution of the number of feldspar phenocrysts, but in some instances a sharp contact with the fine-grained lava was observed.

This porphyritic type of lava occurs frequently in the greenstone areas of northwestern Ontario and has been described by various geologists.[1] The field name of "leopard rock" has been applied to it on account of its spotted appearance,[2] and seems quite appropriate.



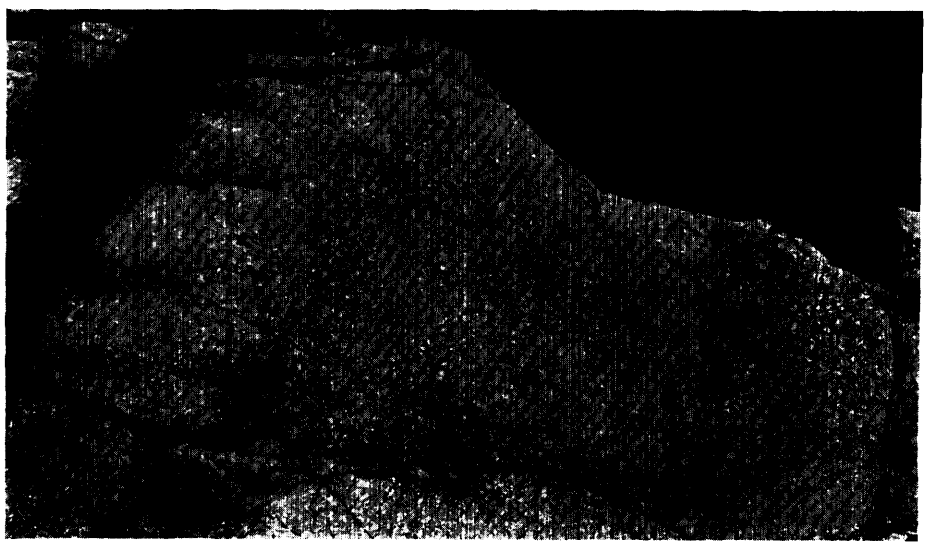
Exposure of agglomerate on Hill lake. The fragmental nature of the rock has been accentuated by surface weathering.

In many places throughout the greenstone complex there are areas of basic rock with a coarse gabbroic texture that are closely associated with the fine-grained lavas. The coarse-textured rock often grades into the typical lava, in which case it is interpreted as being the central part of a basic flow that cooled more slowly than the margin, resulting in the coarser crystallization of the constituent minerals. In a few places, however, rocks of similar appearance intrude the lavas and associated agglomerate and tuff. These are discussed under the heading of "Pre-Algoman Intrusives." It is always difficult to distinguish the intrusive from the extrusive rock in the field, and impossible in the case of isolated outcrops. On the accompanying geological map a large part of these gabbroic rocks have been included with the basic lavas because no intrusive contact could be found.

[1]M. E. Hurst, Ont. Dept. Mines, Vol. XLI, pt. 6, 1932, pp. 9-11.
G. G. Suffel, ibid, Vol. XXXIX, pt. 3, 1930, p. 61.
E. M. Burwash, ibid, Vol. XLII, pt. 4, 1933, pp. 51, 52.
Jas. E. Thomson, ibid, pp. 8, 9.
[2]M. E. Hurst, op. cit.

Fragmental Rocks.—In some parts of the area agglomerates, tuffs, and flow breccias are intimately associated with the basic lavas in such a way that it is impossible to draw the boundaries between the two types on a small-scale map. The fragmental rocks are roughly indicated on the accompanying map by the lettering "lc."

Typical agglomerate consists of fragments of light-coloured material, sometimes porphyritic in texture, in a dark-green matrix that is generally fine-grained but occasionally rather coarsely tuffaceous. The fragments are usually elongated parallel to the regional schistosity but are sometimes angular or subangular. Associated with the agglomerate are narrow bands of well-bedded



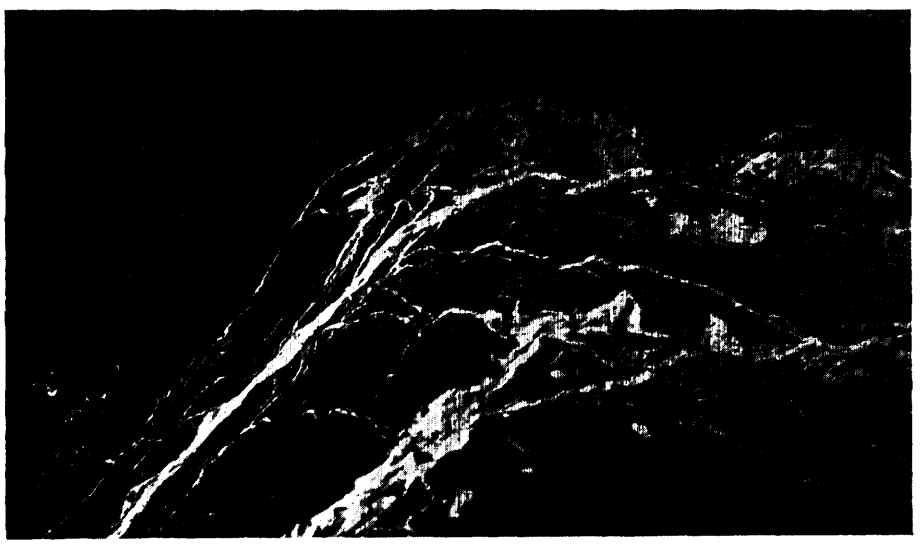
Tuffaceous rock exposed on the south side of Rowan lake.

tuffs, which gradually merge into it above and below. These tuffs and agglomerates are often interbedded with basic lava flows, although at some locations they occur continuously for considerable distances. In places the contact between individual flows and these pyroclastics is well defined. It is apparent that at intervals during Keewatin time, rock fragments and volcanic ash were ejected from the same subterranean source as the molten lava, and caused the intermingling of the flows and pyroclastics. At certain points the finer ashy material was sorted by erosional agencies and deposited in beds. Fine exposures of typical agglomerates are found on the north side of Straw and Voke lakes, and on Hill and Rowan lakes.

Another type of fragmental rock associated with the basic lavas is a volcanic or flow breccia. This may have been formed by the shattering of the consolidated crust on the outer surface of a flow and the engulfing of the fragments in the still molten magma of the interior. The volcanic breccia is characterized by angular fragments, which are of approximately the same composition as the lava matrix. South of Thomson bay in Pipestone lake these fragments occur within and between pillow structures. Some outcrops near the northwest arm of Pipestone lake contain bomb-like masses of light-coloured material and also fragments similar in composition to the lava. This may represent a case of

internal brecciation of a flow accompanied by additions of foreign material before the lava had consolidated.

A tuffaceous type of basic rock occurs along the south side of Rowan lake. It was originally named diabase porphyrite.[1] The rock is characterized by grey phenocrysts of feldspar in a greenish matrix (see photograph on page 8). The rock is often schisted and considerably metamorphosed. On the shore and islands southeast of the old Monte Cristo mine, it is closely associated with fragmental rocks, and in places forms the matrix of agglomerate. There is no evidence that it is intrusive. Microscopic examination of the rock gives little information on account of the extreme alteration. Quartz, orthoclase, and



Typical exposure of quartz veinlets forming a network in carbonated lava, northwest arm of Pipestone lake.

andesine, with large amounts of secondary kaolin, carbonate, sericite, and chlorite are the mineral constituents, and indicate that the rock might be an altered tuff.

Metamorphosed Basic Lavas.—All the rocks described above have been altered in various ways, depending on the type and degree of metamorphism to which they have been subjected. Shearing stresses during the folding of the basic lavas have transformed them locally to chlorite and hornblende schists. Often in the vicinity of granite contacts the greenstone has been recrystallized to a coarse-grained, massive amphibolite.

In several parts of the area the basic lavas and schists have been heavily carbonated. These carbonated zones are characterized by outcrops with a reddish-brown surface gossan due to the weathering of iron-bearing minerals. Often the carbonated rocks are intersected by numerous irregularly branching white quartz veinlets and carry traces of sulphides, particularly pyrite (see photograph above). Hot solutions that carried considerable amounts of carbonates and silica have evidently thoroughly permeated these areas. Carbonated

[1]Manitou Lake Sheet, Geol. Surv. Can., map No. 720, 1902.

basic lavas are quite numerous around the upper part of Pipestone lake and on Brooks lake.

Near the granite-greenstone contact in some parts of the area bands of contact gneisses and schists have developed. In some cases these slightly resemble in appearance the rocks at Bears Pass on Rainy lake that are part of Lawson's Coutchiching series.[1] The strike of the foliation of these gneisses and schists is approximately parallel to the granite contact, and they are intersected by *lit par lit* injections of granitic material. A narrow band of gneisses located at the granite contact on the northwest shore of Lawrence lake was studied by Mr. Wilson. They are typically banded siliceous biotite schists and gneisses and occasionally contain elongated fragments of lighter-coloured rock. It was finally decided that they were highly metamorphosed agglomerate and tuff. Chloritic schists and gneisses occur at the granite contact southeast of the long stretch of lower Pipestone lake, but there is no evidence that any of these are of sedimentary origin.

Acid Volcanics

Lavas.—Acid lava flows are found in several parts of the area but they are very subordinate in amount to the basic variety. These rocks are characteristically lighter-coloured than the basic flows and vary from pink to creamy-white or grey. In some localities they are massive and have a fine-grained cherty appearance. They are generally rhyolites but in rare instances trachyte is identified. Small quartz "eyes" have been found in the rhyolites, but this is not a common feature. Pillow structures were observed in rhyolites on Straw lake and in isolated acid lava flows on Sucan lake. In the latter case numerous spherules occur near the periphery of the pillows. At some points one or two isolated acid flows will be found in a great area of basic lava, but they may be readily spotted on account of their creamy-white colour in contrast to the dark-green basic lava. Numerous small areas of such acid lavas are included with the basic variety on the accompanying geological map because the map scale is too small to show them. Some of the best exposures of typical rhyolites occur south of the shaft of Straw Lake Beach Gold Mines at Straw lake.

Microscopic examination of the rhyolites reveals a felsitic texture and the presence of quartz, orthoclase, andesine, and accessory or secondary minerals, such as magnetite, sericite, chlorite, epidote, and kaolin. The trachyte is quite similar but contains no quartz.

Fragmental Rocks.—Acid fragmental rocks such as agglomerate, tuff, and volcanic breccia occur with the acid flows. In the vicinity of Sandhill lake massive agglomerate of a very acid nature is found. Large angular to rounded fragments of rhyolitic and cherty material occur in a dense, cherty matrix; in a few localities the finer tuffaceous material is sorted, and distinct bedding may be observed. Along the south shore of Schistose lake there are a number of outcrops of carbonated rhyolitic rock containing rounded fragments of cherty and porphyritic acid material. It is difficult to differentiate some of these exposures from the conglomerate on the north side of the lake.

Another type of acid volcanic fragmental rock that was formed under different conditions occurs on claims of the Straw Lake Beach Gold Mines. Here, the rhyolites, being competent rocks, have yielded to deforming stresses by shattering. This produced a breccia that resembles an agglomerate when it is somewhat sheared.

[1]A. C. Lawson, Geol. Surv. Can., Mem. 40, 1913, p. 10.

Metamorphosed Acid Lavas.—A portion of the acid lava flows south of Straw lake have been highly sheared and altered to sericite schist. The rhyolites along the shores of Pipestone lake and on Schistose lake are carbonated in the same manner as the basic lavas.

Iron Formation

A few small bands of iron formation are associated with the lavas on the south side of Schistose lake. These have been described by Burwash.[1] The iron formation is brecciated and contains a great number of angular black and white chert fragments in a rusty-coloured matrix with a low iron content. Some sulphides occur in this brecciated iron formation.



Exposure of sediments interbanded with lava flows on the north shore of Rowan lake.

Clastic Sediments

Several bands of clastic sedimentary rocks are intimately associated with basic lavas. They are often well bedded and are generally similar in appearance to the Timiskaming sediments discussed below. The beds dip at steep angles, scarcely ever varying more than 20 degrees from a vertical position. The rocks are generally classified as slates in the field, but some coarser phases with poorly defined bedding are quartzite and arkose in composition.

A number of these sedimentary bands were recognized around the shores of the upper part of Pipestone lake. On the large island north of Fish island two bands of bedded slates, each 3 feet in width, occur on either side of a pillow lava flow, 12 feet wide. North of this there is a larger exposure of sediments. North of Gates Ajar narrows two bands of sediments, each about 50 feet in width, may be followed along the shore and on an island. These are also interbedded with the lavas.

A band of fine-grained sediments with intermingled basic lava flows was traced for a considerable distance northeast across the central part of Rowan lake. On the north side of the lake there are thin-bedded, greenish-coloured

[1]E. M. Burwash, Ont. Dept. Mines, Vol. XLII, pt. 4, 1933, p. 92.

slates, characterized by small drag folds (see photograph on page 11). Occasionally a bed of black chert occurs with the slate. Alternating bands of sediments and lavas are often observed. On the island immediately north of the old Monte Cristo mine there are also splendid exposures, which show the same intermingling of bedded slates and greenstones.

Cherty graphitic rocks are found at different points in the area. While they are discussed with the sedimentary rocks at this place, it is not at all certain that they were all formed during Keewatin time. On the south and east sides of Sucan lake, a peculiar black, graphitic chert or quartzite containing numerous cavities occurs at or near the contact of the basic lavas and sediments. This rock was discussed in a previous report.[1] Two exposures of a somewhat similar graphitic rock were observed along the south shore of the open stretch of lower Pipestone lake. Well-defined bedding is found here, and the rock is interpreted as being a narrow band of carbonaceous sediments intercalated with the basic lavas. A graphitic rock with spherical vesicles, similar to that on Sucan lake, occurs at the contact of a large mass of white quartz on the Prout claims north of Line bay. The association suggests that the rock at this point may have some relationship to vein material.

The relationship of all these narrow bands of sediments to the lavas suggests that they were deposited during short intermittent periods of sedimentation between the extrusion of lava flows. They are quite similar in many respects to Keewatin sediments in Glass bay on Lower Manitou lake.[2]

Structure of the Keewatin Series

As already stated, it is difficult to interpret the structure of the larger areas of massive basic lavas, but in those places where sediments or pyroclastics occur with them a detailed survey might solve the geologic structures to some extent.

In the Rowan lake section of the map-sheet, the intercalated sediments and lava flows indicate that the formation strikes in a general northeast-southwest direction and dips almost vertically in the vicinity of the sediments. Between Rowan and Pipestone lakes the massive greenstones do not furnish any information as to the attitude of the flows. A synclinal axis is believed to run northwestward along the northwest arm of Pipestone lake. A similar synclinal axis runs northeast through the long open stretch of lower Pipestone lake and merges with the other in the vicinity of Thomson bay. The intervening anticlinal axis might run from the nose of granite near Nightjar lake northeastward to Thomson bay. This anticlinal doming may have been accentuated by the intrusion of the large irregularly shaped mass of porphyry in the vicinity of Dash and Phinney lakes. This interpretation of the general structural relationships of the Keewatin rocks around Pipestone lake is largely based on the known structures of the infolded Timiskaming series, the details of which are described elsewhere in this report.

The strike of the schistosity in the greenstones is approximately parallel to the boundaries of the formation, that is, to the line of contact with granite or porphyry. The dip of the schistosity is rarely more than a few degrees from vertical.

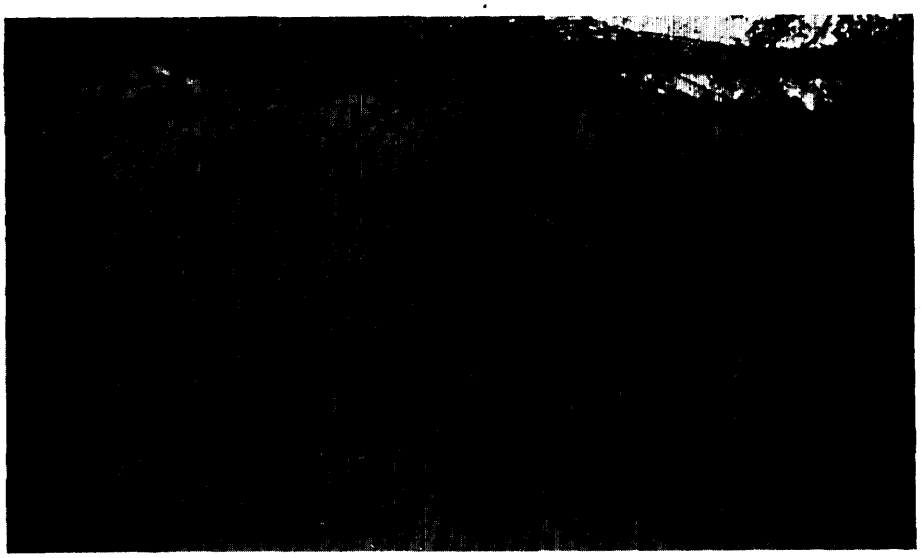
Timiskaming Series

There are two bands of sediments in the area that have the structural and lithological characteristics of the Timiskaming type of sedimentary rocks.

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLIII, pt. 4, 1934, p. 9.
[2]Ibid, Vol. XLII, pt. 4, 1933, p. 11.

These areas contain arkose, quartzite, slate, and a small amount of iron formation and conglomerate. The western band also contains a few lava flows and some pyroclastics interbedded with the sediments. Bedding is generally well preserved, especially in the finer-grained clastics. The beds range in thickness from a fraction of an inch to over 2 feet and in places show a gradation from relatively coarse grained sandy material at the base to very fine grained slate at the top.

Small bands of iron formation occur on two of the tiny islands in the northwest arm of Pipestone lake. These show alternating beds of red chert or jasper and lean hematite ore and are interbedded with the slates and quartzites. At the western exposure the bands of iron formation are only one foot wide (see photograph on page 14).



Exposure of well-bedded Timiskaming sediments on a small island in the northwest arm of Pipestone lake. The angle between cleavage and bedding is quite large.

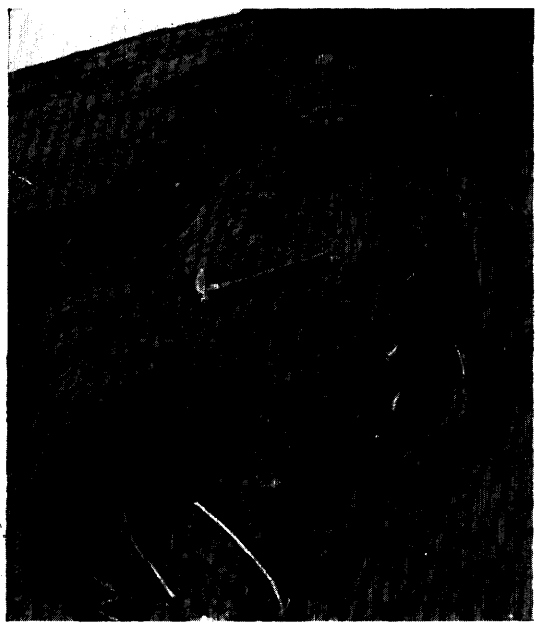
No boulder conglomerate is found in the eastern band, but some pebble conglomerate occurs a short distance east of Thomson bay in Pipestone lake. Conglomerate is found on a small island near the west end of Schistose lake. A few of the boulders in this conglomerate are granite and feldspar porphyry, but chert pebbles are predominant. Most of the boulders and pebbles are well rounded. Along the shore southeast of the island pebble conglomerate occurs and grades into coarse arkose. The sediments in this vicinity are schisted and considerably carbonated so that it is difficult to recognize them. Coarsely clastic arkose is also found along the south shore of the northwest arm of Pipestone lake. An occasional rhyolitic flow and some bands of agglomerate occur in the sediments in this vicinity.

Microscopic examination of a sample of arkose from the northwest arm of Pipestone lake revealed angular to subangular grains of quartz, highly altered orthoclase and plagioclase, and cherty material. The rock is heavily impregnated with carbonate crystals and stringers.

STRUCTURE

Eastern Belt

A rather detailed study was made of this area of sediments as it was thought that they are so strategically located that the interpretation of the structure here might be the key to the general structure of the greenstone-sedimentary complex in the Pipestone lake section. The belt of greenstones and sediments that extends westward from the Manitou lakes presents the first evidence of dividing into two distinct parts in the vicinity of these sediments. One belt continues southwest to Burditt lake and the Rainy River valley, and the other



Drag-folded bands of iron formation (dark-coloured) and Timiskaming sediments, small island in the northwest arm of Pipestone lake.

extends northwest to Kakagi lake.[1] These sediments are thus conveniently located at the junction of two major structural units, and furthermore exhibit the type of geological structures by which it is possible to interpret the nature of the folding with some degree of accuracy.

This eastern area of sediments is interpreted as a syncline at the east end, but near Thomson bay in Pipestone lake it expands into a north and south syncline with an intervening anticline. The sediments lie stratigraphically above the Keewatin lavas and pyroclastics but are so closely folded that the dip of the beds generally varies only a few degrees from the vertical. The southern synclinal axis extends from the dividing point southwest towards Line bay. The northern syncline noses out abruptly near the entrance to Thomson bay, but it is quite probable that the Schistose lake belt of similar sediments may represent a continuation of this syncline. The tongue of intrusive porphyry

[1]See Kenora sheet, Geol. Surv. Can., map No. 266A, 1933.

that projects northwestward from Phinney lake suggests a doming or cross-fold in the formation, which would account for the uplifting and subsequent erosion of the sediments between the eastern and western bands.

On Sucan lake the bedding bends around the nose of the fold, and the axis of the syncline plunges steeply westward. The structure around Thomson bay is indicated in Fig. 2. A section was made across the formation on the west side of the bay, where excellent exposures are to be seen. Here the beds are steeply folded and in places overturned from 10 to 15 degrees. At several points the tops of the beds could be determined by the gradation in grain size across several successive beds. These show a gradual change from coarse material at the base to very fine grained clay slate at the top of the bed. Near



Faulted lamprophyre dike in Timiskaming sediments, western end of the large island north of the entrance to Thomson bay, Pipestone lake.

the mouth of Straw creek these determinations were checked by the relationship of the fracture cleavage to the bedding.

The attitude of the beds along the line of section proves the existence of the northern and southern synclines. The axial plane of the northern syncline dips steeply to the south while that of the southern syncline is more nearly vertical. The plunge of the folds is very steeply to the east, as indicated by the dips of the beds at the anticlinal and synclinal axes. This eastward plunge of the formation accounts for the nose of greenstone that projects eastward toward Thomson bay along the anticlinal axis of folding and separates the northern and southern synclinal belts of sediments.

It will be noticed that the strike of the beds on the south side of Thomson bay adjacent to the greenstone makes a considerable angle with the line of contact and suggests the possibility of a fault. On the east end of the large island the contact between the sediments and the lava is highly sheared, and the beds are truncated at an angle of 20 degrees at the contact by the shearing. At the western end of the same island numerous faults with a small horizontal displacement were noted (see photograph above), the strike of the faults being

approximately parallel to the sheared contact of sediments and lavas. The possibility of a large drag fold in the sediments around the southern part of the island is indicated by the rapid change in strike of the beds and the northern bulge of the greenstone-sedimentary contact. Both the drag fold and the offset of the faults show that the north side moved east with respect to the south side.

Western Belt

The sedimentary rocks between Schistose lake and the northwest arm of Pipestone lake are considered to form a closely folded, canoe-shaped syncline whose relationship to the Keewatin rocks is similar to that of the eastern belt. The cleavage and bedding relationship in the arkoses and slates on the south shore of Pipestone lake invariably show that the tops of the beds face south. This was checked at several points. Gradation in grain size in the beds was noted at two places and corroborated the above evidence. It is thus quite certain that the strata on Pipestone lake are located on the north limb of a syncline. Unfortunately the sediments on Schistose lake are so schisted and impregnated with carbonate material that reliable structural data are very hard to obtain. However, at one point on a small island towards the western end of the lake, gradation in grain size indicated that the tops of the beds face north, that is, the island is on the southern limb of the syncline.

CORRELATION

Synclinal belts of sedimentary rocks with similar characteristics have been mapped by the writer[1] at intervals along the trend of the greenstone belt from Stormy lake, through the Manitou lakes, Pipestone lake, and as far west as Schistose lake, a distance of about 70 miles. These isolated bands are closely infolded with the Keewatin series, lie stratigraphically above it, and are so located with respect to one another that it is quite possible that they are remnants of a once continuous body of sedimentary rocks.

A glance at the different geological maps of this large area will show that wherever the sedimentary series is missing there is evidence of cross-folding or doming of the formation in that vicinity. Any such elevated portions of the series would be subsequently eroded in the general peneplanation of the country. An area of granite separates the Stormy lake belt of sediments from those near Upper Manitou lake. The projecting tongues of granite on either side of Lower Manitou lake are evidence of cross-folding that might account for the disappearance of the sediments in that vicinity. Again, the finger of granite around Bretz lake occurs between a small band of sediments east of Manitou stretch and the Esox lake synclinal remnant. The nose of granite on Straw lake and the stock of porphyry on Furlonge lake indicate an uplift between the Esox lake sediments and the Sucan-Pipestone Lakes area of similar rocks. Evidence of cross-folding between the latter belt and the Schistose lake syncline has already been mentioned.

The above information is presented because the writer believes that any correlation of the sediments in the Rowan-Straw Lakes area must of necessity take into account the structural evidence presented by the sedimentary series in the Manitou Lakes area. It is true that there is some variation in the kind of sedimentation in different areas, but that is to be expected. The Upper Manitou and Stormy lakes sediments are characterized by the presence of a large

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLII, pt. 4, 1933; Vol. XLIII, pt. 4, 1934.

amount of boulder conglomerate, in sharp contrast to the paucity of this rock in the Esox-Pipestone-Schistose lakes areas. With this exception there is no outstanding difference in the lithology of these separate bands of sediments.

There is evidence of an unconformity between the sediments and the Keewatin series in the Manitou lakes country.[1] While there is reason to believe that the sedimentary belts in the Rowan-Straw Lakes area lie stratigraphically above the greenstone complex, the only sign of an unconformity is the manner in which the west end of the Schistose lake sedimentary band lies across the contact between acid and basic types of flows and pyroclastics. South of the narrows at the entrance to Thomson bay in Pipestone lake a narrow band of sediments in the lavas is folded almost parallel to the contact of greenstone and sediments and suggests a conformity of the two series at this place. However, considering all the above-mentioned bands of sedimentary rocks as a unit, there is fair evidence of an unconformity between the Keewatin and sedimentary series. The latter corresponds to rocks of Timiskaming age found elsewhere in Northern Ontario.

Pre-Algoman Intrusives

Areas of dark-green to greenish-grey basic rocks of medium to coarse texture are intimately associated with the basic lavas. They are generally massive but are schisted locally, and the mineral constituents are always considerably altered. In the field they were roughly classified as gabbro, but microscopic examination of several samples from different points showed that diorite and quartz diorite are more common in occurrence than gabbro. On rare occasions a sharp intrusive contact with the fine-grained lavas was found, but ordinarily the transition from one type to the other is gradual. Some of the coarse-grained rocks are probably phases of lava flows. These gabbroic rocks are quite resistant to erosion and stand out as ridges.

A considerable area of these basic rocks occurs in the vicinity of the lower and central part of Pipestone lake and has been differentiated on the geological map, although the contact with the fine-grained basic flows is not well defined. Their relationship to the general structure suggests that they may be sills intruded more or less parallel to the flows and derived from the same magma that produced the lavas. Gabbroic rocks of similar appearance intrude the Timiskaming sediments in other parts of the country,[2] but it is possible that there are two or more ages of these altered basic plutonics.

An occasional lamprophyre dike occurs in the area. These dikes are often only one or two feet in width and are generally too small to be shown on the geological map. They intrude the Keewatin greenstones and Timiskaming sediments, but their relationship to the Algoman granite and porphyries was not determined. The lamprophyres are dark-coloured, medium- to fine-grained rocks, containing much mica, usually biotite.

Algoman

Granites and Gneisses

Large areas of granite and associated porphyries occur in various parts of the map area, but, as far as could be determined, they were all intruded during one period of plutonic invasion, although there is a considerable variation in

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLII, pt. 4, 1933, p. 20; Vol. XLIII, pt. 4, 1934, pp. 13, 14.

[2]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLII, pt. 4, 1933, p. 20; Vol. XLIII, pt. 4, 1934, p. 14.

texture, composition, and colour, and gradation from one type to another. Granite may be observed to grade laterally into some kind of porphyry in so many places that the age relationship between these two acid rock types seems quite definitely established. The granite does not intrude the Timiskaming rocks in the Rowan-Straw Lakes area, but numerous porphyry dikes intersect the slates and quartzites on Sucan lake. Masses of granite intrude the Timiskaming sediments in the vicinity of Esox lake, east of the map sheet (see map No. 43a). Thus part of the granite is definitely Algoman in age. The age of the remainder cannot be so definitely established, but in all probability it is also part of the same Algoman batholith.

The granite may be generally described as a medium- to coarse-grained rock, pink to grey in colour. It is almost entirely massive, although a little gneissic granite occurs in the southeastern part of the area, especially around Loonhaunt



Blocks (xenoliths) of greenstone (dark-coloured) in granite at the granite-greenstone contact, northern part of Lawrence lake.

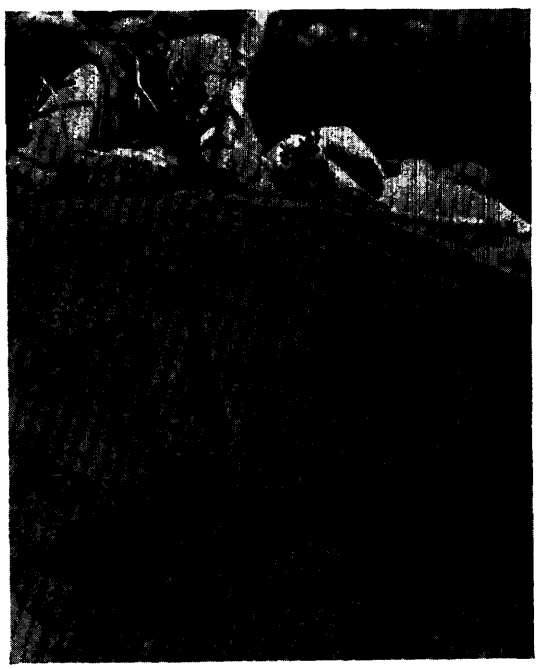
lake. The ratio of hornblende to biotite in the granite varies with the locality, the hornblende variety being more abundant near the greenstone contacts.

Near the margin of the granite areas there is often a gradation to other types of acid rock. This is well illustrated in the case of the small stock of granite north of the lower part of Pipestone lake. Tongues, dikes, and irregularly-shaped masses of porphyry grade laterally from massive pink granite. The transition is generally from granite to quartz-feldspar porphyry and then to a quartz or feldspar porphyry with large phenocrysts in a fine-grained groundmass. On the northeast side of Straw lake a grey quartz porphyry containing a large amount of free quartz occurs across a width of from 200 to 300 feet. To the north this grades into massive red granite without any visible contact. A similar transition to porphyry is found at the granite contact on Nightjar lake.

Conditions are encountered in some places that make the geological mapping of the granite-greenstone contact a matter of individual opinion and experience rather than the location of a well-defined change of formation. A contact complex is sometimes developed over a considerable area. This zone

will contain blocks of the older greenstone, hybrid rocks formed by the fusion and mixture of granite and greenstone, and a variety of dikes and irregular intrusive masses of different phases of the granite.

Contact conditions of this nature are found on Bluffpoint, Lawrence, Hector, and Priam lakes, and also along the granite-greenstone contact north of Rowan lake. In contrast to this, the contact of the stock of granite south of Rowan lake and the similar area on Ajax lake is quite sharp and well defined. On Bluffpoint lake a contact zone containing granite, granodiorite, gabbro, and greenstone, sometimes recrystallized to amphibolite, occurs across a width of approximately one mile. The transition is roughly from granite to granodiorite



Fragments of greenstone (xenoliths) that have been partly digested in a hornblende granite at the granite-greenstone contact, Lawrence lake. The upper part of the picture shows the hornblende granite cut by a massive grey granite.

and from granodiorite to gabbro near the greenstone body. A large number of greenstone inclusions are found in the basic marginal phase of the batholith.

On Lawrence lake hybrid hornblende granite and granodiorite containing numerous partly assimilated fragments of greenstone are cut by massive biotite granite (see photograph above). The biotite granite is regarded as a later phase of the granitic magma that was injected into the earlier-formed marginal granite. This marginal rock was consolidated as soon as the magma lost the superheat necessary for further stoping action, but while the magma at greater depths was still molten. North of Rowan lake almost every type of plutonic rock between granite and gabbro in composition might be distinguished in the contact zone, but areas of massive pink biotite granite are also associated with them.

In a previous report the writer has discussed the problem of the age relationship of the different rock types at the granite contacts.[1] It was suggested that the more basic marginal phase of this granite batholith is due either to differentiation within the granitic magma or to assimilation of large amounts of basic lavas near the contact. Field evidence obtained in 1934 tended to support the latter theory. In the adjoining Kakagi Lake area Burwash[2] has noted the more basic marginal phase of this same granitic batholith but offers a different explanation of its origin.

Microscopic examination of the different granitic rock types aided in the finer distinction between the various phases but largely confirmed the field classification.



A series of porphyry dikes intersecting the Keewatin greenstone on an island in the central part of Rowan lake.

Acid Porphyries and Aplite

As already stated, granite may be observed to grade laterally into porphyry in several places, and it is quite evident that both types of rocks are of the same age and were derived from the same parent magma.

A large percentage of the porphyry occurs as dikes, which were injected parallel or nearly parallel to the strike of the schistosity of the adjoining rocks. These dikes range from a few inches to 100 feet in width. Individual dikes have been traced a distance of half a mile along the strike. On Rowan lake a band of porphyry was picked up at intervals for about 2½ miles along the strike. This band consists of a branching network of more or less parallel dikes, which coalesce in certain places along the strike to one main body and then divide again. On one of the islands in the lake 22 porphyry dikes, from 1 to 6 feet wide, were counted over a width of 150 feet (see photograph above).

Quartz porphyry is the commonest type of these dike rocks. It is typically a greyish to cream-coloured rock, generally massive but sometimes schistose, and is distinguished by the presence of distinct "eyes" of quartz. In some of

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLIII, pt. 4, 1933, p. 15.
[2]E. M. Burwash, Ont. Dept. Mines, Vol. XLII, pt. 4, 1933, pp. 55, 56.

the quartz porphyry dikes adjacent to the Dash and Phinney lakes porphyry stock, these quartz phenocrysts are over half an inch in diameter and form a striking contrast to the fine-grained cherty groundmass. Feldspar porphyry differs from the quartzose variety only in the occurrence of feldspar phenocrysts instead of quartz. Some of the porphyries contain both quartz and feldspar crystals. Granite porphyry differs from those already mentioned in that the phenocrysts occur in a rather coarsely crystalline or granitic-textured groundmass. A small stock of this rock occurs on Furlonge lake. It contains perfect crystals of pink orthoclase up to an inch in length in a granitic groundmass. Aplite generally occurs as narrow dikes. It is a dense fine-grained intrusive and is a finely crystalline equivalent of the granite.

In the vicinity of Straw lake the intrusive porphyries and the extrusive rhyolites and trachytes are rather similar in appearance, and it is sometimes

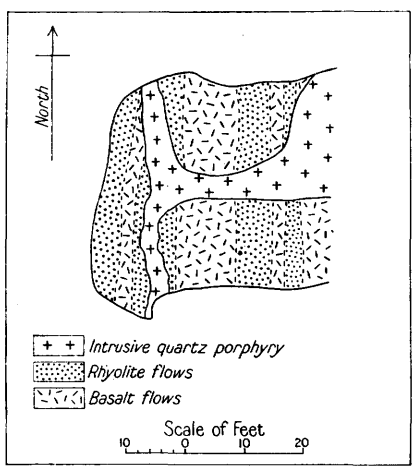


Fig. 3—Diagram showing the relation of the quartz porphyry to the lava flows, northeast of Line bay on Pipestone lake.

difficult to distinguish between them. In general the acid lavas are more schisted than the porphyries, and phenocrysts of quartz are seldom seen in the rhyolites but are common in the porphyries. The fact that there are two distinct ages of acid rocks in this vicinity is proved at several places south of Straw lake. The relationship is well shown a short distance west of the portage to Sucan lake. Here, a fine-grained, greyish rhyolite with flow structure is cut at about right angles to the schistosity by a massive quartz porphyry dike containing distinct quartz phenocrysts. Half a mile northeast of Line bay in Pipestone lake narrow flows of fine-grained, white trachyte are interbedded with flows of dark-green basalt. These are intersected by dark-grey quartz porphyry dikes in such a manner that there is no doubt as to the relationship (see Fig. 3).

Some of the porphyry dikes contain a large amount of quartz. This is generally present as a network of small veins and stringers. The pattern formed by these veinlets suggests that they occupy tension cracks, which were developed by shrinkage of the dike on cooling. Tourmaline and carbonate are sometimes associated with this quartz, and gold has been found in it.

On the north side of Dash lake there are small irregular areas of fragmental rocks that have been grouped with the porphyries on the geological map. Fragments of foreign porphyritic material are embedded in the quartz porphyry matrix, so that the rock has the appearance of a volcanic breccia. It is possible that these inclusions have been picked up by the invading quartz porphyry magma, in which case the fragmental rock is only a phase of the intrusive.

Keweenawan

Dikes of massive basic rock resembling Keweenawan diabase intersect the Keewatin greenstone and Algoman porphyry in the vicinity of Phinney and Dash lakes. Microscopic examination of the rock revealed that it has the composition of a diorite. Geological surveys in adjoining areas[1] have shown that these dikes of probable Keweenawan age are diorites rather than the typical diabases of the Lake Superior region.

Pleistocene and Recent

There are no very extensive areas of glacial deposits in the map area, although sand and clay soils occur everywhere in the valleys. Along the south shore of Rowan lake a mantle of boulder clay, 3 to 4 feet in thickness, usually overlies the pre-Cambrian rocks. Gravel banks of considerable thickness were noted on an island north of the old Monte Cristo mine and at the narrow entrance to a long bay about a mile and a half north of this island. The gravel is coarse and full of boulders and contains some clay. There is no appearance of bedding or sorting to suggest that it is a glacial outwash deposit. The gravel deposits are probably kames formed at or near the edge of the ice-sheet.

A ridge of glacial material runs parallel to the south shore of the lower part of Pipestone lake and has the characteristics of a moraine. Glacial striae, grooves, and pot-holes are other evidences of continental glaciation in the area. Glacial striae show the direction of ice movement to have been S.20°W. to S.50°W. A pot-hole that had been cut to a depth of 10 feet in massive greenstone was observed on the shore of Pipestone lake. It is about 3 feet in diameter.

ECONOMIC GEOLOGY

Nature and Location of the Gold Deposits

To date, gold is known to occur in the following parts of the Rowan-Straw Lakes area: (1) on mining locations around Straw lake, (2) north of Line bay in Pipestone lake, (3) west of Bethune lake, and (4) at the old Monte Cristo mine on Rowan lake. Claims have been staked on Brooks lake, but it is not definitely known that gold was ever found. At these places the gold occurs chiefly in quartz veins located in Keewatin greenstone but is also found in porphyry and sheared zones in the lavas. The known auriferous veins contain varying amounts of sulphides, generally pyrite and traces of chalcopyrite. In the main vein on the property of Straw Lake Beach Gold Mines the gold is closely associated with the bismuth telluride, tetradymite; and traces of galena and sphalerite are also found. Carbonate and tourmaline often occur with the quartz veins.

[1]E. M. Burwash, Ont. Dept. Mines, Vol. XLII, pt. 4, 1933, p. 70.
Jas. E. Thomson, ibid, Vol. XLIII, pt. 4, 1934, p. 17.

The gold deposits that have been uncovered to date are usually found in close proximity to bodies of Algoman porphyries, and there is every reason to believe that they are genetically related to these intrusives.

Prospecting Conditions

As the rocks in the area are similar to those in which the gold deposits of Northern Ontario are often found, the Rowan-Straw Lakes area may be regarded, in a general way, as favourable country for prospecting. The gold deposits seem to be closely associated with intrusive porphyries of Algoman age. Thus, it is only logical to assume that those areas containing schistose or fractured Keewatin greenstones or Timiskaming sediments that are intruded by porphyries should be of most promise to prospectors. Study of the geological map will show that these theoretically ideal geological conditions for the occurrence of gold occur in certain parts of the area.

A band of well-schisted acid lavas extends eastward from Straw lake beyond the limits of the map-sheet, and porphyry intrusives are quite numerous between Straw and Kaiarskons lake. During the excitement of gold discoveries on Straw lake in 1933, most of this country was staked. Assessment work on the claims in this area in 1934 failed to reveal any important new gold showing.

The country near the large irregularly shaped areas of intrusive porphyry in the vicinity of Dash and Phinney lakes does not seem to have received much attention from prospectors. In contrast with structural conditions south of Straw lake, both porphyry and greenstones in this area are rather massive and "tight." An occasional quartz vein, however, was seen by the writer's party in the vicinity of this porphyry. Gold has been found in association with the porphyry on the Bethune claims west of Bethune lake. On Dash lake some sulphides are found in the quartz porphyry. A grab sample from one location on the shore gave no gold values.

Several bodies of massive sulphides occur around Pipestone and Furlonge lakes, but none are known to contain gold values. They are chiefly pyritic replacement masses in the greenstones, but sometimes pyrrhotite and traces of chalcopyrite are associated with the pyrite. Several lenticular bodies of almost solid sulphides are found near the stock of granite porphyry on Furlonge lake. These have been described in a previous report.[1] A small amount of sugary white quartz is sometimes associated with the sulphides on Pipestone lake. At the entrance to Stonedam lake a shaft was sunk on a body of sulphides many years ago. A grab sample of the sulphide material on the dump gave no gold values when assayed.

In certain parts of the area, particularly on Pipestone and Brooks lakes, there are large areas of carbonated lavas. These are characterized by a rusty surface weathering and often contain a network of small, irregular, white quartz veins, and traces of sulphides, generally pyrite. As far as is known, these zones of carbonated lavas are practically devoid of gold values.

Some quartz veins occur near the central part of Pipestone lake, and gold has been found north of Line bay; but most of the veins observed around the lake-shore contained white quartz. Few quartz veins were seen in the northern part of the area. A vein containing sulphides occurs on the large island on the north side of Rowan lake near the edge of the map-sheet, but a grab sample of the most promising-looking material gave no gold values.

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLIII, pt. 4, 1934, p. 19.

Gold has been found in quartz veinlets in a porphyry dike on the property of the Straw Lake Syndicate at Straw lake. Similar dikes occur in some parts of the area and occasionally contain a considerable amount of sulphide mineralization. Gold could not be panned from any of these dikes seen by the writer's party.

Description of Properties

Monte Cristo Mine

The old Monte Cristo mine is located on the south side of Rowan lake near the edge of the map-sheet. It has been discussed in considerable detail by Burwash.[1] A number of trenches have been cut across a sheared zone in basaltic lava that runs about parallel to the shore-line. The sheared zone contains soft, fissile chlorite schist, which is highly carbonated in places. Disconnected stringers and lenses of quartz run in all directions through the schist. Some of the quartz masses are 2 to 3 feet in width but seem to have no continuity along the strike. The quartz is white and sugary and contains some carbonates and traces of sulphides. The schist at the vein wall sometimes carries small cubes of pyrite and traces of chalcopyrite. The rock near the showing is basic lava with interbanded sediments to the north. The lava is cut by massive porphyry dikes. According to Burwash[2] and Cross,[3] sampling of this schisted zone has indicated low gold values across considerable widths.

Bethune Claims[4]

A group of claims located between Bethune and Nightjar lakes is owned by F. H. Bethune and sons, of Emo. The showing consists of a quartz vein, which lies between a quartz porphyry dike and massive greenstone. The largest exposure of the vein is 110 feet in length and from 3 to 16 inches in width. To the west this exposure disappears under a swamp, but some quartz occurs along the strike to the east. The basaltic wall rock is slightly mineralized, but the porphyry is not. The porphyry is cut by small unmineralized quartz stringers. Two kinds of quartz are found in the vein, a white sugary variety, which contains rather fine visible gold, and a dark-coloured quartz, which is mineralized with pyrite and chalcopyrite along fractures. Five channel samples across 2 feet, at intervals over a length of 200 feet, are reported to show from 0.02 to 0.98 ounces gold per ton.

Sullivan-Phinney Claims

A group of claims was staked on the north side of Line bay in Pipestone lake during the summer of 1934 by Charles Phinney and Geo. L. Sullivan and sons. Some small gold-bearing veins were uncovered during the summer. A flat-lying vein in basic greenstone, 6 inches in width, contains some sulphides and visible gold but had not been traced any appreciable distance when seen by the writer.

Prout Claims

During the summer of 1934 J. W. Prout, of Fort Frances, staked a group of claims on Line bay. These adjoin the Sullivan-Phinney claims on the west. A dome-like mass of quartz, 65 feet by 60 feet in surface dimensions, is exposed

[1]E. M. Burwash, Ont. Dept. Mines, Vol. XLII, pt. 4, 1933, pp. 86-89.
[2]Ibid.
[3]J. G. Cross, personal communication.
[4]Description from notes of B. T. Wilson, field assistant.

at one location on the claims. The quartz is white and glassy in appearance and contains small inclusions of carbonated and pyritized greenstone. The country rock is massive carbonated basalt. Other small areas of white quartz have been uncovered, but none look very promising as gold-bearing material.

Straw Lake Beach Gold Mines Syndicate, Limited

A gold discovery was made in 1933 on the southeastern shore of Straw lake by Murdock Mosher and Fred Grozelle. A thorough programme of surface trenching and test-pitting was carried out on this property by Moneta Porcupine Mines, Limited, during the following winter and spring. The showing proved of sufficient importance that underground work was recommended and the Straw Lake Beach Gold Mines Syndicate, Limited, was organized to carry out



Quartz vein on Prout claims, north shore of Line bay, Pipestone lake.

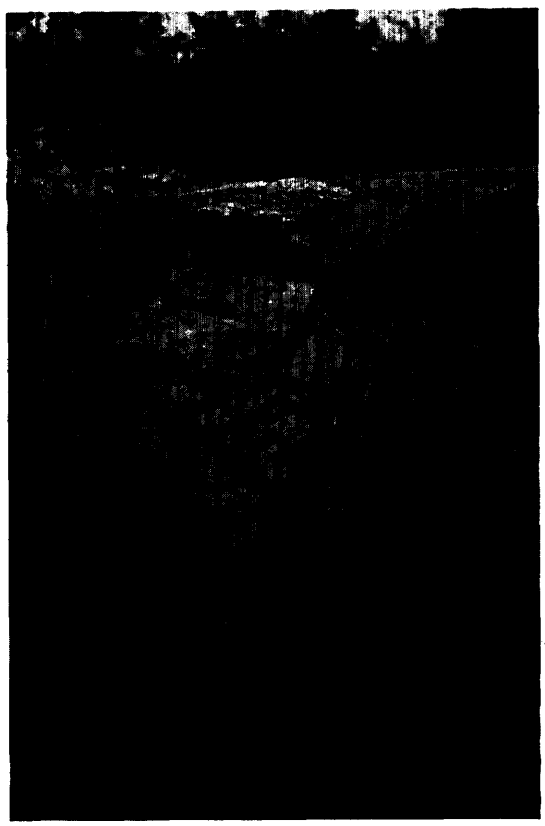
this programme. A shaft was sunk 120 feet on the vein, and by May, 1935, 576 feet of drifting and 56 feet of crosscutting had been completed on the 100-foot level. The company plans to sink the shaft to the 300-foot level, where development will be continued.

The geology of this property has been discussed in a previous report.[1] The exposed rocks in the vicinity of the vein are light-coloured rhyolites and acid fragmentals. The fragmental rock looks somewhat like agglomerate but is interpreted as being a brecciated rhyolite. Outcrops a short distance southwest of the shaft show massive rhyolite, but near the vein the rock is more schisted and sericite schist is developed to some extent. Massive quartz porphyry cuts the rhyolite.

Vein material has been uncovered in trenches and test pits along a general east-west zone on claims K.3,944 and K.3,943 (Fig. 4). At the eastern end a quartz vein, known as the Mosher vein, carries gold values for a considerable distance along the strike, and development work to date has been largely concentrated on this section.

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLIII, pt. 4, 1934, pp. 22-26.

The Mosher vein is located along a sheared zone in acid lava. Its general strike is N.80°E., although in the central section it swings to about N.60°E. The dip is about vertical. The vein material consists of quartz and schist containing varying amounts of pyrite, chalcopyrite, tetradymite (bismuth telluride), and native gold. Galena, magnetite, and sphalerite have been found by microscopic examination of the ore. Visible gold occurs frequently and is always closely associated with the tetradymite.



Exposure of a gold-bearing quartz vein in a test pit, Straw Lake Beach mine. A shaft has been sunk at this location.

The vein quartz is from 2 to 25 inches in width on the surface. At some places, and especially near the shaft, it branches into small, closely spaced, parallel veins and has the form of a lode. In some of the pits east of the shaft only small irregular veinlets of quartz are found in the sheared zone, but sulphide mineralization occurs. Vein quartz is again found in the pits near No. 4 pit.

Two types of schist are associated with the vein quartz: a light-coloured silicified schist with sulphides, and a dark-coloured chloritic schist. It has been found that the light-coloured silicified schist carries gold values, whereas the dark-coloured variety generally contains only traces of gold. In some places in the drift on the 100-foot level the silicified schist along the sheared zone carries sufficient gold values to make ore, even when the vein quartz pinches out. On

the surface the silicified schist is generally adjacent to the quartz, and the dark-coloured schist merges into the more massive wall rock; but places were noted where light-coloured schist occurs on one side of the quartz vein and dark-coloured schist on the other. Sometimes a fairly sharp line of contact between the two kinds of schist may be observed. Along certain sections of the vein no silicified schist is found.

Surface sampling of the Mosher vein during the summer of 1934 indicated that a section of it, 600 feet in length (from pit No. 28 to pit No. 4), averaged 0.80 ounces of gold across an average width of 13.4 inches. In December, 1934, W. E. Segsworth, president of the company, officially reported that values were obtained to a depth of 35 feet in the shaft, but the vein was very narrow from the 35-foot to the 100-foot level and the assays were low. The first 96 feet of drifting to the west on the 100-foot level indicated such erratic values that no attempt was made to compute them. In May, 1935, Mr. Segsworth reported that two ore shoots had been encountered in the east drift: The first shoot is 198 feet long, 32.8 inches wide, and averages 0.64 ounces gold per ton; the second shoot is 80 feet long, 31.8 inches wide, and averages 0.42 ounces gold per ton.

A mineralized zone has been uncovered west of the Mosher vein and is known as the Sulphide vein. It strikes approximately E.10°S. and lies about 50 feet north of the projected strike of the Mosher vein, but it could be a continuation of the latter if it were to bend somewhat to the north. The Sulphide vein consists of a quartz vein, which has been traced 125 feet, and sulphide replacement zones, which are revealed at intervals along the strike in the schisted and brecciated rhyolite. In places the vein quartz is well mineralized with pyrite and chalcopyrite. Gold values are reported from a few grab samples taken from the Sulphide vein, but no systematic channel sampling has been done on it to date.

Konigson Claims

The Konigson claims are located on the north shore of Straw lake, north of the claims of the Straw Lake Beach Gold Mines Syndicate, Limited. A shaft has been sunk to a depth of about 40 feet on a gold-bearing vein. This showing was discussed in a previous report.[1] No work was done on this property in 1934 on account of a dispute over the ownership of certain adjoining claims.

Straw Lake Mining Syndicate

A gold discovery was made on the southwest side of Straw lake in 1933 by Wm. Lucy of Fort Frances. The Straw Lake Mining Syndicate carried on development work on this property in 1934. The showing consists of a feldspar porphyry dike, which contains a network of quartz veinlets and stringers. The dike has been traced for approximately 1,950 feet across claims K.4,016 and K.4,017. A similar dike has been picked up along the strike on the Mathieu claim to the west and traced about 450 feet.

The feldspar porphyry dike has been opened up by surface stripping and sinking of test pits. The strike of the dike changes from E.5°S. to E.35°S. as it crosses the property. The dip is about vertical. It varies from 3 to 15 feet in width and intersects basaltic greenstone, which is sheared in some places to chlorite schist. A small amount of carbonated rhyolite and sericite schist

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLIII, pt. 4, 1934, p. 21.

is interbanded with the basic flows on the property. A few quartz porphyry dikes intrude the lavas.

The feldspar porphyry contains crystals of feldspar up to a third of an inch in length and has a sharp intrusive contact with the lava. The prophyry is somewhat carbonated and carries some fine-grained sulphides. The quartz veinlets in it are white and contain some carbonate, but are practically devoid of sulphides. They are almost always less than 6 inches in width and in places form a pattern that suggests that they occupy tension cracks developed in the dike on cooling. A little native gold has been found in the quartz.

No channel sampling had been done on the showing at the time of the writer's visit in August, 1934. Selected grab samples of the porphyry are reported to have assayed as high as 0.03 ounces gold per ton, and selected grab samples of the quartz from 0.15 to 0.52 ounces gold.

Gold Deposits on the Lake of the Woods

By Jas. E. Thomson

Introduction

During September and October of 1934, the writer visited most of the mining properties on the Lake of the Woods and Shoal lake where active development was in progress. There has recently been a distinct revival of mining activity in this section of the district of Kenora. Almost all the mines and prospects discussed below were opened up during the early days of mining development in this region, and some produced a certain amount of gold. On the whole, however, gold mining in the Lake of the Woods country was not

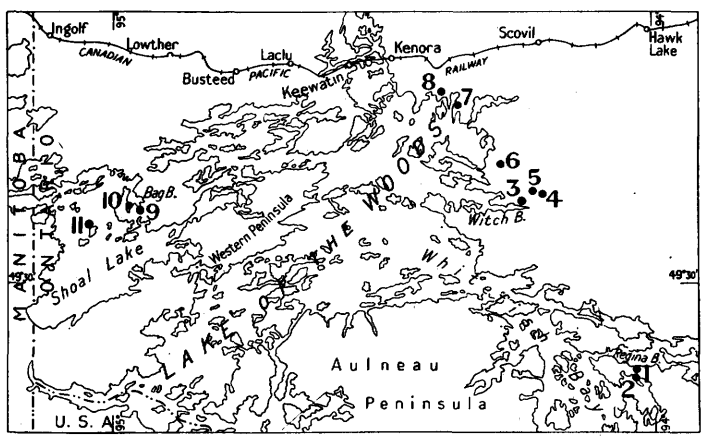


Fig. 1—Key map showing the location of gold properties on the Lake of the Woods and Shoal lake. Scale, 16 miles to the inch.

1. Horseshoe Mines.
2. Abraham claims.
3. Wendigo Gold Mines.
4. Witch Bay Gold Mines.
5. Stella-Lac La Belle Mines Syndicate.
6. Johnson-Nilson claims (Golden Gate mine).
7. Bigstone Bay Gold Mines (Gold Creek mine).
8. Aronek Gold Syndicate.
9. Kenora Prospectors and Miners (Mikado mine).
10. Kenora Prospectors and Miners (Cedar Island).
11. Duport Mining Company (Cameron Island).

successful at that time. Most of the properties have lain idle for many years. The recent revaluation of gold has been the chief incentive for reworking a number of these deposits. Encouraging results are now being obtained at some properties. With the introduction of new and efficient prospecting and mining methods and the proper management as the result of experience accumulated from successful gold mining in other parts of Northern Ontario, it seems possible that some of the gold deposits around the Lake of the Woods may be developed into profitable producing mines.

The general geology and mineral deposits of the Lake of the Woods region have been discussed in numerous reports of the Geological Survey of Canada

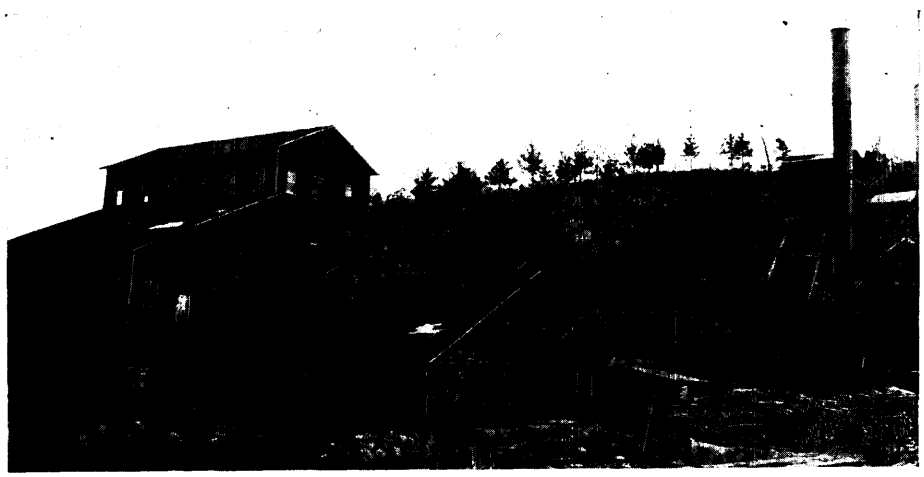
and the Ontario Department of Mines. This report deals chiefly with recent mining developments and the more detailed geology in the vicinity of the gold occurrences, but no attempt is made to discuss the general geology of any particular area.

Acknowledgments

The writer wishes to gratefully acknowledge the kindness and hospitality of officials of the various mining organizations with whom he came in contact. Every possible assistance was rendered at all the properties visited. Much of the information in this report was obtained by a study of mine maps and records placed at the writer's disposal. Special acknowledgment for many courtesies is due W. A. Lamport, president, and Geo. Marwick, caretaker, of the Horseshoe Mines, Limited; C. L. Spencer, manager, H. G. Young, managing director, and R. E. L. Lott, of the Wendigo Gold Mines, Limited; F. M. Passow, manager of the Witch Bay Gold Mines, Limited; Mrs. Thayer Lindsley, manager, and Geo. H. Ince, secretary, of Kenora Prospectors and Miners, Limited; J. G. Cross, president and manager of Duport Mining Company, Limited; H. E. Silver, of Bigstone Bay Gold Mines; and J. D. C. Smith, mining recorder at Kenora. A sketch map of the showing on the Johnson-Nilson claims and information regarding the veins were obtained from a report by A. K. Muir, mining engineer. A geological map of Cameron island and neighbouring islands, prepared by P. E. Hopkins, consulting geologist, was kindly furnished by J. G. Cross. The writer is indebted to D. R. Derry, geologist of Ventures, Limited, for valuable information regarding the geology near Cameron island.

The writer was ably assisted in the field by W. R. Newman, who did a considerable part of the detailed geological mapping.

Polished sections of ore and photomicrographs were made by J. Ellis Thomson, professor of mineralogy of the University of Toronto.



View of Horseshoe mine, Regina bay.

Horseshoe Mines, Limited

The property of the Horseshoe Mines, Limited, includes the old Regina mine, which is situated on the south shore of Regina bay, an eastward extension

of Whitefish bay. There is some doubt as to the actual amount of gold removed from the mine in the early days. The mine is generally credited with a production of $500,000, but one report states that it was about $200,000.[1] All authorities seem to agree that it was operated at a loss. It is quite evident that this was at least partly due to mismanagement.

History and Development

The vein was discovered in 1894. Mining and milling began on the property in 1895 and continued until 1899. About 1901 a new 30-stamp mill was operated for a short period, and again in 1905 some milling was done. In 1911 the property was examined by the Coniagas Mining Company. In 1921 the Regina Reef Gold Mines was formed to develop the property but no work was done, although the shaft was dewatered in 1924. In 1929 the Horseshoe Mines, Limited, took over the property.

The old mine workings were thoroughly sampled in 1931 by F. L. Smith, acting for K. A. MacPhayden of Toronto. The examination revealed a section of ore on the deepest of the old levels. Accordingly, a winze was sunk below this level. In 1934, 131 feet of drifting was done along the 4th level to the south.

The main shaft has been sunk on No. 3 vein. Nine levels have been opened up to a depth of 540 feet. A winze has been sunk 127 feet below the 9th level, and a little drifting has been done on the 10th level. The shaft follows the vein to the 6th level but in doing so makes a slight bend and would have to be straightened before any ore could be hoisted to the surface. From the 7th to the 9th levels short crosscuts have been made from the shaft eastward to the vein. The writer was able to see the vein in the shaft and in several of the drifts down to the 9th level but did not get down the winze below this level.

General Geology

The rocks on the property consist of basic lavas that have been intruded by a stock of granite. The surface geology has been discussed in detail by Bruce.[2] The intrusion of the granite seems to have taken place with very little disturbance. Both on the surface and underground the contact between the two rocks is quite sharp and the greenstones show little evidence of alteration by the granite. A few dikes of granite cut the greenstone near the contact.

Veins

A number of roughly parallel veins have been found on the property, some of which contain gold, but the most important is No. 3 vein. It strikes approximately E.25°S. The dip is about vertical in the upper part of the mine, but from the 6th to the 9th levels it dips 80° to 85° N.E. The strike is transverse to the granite-greenstone contact. At the collar of the shaft the vein lies in granite, but to the southeast it passes into the greenstone. The contact between the granite and greenstone dips to the north at such an angle that while the upper workings are in granite the shaft passes into greenstone at the 3rd level, and the vein in the lower workings is very largely in greenstone (see Fig. 2). Granite dikes are found in the shaft between the 7th and 9th levels. The last 17 feet of the winze below the 9th level and the drifting on the 10th level was

[1]E. L. Bruce, Ont. Dept. Mines, Vol. XXIV, pt. 6, 1925, p. 10.
[2]Ibid.

in granite. The vein does not continue into the granite at these places. There was not sufficient work done to determine if this is the main granite mass or only a dike. The projection of the granite-greenstone contact from the upper levels would carry it about 250 feet to the north of the winze.

Immediately south of the shaft-house the vein consists of white quartz with some iron stain. The granite walls are very sharply defined, and the wall

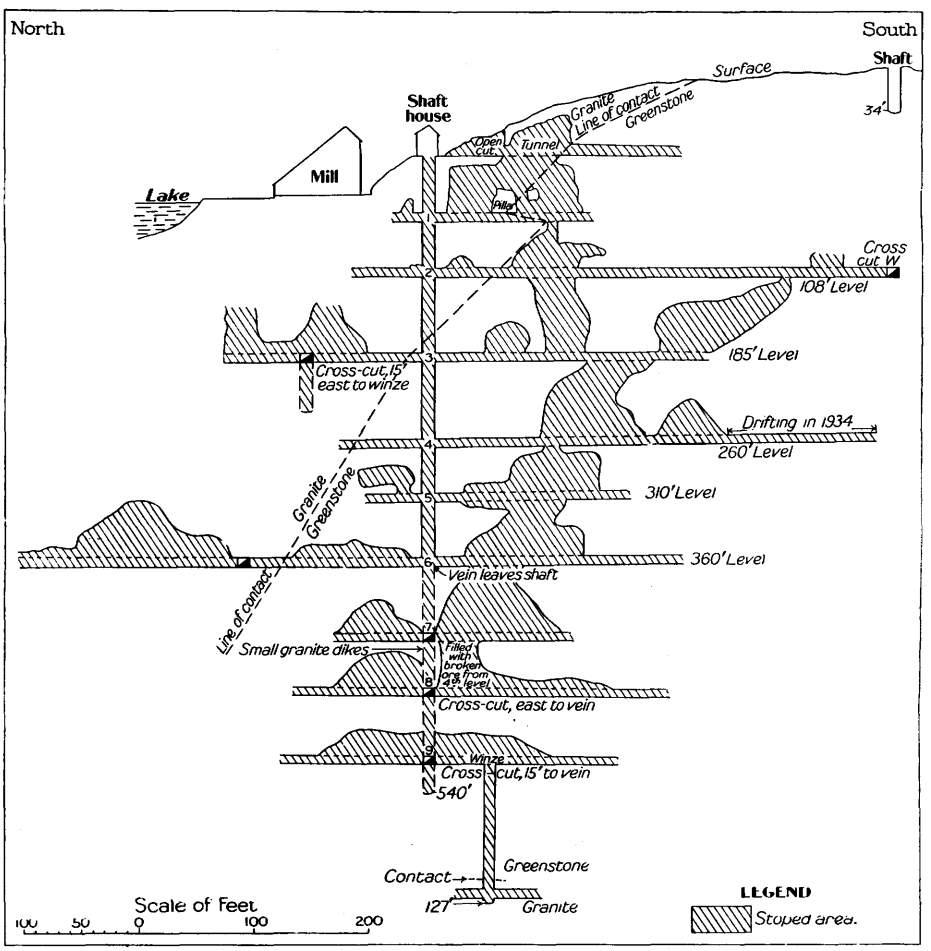


Fig. 2—Vertical section on No. 3 vein, Horseshoe mine, showing underground workings.

rock seems to have undergone little alteration. Microscopic examination of a sample of granite from the walls of the vein on the 4th level, however, showed great alteration of the constituent minerals. The feldspars are completely sericitized, and quartz, pyrite, and carbonate have been introduced. Original quartz phenocrysts are largely granulated. The original granitic texture is almost completely obliterated.

In the underground workings the vein material consists largely of white quartz, which carries fine-grained pyrite in places. Where the vein lies in greenstone, pyritized and silicified chlorite schist occur with the quartz, especially

along the walls. Native gold has been found but, on the whole, the content is very small. Sampling of the mine has indicated that the values are largely confined to the quartz.

If it is assumed that the location of the stopes indicates the position of the ore shoot, the main ore body was in the granite at the surface but passed into the greenstone below the 1st level. The ore shoot appears to have been continuous, varying in length from level to level but chimney-like in outline. Below the 3rd level the ore shoot rakes to the north and lies roughly parallel to the granite contact. The width of the stopes varies from 3 feet on the upper levels to 9 feet in places on the 9th level. On the 9th level the vein is much stronger in physical appearance and better defined than at the surface, where only a small portion of it outcrops. F. L. Smith has estimated that the whole stoped section had an average width of about 5 feet.

In the greenstone the vein material consists of the main quartz lenses with areas of chlorite schist impregnated with fine pyrite. The quartz lenses vary in width and length; in other words, it is the composite or lode type of vein. While the vein may be observed to cross the granite-greenstone contact (e.g. on the 3rd level) without any perceptible physical change, it does not continue as strongly in the granite and becomes more irregular in outline. Although the bulk of the ore came from the portion of the vein lying in greenstone, the richest ore is reported to have been obtained from the winze below the 3rd level. This section of the vein is located in the granite.

Ore Reserves

A hundred samples of mill tailings taken by F. L. Smith in 1931 are reported to have indicated 8,000 tons of such material averaging 0.15 ounces of gold per ton.

Most of the ore above the 9th level was removed in the early days. The above-mentioned report states, however, that 6,128 tons of ore, averaging 0.41 ounces gold, remain in various places above the 9th level. On the 9th level there is a section of the vein, 120 feet in length, that is reported to average 0.57 ounces gold across an average width of 6 feet 1 inch. In the winze a section from the 9th level to 82 feet below that level is reported by Horseshoe officials to average 0.43 ounces across 35 inches.

In any future development attention should be paid to the possible downward projection of the ore shoot below the 9th level and to the north of the 10th level. Diamond-drilling from the 10th level might be of great assistance in delimiting the granite encountered in that vicinity.

Abraham Claims

Some development work was done in 1934 on the mining claims of Michael Abraham, which adjoin the Horseshoe property. The main showing is located near the claim line of K.3,655, about 400 feet west of No. 1 post. A quartz vein, located along a sheared zone, 8 feet wide, in massive basalt, is well exposed at the bottom of a pit 25 feet deep. Here, the main quartz leader is about one foot wide, but there is considerable quartz across 3 feet, and a number of parallel quartz stringers occur in the schisted wall rock. The vein strikes E.20°S. and dips 70°N.E. The quartz has a bluish shade and is well fractured; it carries a fair amount of fine-grained pyrite and chalcopyrite. A number of channel samples taken from this pit are reported to have given encouraging gold values across an average width of 44 inches.

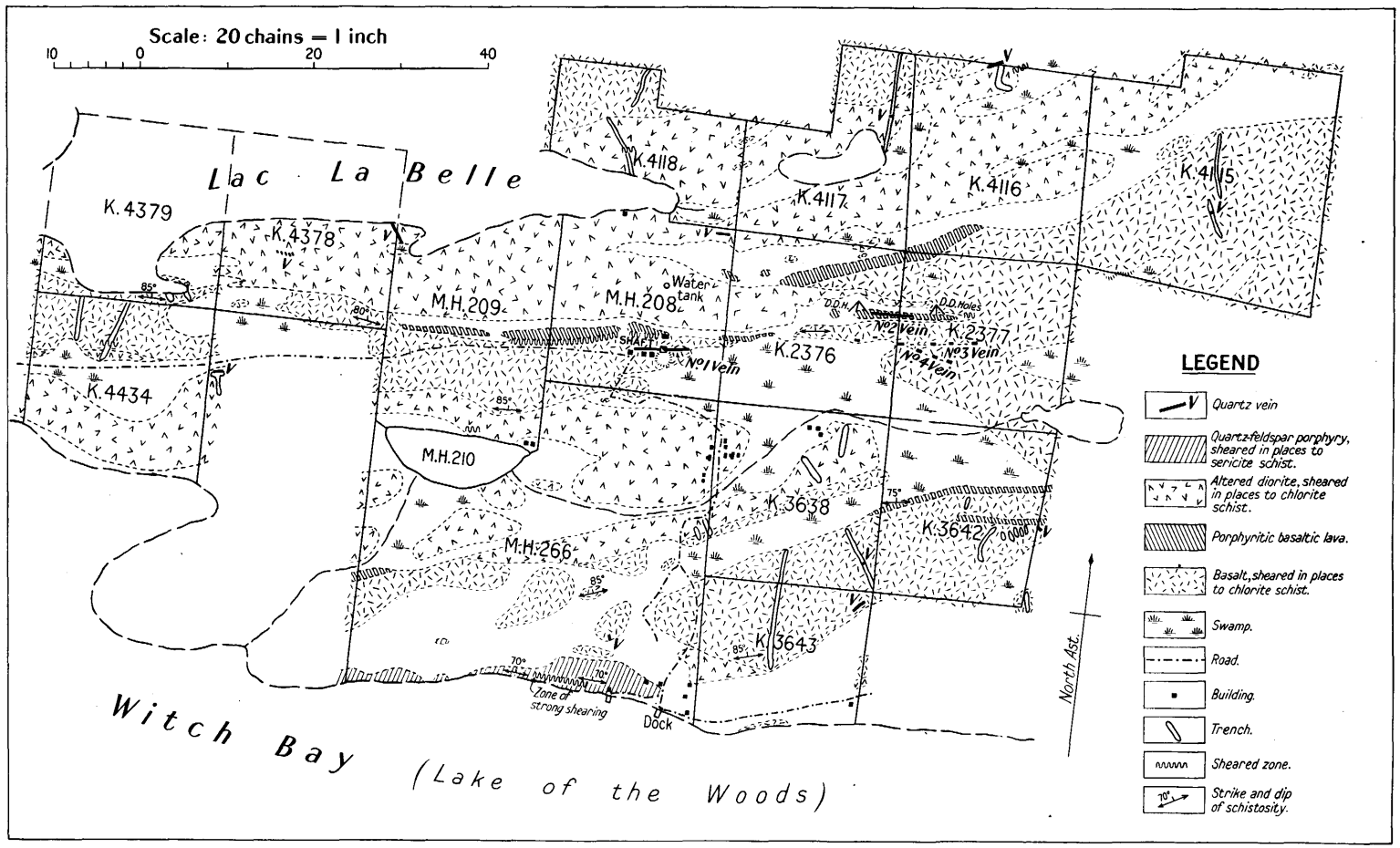


Fig. 3—Geological sketch map of the claims of Wendigo Gold Mines, Limited.

The vein has been traced 50 feet to the east of the test pit, at which point it disappears under drift and swamp. It is exposed for a distance of about 40 feet west of the pit. Three hundred feet farther along the strike, on the Horseshoe property, an old shaft is located on a sheared zone in the basalt. No quartz was seen at the shaft.

Wendigo Gold Mines, Limited

Wendigo Gold Mines, Limited, owns a group of 16 mining claims on the north shore of Witch bay, an eastward extension of Andrew bay. Active development of the property by this company began in the fall of 1933. Former operators had sunk 2 shafts, one of which reached a depth of 110 feet, on the main vein, and had done some lateral work at the 50- and 100-foot levels. Surface trenching and stripping by the present owners has revealed a number of



View of Wendigo mine, Witch bay.

veins and sheared zones on the claims, but development work has been largely concentrated on No. 1 vein (see Fig. 3). A complete mining plant has been installed and active underground development is being carried on. An inclined shaft has been sunk on the vein to a depth of 518 feet, and new levels have been opened at depths of 200 feet, 350 feet, and 500 feet. A considerable amount of drifting has been done on these levels.

General Geology

The geology in the vicinity of the property has been described by Suffel.[1] The rocks consist largely of alternating bands of basalt, porphyritic basaltic lava, and diorite. A small amount of quartz-feldspar porphyry occurs along the shore of Witch bay.

The basalt is a dark-green, medium- to fine-grained rock and in many places is altered to chlorite schist, especially near veins and in sheared zones. Associated with the basalt are bands of porphyritic lava. These consist of crystals of feldspar, sometimes rounded, in a fine-grained basaltic matrix. This porphyritic phase is easily recognized and is believed to represent either an

[1]G. G. Suffel, Ont. Dept. Mines, Vol. XXXIX, pt. 3, 1930.

entire flow or a horizon in a flow. A band of this material was traced for a considerable distance across the property north of No. 1 vein. The boundaries of the porphyritic material are not well defined. There is a gradual transition to ordinary basalt by diminution of the number of feldspar phenocrysts in the lava matrix. These bands of porphyritic lava are important because they mark certain horizons in the greenstone complex and might be valuable in solving structural features.

The diorite is generally a medium- to coarse-grained rock, but near the boundaries of the mass it becomes much finer-grained and is difficult to distinguish from basic lava. It is possibly later in age than the lava, but no definite intrusive contacts were seen. Sheared zones occur locally in the diorite, and at these places the rock is altered to chlorite schist. The massive diorite is resistant to erosion and stands out as ridges. A ridge of typical diorite outcrops north of the mining plant at No. 1 vein. Thin sections of this material show that the rock is greatly altered and consists of hornblende crystals almost entirely altered to chlorite, kaolinized andesine feldspar, and a few stringers and crystals of carbonate.

Along the north shore of Witch bay the quartz-feldspar porphyry is very highly sheared to fissile sericite schist, but 200 feet from the shore the rock is more massive and contains distinct "eyes" of quartz and feldspar a quarter of an inch in diameter. In some places elongated, angular fragments are found in the porphyry. The contact with the greenstone is largely drift-covered, but no evidence was found that the porphyry is intrusive into the lava. Suffel[1] does not regard this porphyry as an intrusive.

An aplite dike occurs a short distance south of No. 4 vein and is the only evidence of acid intrusives on the claims. It is about 2 feet wide and cannot be traced any appreciable distance.

Geological Structures

The bands of porphyritic lava in the greenstone complex indicate that the strike of the flows is N.70°–80°E. It is possible that the diorite occurs as sills, which were injected more or less parallel to the flows and derived from the same parent magma that produced the lavas. On the whole, the diorite is a more competent rock and has resisted the shearing stresses produced on folding to a much greater extent than the flows. No information was obtained regarding the nature of the folding. The strike of the schistosity and sheared zones varies only a few degrees from an east-west direction and the dip is 70° to 85°N. Quartz veins have been largely introduced along these fractured and sheared zones.

Veins

Underground development has been confined to No. 1 vein. It follows a well-defined sheared zone in a band of basaltic greenstone, which at this point is over 500 feet in width and lies between large masses of diorite. The vein strikes N.80°E. and dips about 79°N. On the surface the quartz vein has a maximum width of 2 feet. It pinches out entirely at a few places along the sheared zone, but the schist in such places carries low gold values across widths up to 5 feet. Sampling of the surface is reported to have indicated an average of 0.59 ounces of gold across 25.5 inches for a length of 334.5 feet. To the east the vein disappears in a swamp; No. 3 vein outcrops directly along the strike on the opposite side of the swamp 22½ chains distant.

[1]G. G. Suffel, op. cit., p. 63.

In the shaft the quartz-sulphide vein material is well-defined and would probably average about one foot in width down to the 500-foot level. It pinches and swells to some extent; the quartz has a maximum width of 2½ feet in the shaft.

The vein material consists of quartz, well mineralized with pyrite, pyrrhotite, and chalcopyrite. In places the sulphide content is greater than that of the quartz. It may be roughly estimated that, throughout the whole mine, half of the vein material is sulphides. Pyrrhotite and chalcopyrite form the bulk of this material, and chalcopyrite is occasionally the predominant sulphide.

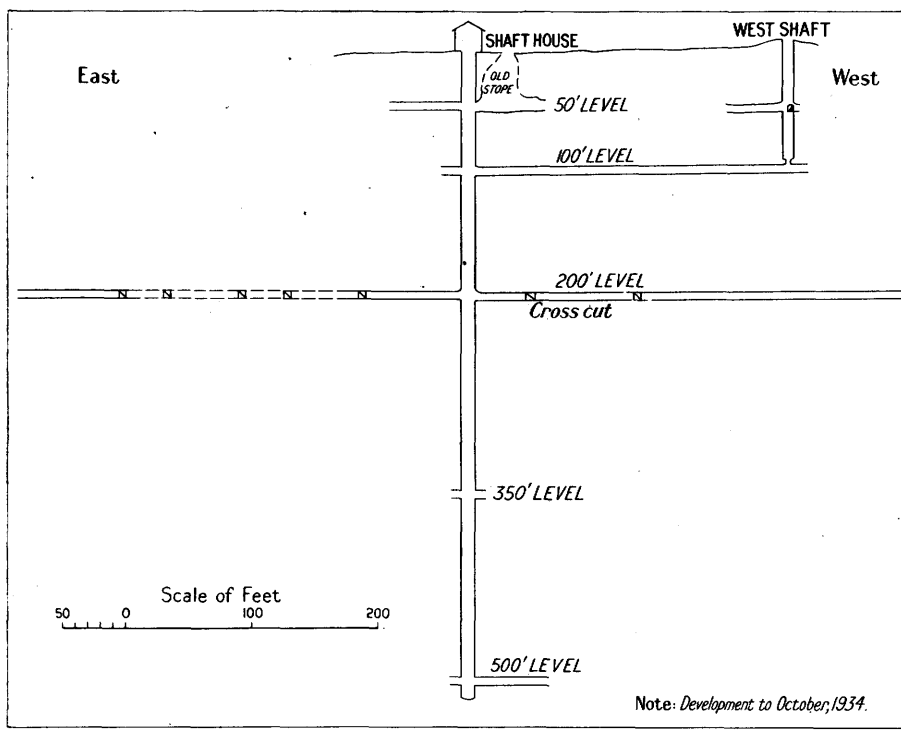


Fig. 4—Longitudinal section in the plane of No. 1 vein, looking south, showing the underground development at the Wendigo mine.

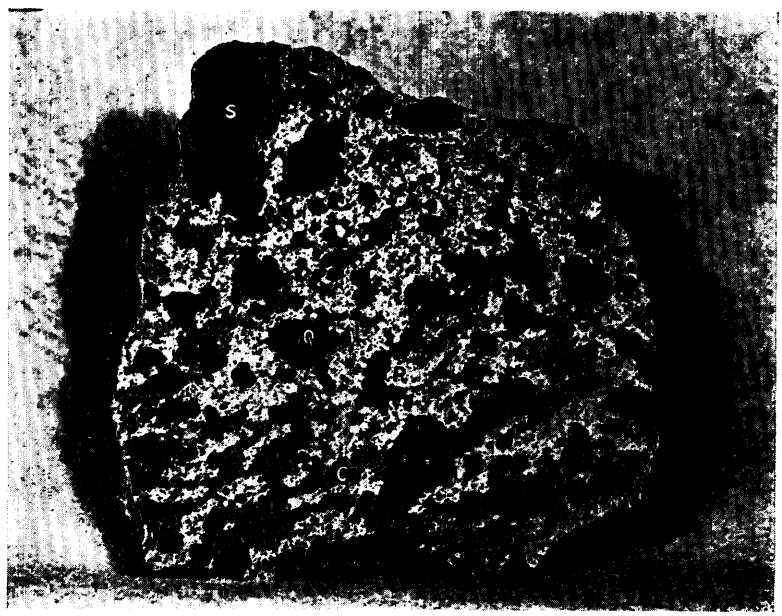
The vein quartz is generally well fractured, and the sulphides occupy the fractured zones. When the vein is over a foot wide, the sulphides are often concentrated near the outer margin, but in a narrow vein the sulphide impregnation is quite uniform. The schist immediately adjoining the quartz is often well mineralized with sulphides.

A milky-white quartz, in places containing traces of ankerite, may be seen on the surface and underground. On the face of the east drift on the 200-foot level (340 feet from the shaft), one of these white quartz veins was observed to cut across the auriferous quartz vein, proving that there are two distinct ages of vein quartz. The later quartz is devoid of gold.

The wall rock of the vein consists of chlorite schist, which grades outward into more massive lava. The contact between vein material and the country

rock is rather sharply defined. The wall rock seems to have undergone little hydrothermal alteration, that is, it is not mineralized with sulphides, nor is it carbonated or silicified to any extent. In the upper workings, it appears that the ore solutions were largely confined to the main fissure. At some places in the drifts, however, a branching vein system has been found. This is particularly true in the west drift on the 500-foot level. Underground drilling north and south to the diorite-basalt contact has shown the presence of parallel sheared and mineralized zones, some of which carry gold. On the surface sheared zones are also to be seen in the greenstone to the north and south of the vein.

The vein is faulted in places, but the offset is never more than a few feet. On the surface near the west shaft the vein is displaced 7 feet by a cross-fault



Specimen (natural size) of gold ore from the Wendigo mine, showing heavy sulphide mineralization. The sulphides are pyrrhotite (P) and chalcopyrite (C). Fragments of quartz (Q) and schist (S) are embedded in the sulphides.

that throws the west side north. In the shaft several small flat-lying faults have offset the vein. These almost invariably throw the lower side north to the hanging wall. The most noticeable fault occurs between the 100- and 200-foot levels. Here the fault dips to the north at an angle of 30 degrees, and from 1 to 12 inches of gouge lies in the fault plane. The vein is offset about three feet.

Up to October 25, 1934, the following value are reported to have been obtained in underground development on No. 1 vein. The first 212½ feet of the shaft averaged 0.24 ounces of gold across 24 inches; the lower 303 feet, 0.46 ounces across 21 inches. On the 50-foot level, 128 feet of drifting averaged 0.60 ounces across 30 inches. On the 100-foot level, 230½ feet averaged 0.40 ounces across 37 inches. The 200-foot level showed 388 feet of ore, averaging 0.40 ounces across 30 inches, out of a total drifting length of 690 feet. There is also another 60-foot section averaging 0.38 ounces across 23 inches. The

first 60 feet of drifting west on the 500-foot level averaged 0.48 ounces across 35 inches, but the east drift, up to that time, contained little mineralization.

No. 2 vein has been traced 386 feet on the surface. Diamond-drilling has indicated that it extends at least 150 feet farther east and 230 feet farther west. The vein, which strikes N.82°–87°E. and dips about 78°N., lies in porphyritic basaltic lava and consists of rusty, sugary quartz. It ranges in width from 6 to 20 inches. Native gold and a telluride, probably tetradymite, occur in the quartz at the east end of the exposed section of the vein.

No. 3 vein lies on the strike of No. 1 vein. It has been picked up in 4 test pits at intervals over a length of 600 feet. These pits reveal lenticular masses of quartz up to a foot in width; the quartz contains some sulphides

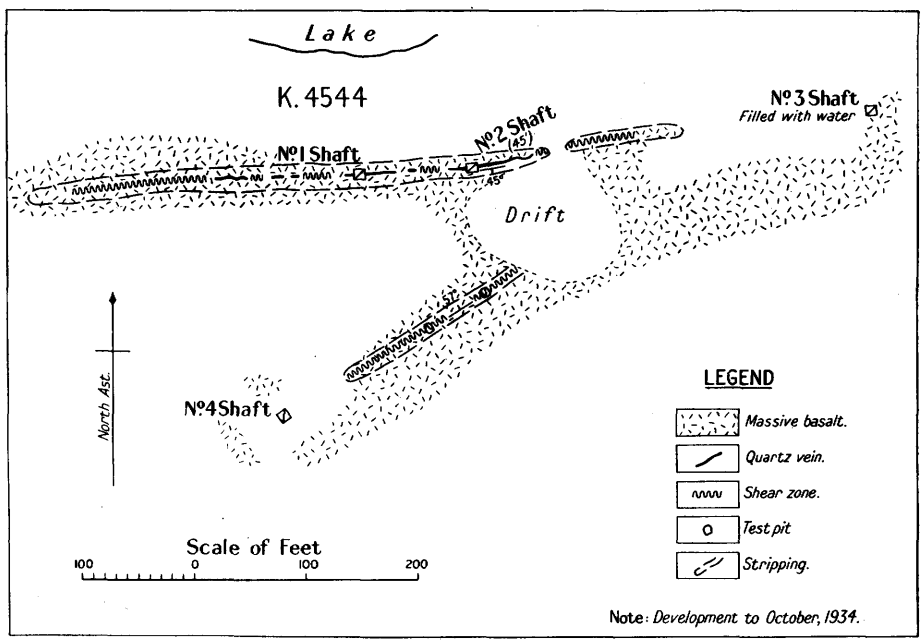


Fig. 5—Geological sketch map of the showings on the east group of claims, Witch Bay Gold Mines, Limited.

No. 4 vein is essentially the same as No. 3. It has been found in 4 test pits located at intervals over a length of 400 feet along the strike. A small vein containing a large amount of sulphides occurs on the north boundary of claim K.4,116.

Witch Bay Gold Mines, Limited

Witch Bay Gold Mines, Limited, owns two groups of claims, one east and the other west of the Wendigo. In 1934 development work was concentrated on the eastern group. The main showing is located near a small lake on claim K.4,544. It consists of lenticular masses of white quartz located at intervals over a length of 280 feet, along a sheared zone in basaltic lava (see Fig. 5). The sheared zone strikes N.85°E. and dips 45° to 70°S. The maximum width of the quartz is about 18 inches. Three shafts were sunk on this vein in the early days. The present owners obtained low gold values on the surface; but better values at the bottom of No. 2 shaft offered more encouragement, and it was

decided to deepen this shaft. A mining plant was installed for this purpose. Work was discontinued at the property in the winter of 1934-35.

South of this vein a well-pronounced rusty sheared zone in greenstone strikes N.60°E. and dips 57° to 80°N.W.

Stella-Lac La Belle Mines Syndicate

The Stella–Lac La Belle Mines Syndicate holds a group of claims that adjoin the Wendigo property on the north. These surround the old Stella mine.

A number of veins and sheared zones have been uncovered on the property and developed by trenching and test-pitting. Four shafts were sunk on the Stella

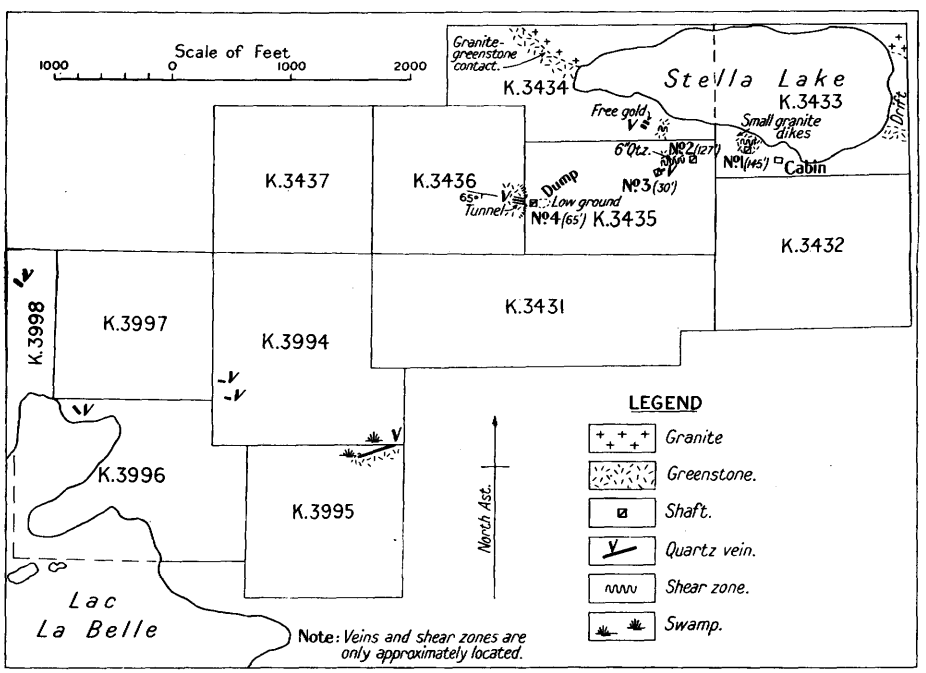


Fig. 6—Geological sketch map showing the location of veins and sheared zones on the claims of the Stella–Lac La Belle Syndicate.

location in the early days. The showings observed by the writer are approximately located in Fig. 6, but other veins reported on the property are not shown in the sketch map.

The country rock on the claims is largely basaltic greenstone with some associated diorite. A large granite batholith occurs north of Stella lake. The main workings of the old Stella mine are located in the greenstone not far from the granite contact.

Test pits have been sunk on a sheared zone that occurs near the south shore of Stella lake (north of No. 1 shaft). The zone strikes about N.70°W. and contains a little rusty schist with disseminated sulphides and quartz stringers in places. West of No. 2 shaft a quartz vein, 2 to 6 inches in width, is located on a sheared zone, which strikes N.82°E. and dips about 60°S. A 60-foot length of this material, commencing 160 feet west of the shaft, is reported to show from 0.02 to 6.92 ounces of gold per ton over widths of 1 to 3 feet.

In the early days a tunnel was driven 104 feet into the side of a hill along a quartz vein. The vein strikes about N.80°W. and dips 65°S. In places along the tunnel the quartz is about 18 inches wide and rather white in appearance. A shaft (No. 4) was sunk on the vein near the entrance to the tunnel.

A quartz vein near the No. 1 post of claim K.3,995 has been uncovered by surface trenching for a length of 330 feet. To the west it disappears under

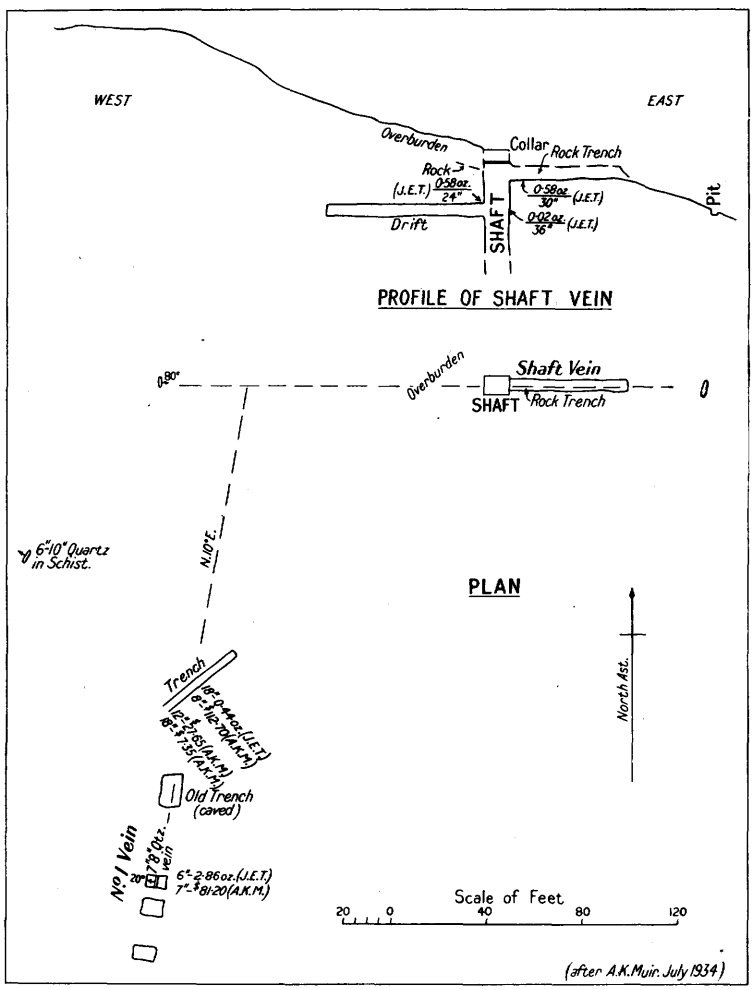


Fig. 7—Sketch map of the Johnson-Nilson claims showing the location of the trenches and shaft. In the A.K.M. assays, gold is taken at $35 per ounce.

swamp. The vein quartz is from 4 to 17 feet in width with an average of about 9 feet. The quartz is well fractured, contains tourmaline, and is well mineralized with pyrite, pyrrhotite, and chalcopyrite. It is reported that this vein does not carry gold values.

Johnson-Nilson Claims

H. Johnson and A. Nilson, of Kenora, own a group of 7 claims on the northwest side of Hollow lake. These include the old Golden Gate mine, which is

located on claim K.3,928. The Golden Gate mine was developed in the early days of the Lake of the Woods mining activity, but the claims lapsed in 1910. They were restaked by the present owners in 1934. Recent work on the claims consists of trenching and test-pitting near the old workings.

The southwestern portion of the property is underlain by basaltic lavas that are locally sheared to chlorite schist. Intrusive granite occupies the northeastern part of the group. The gold-bearing quartz veins are located in the greenstone a short distance from the granite contact.

In the early days a shaft was sunk 85 feet on a quartz vein located in a sheared zone, which strikes about east and west. The vein is exposed in a trench for a distance of 50 feet east from the shaft. A drift, 25 feet below the collar of the shaft, was driven west along the sheared zone. Closely spaced veinlets and short lenses of quartz occur in the vein and have a maximum width of 3 feet. Sampling of this vein by A. K. Muir, mining engineer, is reported to have indicated a small shoot of ore at the shaft.

A narrow flat-lying quartz vein (No. 1 vein), 8 to 18 inches wide, lies about 300 feet southwest of the shaft vein. It has been opened up for about 100 feet along the strike. This vein contains some visible gold. Channel samples taken from the vein have yielded high gold values across narrow widths.

About 300 feet north of the shaft lenses of quartz appear in an east-west sheared zone that dips 70°S. A pit 20 feet deep shows 3 feet of quartz at one end and chlorite schist at the other end. At the shore of Hollow lake, a quartz vein, 18 inches wide, is exposed in a trench. The quartz is fairly well mineralized in places.

Aronek Gold Syndicate

The Aronek Gold Syndicate holds 7 claims on the Indian reservation north of Bald Indian bay. Development work in 1934 consisted of stripping, trenching, and test-pitting, which revealed a number of quartz veins. The country rock is basic greenstone, schisted in places. There is an area of granite on the northeastern part of the property. The vein material is chiefly white quartz and black tourmaline, with sulphides in places. Native gold occurs in the quartz veins. Values are reported to be spotty. No channel samples had been taken at the time of the writer's visit, but some bulk samples of vein material are reported to show gold values.

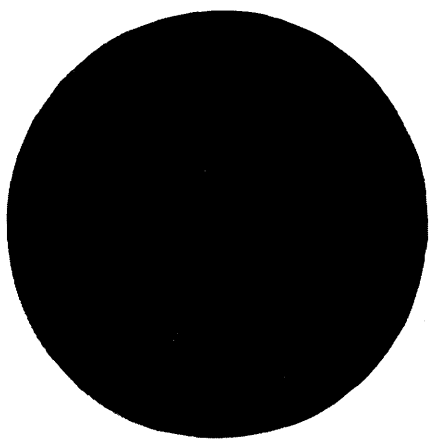
Bigstone Bay Gold Mines

Bigstone Bay Gold Mines holds a group of claims on the east side of Pine Portage bay, which includes the old Gold Creek mine. Development work was being done in 1934 by means of surface stripping and diamond-drilling. Basic greenstone underlies the claims; the contact with a large granite batholith occurs half a mile east of the Gold Creek shaft. A small quartz porphyry dike intrudes the greenstone close to the vein.

When the writer visited the property, a quartz vein, which strikes N.45°E., had been exposed for a distance of 150 feet southwest of the old shaft. It follows a well-defined shear zone in massive basalt and amphibolite. The main quartz ranges in width from a few inches to a foot. The shaft was full of water, but H. E. Silver, manager, reported that the vein quartz is 6 feet wide a short distance below the collar at a point where the vein rolls. To the northeast of the shaft, the vein disappears in low ground, but it had been traced 250 feet in that direction by diamond-drilling.

The vein quartz is of two types. There is a white quartz with tourmaline, which is rather deficient in sulphides, and a bluish, sugary quartz with galena, zinc blende, pyrite, and traces of chalcopyrite. Native gold and tellurides are also found in a sample from the vein submitted to the writer by Captain Silver. Professor Thomson made a microscopic examination of a polished section of this sample and found three tellurides, tetradymite (bismuth telluride), petzite (gold-silver telluride), and calaverite (gold-silver telluride). He has furnished the writer with the following description of the section:—

The chief metallic mineral is tetradymite, but the section also contains a considerable amount of pyrite, calaverite, and petzite, as well as minor quantities of chalcopyrite and native gold. These metallic minerals are associated with a quartz-carbonate gangue and occur in the following forms: pyrite as isolated crystals associated with the gangue and the tellurides; the remaining metallic minerals in vein-like forms associated chiefly with the gangue and to a lesser extent with the pyrite. The order of deposition appears to have been: (1) pyrite, (2) quartz, (3) carbonate, tellurides, chalcopyrite, and native gold.



Polished section of ore from a vein on the property of Bigstone Bay Gold Mines, showing the association of three tellurides, petzite (P), calaverite (C), and tetradymite (T). The black portions are gangue. (×160).

Some channel samples from the surface are reported by Capt. Silver to show gold values as high as 0.27 ounces across 52 inches, and 0.46 ounces across 18 inches; gold values have also been obtained by drilling. Grab samples from the old dump are reported to have assayed 0.43 and 0.98 ounces gold.

Kenora Prospectors and Miners, Limited

Kenora Prospectors and Miners, Limited, owns a group of claims in the vicinity of Bag bay on Shoal lake. These include the Mikado and Cedar Island mines. In 1934 some underground development was done on the 9th and 10th levels of the Mikado mine, but this was discontinued in order to proceed at Cedar island.

Cedar island lies less than a mile west of the Mikado mine and is the site of the old Cornucopia mine. A gold recovery of $1,560 is recorded from this property in the early days. The main vein lies at the extreme north end of the island. An inclined shaft has been sunk on the vein to a depth of 150 feet,

and a considerable amount of drifting done along the vein to the northwest. As this shaft was not well located, an old shaft towards the centre part of the island was deepened vertically to a depth of 300 feet and a crosscut run northwest from the 283-foot level to intersect this vein. A complete mining plant has been installed.

General Geology

The exposed rock on Cedar island is largely massive, dark-green, medium- to fine-grained basalt. Bands of porphyritic lava occur on the southern part of the island. At some places the lavas have been recrystallized to amphibolite. The greenstones are intersected by dikes of quartz porphyry, granite, pegmatite, and aplite. In the crosscut northwest from No. 2 shaft a large number of red granite and aplite dikes run in all directions. They are generally less than 4 feet wide and in many places have calcite, feldspar, and quartz veinlets or stringers associated with them. Sometimes vugs occur in the calcite veinlets where underground waters have leached out this material.

Sulphides occur in the greenstone at some points on the northern part of the island. Veinlets and grains of pyrite, arsenopyrite, and chalcopyrite are disseminated throughout the basalt and form a gossan on the oxidized surface of the outcrops. The sulphide zones have indefinite boundaries and appear to be replacement deposits. At the north end of the island the band of sulphides is 20 feet wide.

Faults have been found in the underground workings. Near No. 2 shaft on the 283-foot level a relatively flat fault may be observed.

Veins

Three gold-bearing veins have been found on Cedar island. The most important vein lies at the extreme north end of the island. It strikes approximately E.45°S. and dips 69°S.W. The shaft on this vein was filled with water at the time of the writer's visit. In the open cut the quartz vein lies in a schisted zone in basalt and amphibolite. An aplite dike, 2 feet in width, runs parallel to the vein on the hanging wall. The vein material consists of quartz, chlorite, and a small amount of carbonate. Pyrrhotite, arsenopyrite, sphalerite, galena, chalcopyrite, native gold, and two generations of pyrite are associated with the quartz and schist. Most of the gold occurs in the quartz and later pyrite. It is reported that a section of this vein on the 144-foot level, 180 feet in length, averages 1.476 ounces of gold per ton across 46 inches.

Near No. 2 shaft there are 3 small veins, but they are almost entirely covered by the mine dump and surface buildings.

Duport Mining Company, Limited

The Duport Mining Company, Limited, holds a group of claims that include Cameron island in Shoal lake. A gold deposit on Cameron island was worked many years ago. The former operators sank an inclined shaft to a depth of 132 feet on a vein and did some drifting on two levels. A plant, including a chlorination furnace, was installed to treat the ore, which has a high arsenic content, but apparently the treatment was not successful.

The presence of high-grade gold-bearing float at the water's edge on the extreme south end of the island led J. G. Cross, the manager, to diamond-drill under the lake during the winter of 1933–34. A series of holes is reported to have outlined a body of gold ore. Some diamond-drilling had been done in this vicinity in 1929 by other mining interests.

In the fall of 1934 a mining plant was installed at the property. The former operators had drifted 236 feet along the vein to the south in the 2nd level. It is planned to continue this drift for approximately 500 feet to intersect the ore body found by drilling under the lake.

General Geology

The interpretation of the geology of Cameron island may be largely dependent on the geological features of several of the neighbouring islands. The writer spent only two days at the property and consequently saw only a small portion of the rock exposures on some of the islands. A thorough examination in the general vicinity of Cameron island would be necessary before any very definite statements could be made regarding the relationships of the various rock types.[1]

On the western part of Cameron island a fine-grained basic rock, probably basaltic greenstone, occurs. The eastern half of the island contains a dioritic rock, which is probably a phase of the Stevens island complex described below. It is a coarse-grained, dark-green rock containing elongated black crystals of amphibole. Microscopic examination shows that the rock is a diorite; it contains basaltic hornblende, orthoclase, andesine, ilmenite, and accessory and secondary minerals. The rock on the southeast side of Pine island, located south of Cameron island, is also a diorite and shows the same mineral assemblage in a thin section, but contains in addition much secondary epidote and zoisite.

Stevens island, which lies southeast of Cameron island, is underlain by a series of plutonic igneous rocks ranging in composition from gabbro to granodiorite, or possibly granite. The extent of this series of rocks beyond Stevens island is not known. It is possible that the various members may all be differentiates of a common parent magma. The Stevens island plutonic rocks are somewhat schisted and are intersected by dikes of massive cream-coloured quartz porphyry. They also contain a number of small gold-bearing quartz veins. Microscopic examination of thin sections of the rock along the north shore of the island showed it to be a gabbro. Evidence of much hydrothermal alteration may be seen in some sections, and a large amount of secondary zoisite is developed. A section of the granitic rock from the east side of the island, opposite Pine island, proved it to be a granodiorite.

The diorite and basalt on Cameron island are cut by quartz-feldspar porphyry and aplite (locally called felsite) dikes.

Massive pink granite dikes intrude the Pine island diorite. Similar pink biotite granite occurs on the second small island south of Pine island and may be part of the large granite batholith to the west.[2]

Ore Bodies

The surface exposures of the veins on Cameron island are shown on the accompanying sketch map (Fig. 9, page 46).

The mineralized zone southeast of the shaft follows a sheared zone in the diorite. This schisted rock is much silicified and is replaced by arsenopyrite, pyrite, pyrrhotite, and chalcopyrite. The silicified rock along the mineralized zone has a felsitic appearance. The shaft was sunk on the vein and dips about 80°N.W. For 115 feet south of the shaft the vein has various widths; one

[1]A more detailed account of the geology in this vicinity will appear in a later report (Volume XLV) covering field work for 1935.

[2]See map No. 39*e*, Ont. Dept. Mines, Vol. XXXIX, pt. 3, 1930.

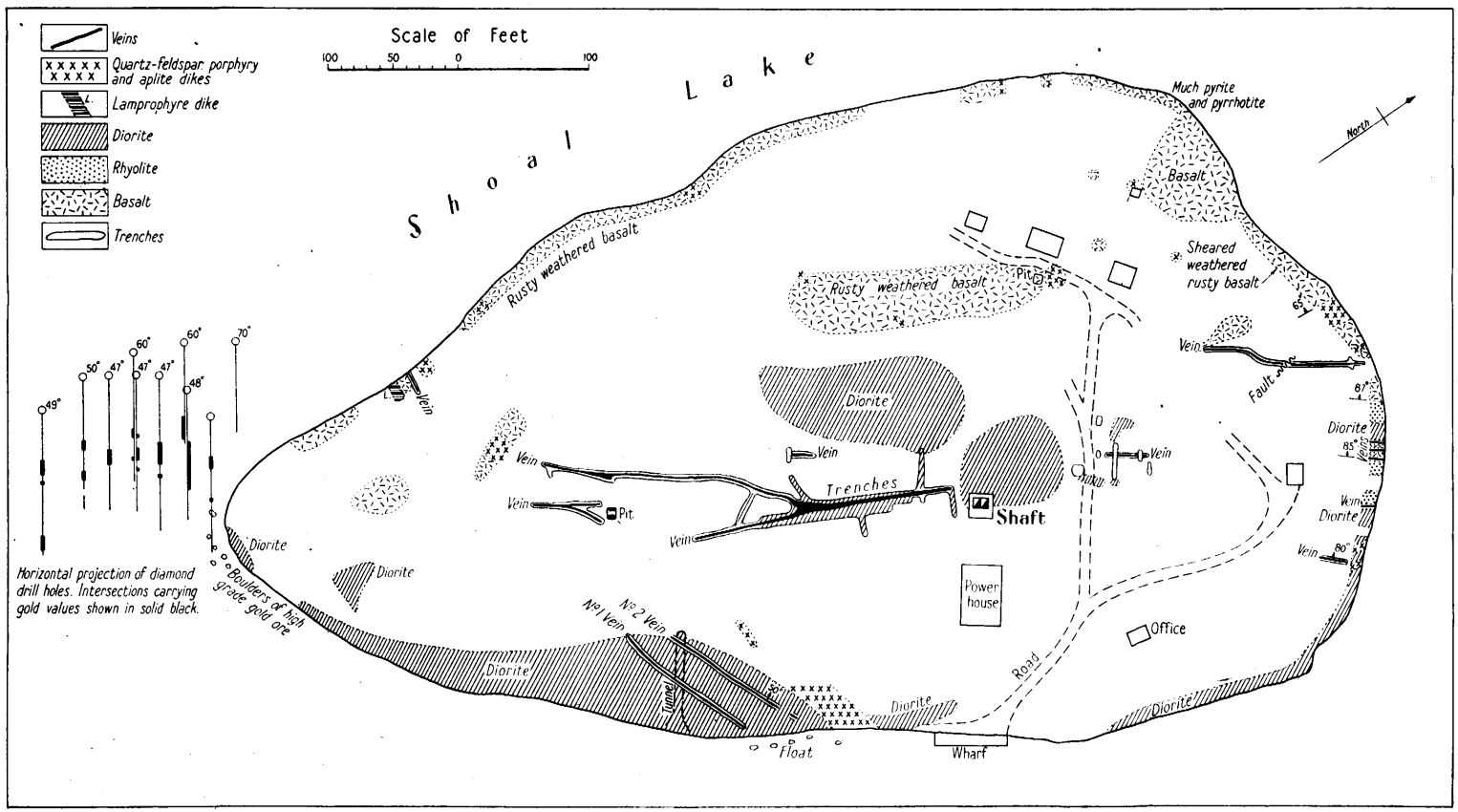


Fig. 9—Geological sketch map of Cameron island, Shoal lake, Duport Mining Company, Limited.

section contains values across 16 feet, and in the adjoining pit the vein is reported to carry a little over one ounce of gold across 6 feet. At 115 feet south of the shaft the vein splits; the western branch carries values across 9 to 28 inches for a length of 180 feet from the junction.

Veins designated as No. 1 and No. 2 on the map (Fig. 9) are narrow quartz veins mineralized with some arsenopyrite and pyrrhotite.

The high-grade float at the south end of the island and the gold-bearing material from the drill-cores obtained under the lake consist of bands of fine-grained arsenopyrite associated with sericite and apple-green chrome mica (fuchsite). Microscopic examination of this material shows parallel flakes of sericite and chlorite cut by secondary quartz veinlets. Bands of arsenopyrite crystals have been introduced more or less parallel to the schistosity.

A series of 9 holes drilled under the lake is reported to have indicated a body of high-grade gold ore over good widths for a length of 140 feet. One exceptionally good hole shows values across a true width of 52.7 feet.

Ore Relationships

The amount of gold seems to vary directly with the amount of arsenopyrite in the ore. Massive arsenopyrite ore is said to carry high gold values, while some of the quartz veins with only traces of arsenopyrite are almost devoid of gold. Tests on the ore by the Mines Branch, Department of Mines, at Ottawa, have shown the presence of arsenopyrite, pyrite, pyrrhotite, chalcopyrite, and native gold.[1] The larger part of the gold was found to be with the arsenopyrite and is thought to be in solid solution. The native gold was found in association with pyrrhotite. The pyrite does not seem to contain gold.

[1]Bull. No. 736, Mines Branch, Can. Dept. Mines, 1932, p. 60.

Some Gold Occurrences West of Port Arthur

By Jas. E. Thomson

Introduction

During the field season of 1934 the writer spent a few days examining recent gold discoveries at Saganaga lake and on the Trans-Canada highway west of Port Arthur. Both of these areas are in the district of Thunder Bay. There was some interest in the gold occurrences at these locations for a short period, but the results of development work were disappointing and most of the claims were subsequently dropped.

Saganaga Lake Area

Saganaga lake is located on the International boundary at the extreme southwest corner of the district of Thunder Bay. During the summer of 1934 gold was found on the north side of the northeast arm of the lake by the Powell brothers. A number of claims were staked in the vicinity of this discovery.

Saganaga lake is most easily reached by means of a highway, 59 miles in length, that extends from Grand Marais, Minn., directly to the lake. Other routes into the area are: (1) the Canadian National (old Port Arthur, Duluth and Western) railway or the highway from Port Arthur to Mackies, gas car to North Lake station, and a canoe route through Gunflint and Seagull lakes; or (2) from Ely, Minn., along the International boundary by a canoe route through Basswood, Knife, and Cypress lakes.

The Quetico sheet (No. 52B) of the Topographical Survey of Canada is an excellent aerial map of the district. The general geology of the region is shown on the Kenora sheet (map 266A) of the Geological Survey of Canada.

GENERAL GEOLOGY

A belt of Keewatin greenstones and sediments, the latter probably Timiskaming in age, extends along the Canadian side of the International boundary from Northern Light lake through Saganaga, Knife, and Birch lakes, and thence southwest to the Vermilion iron district of Minnesota. The Canadian portion of these rocks has been described by Smith,[1] and less fully by Van Hise and Leith.[2] Parsons[3] has reported on the iron deposits in this vicinity. The granites on Saganaga lake have been described by Grout.[4]

Stakings in 1934 were confined to an area between the east end of Saganagons lake and the northeast arm of Saganaga lake. The rocks observed by the writer in this vicinity consist of massive andesite and basalt with gabbroic and schistose phases. These are intruded by quartz-feldspar porphyry dikes. Some quartz veins occur, but prospecting during 1934 did not reveal any veins with encouraging gold values. A large area of granite extends south of the east end of Saganaga lake and is regarded as Algoman in age.

[1]W. H. C. Smith, Geol. Surv. Can., Vol. V, pt. G, 1890-91.
[2]C. R. Van Hise and C. K. Leith, U.S. Geol. Surv., Mon. 52, 1911, pp. 119-128.
[3]A. L. Parsons, Ont. Bur. Mines, Vol. XXV, pt. 1, 1916, pp. 163-191.
[4]F. F. Grout, Jour. Geol. Vol. 37, 1929, pp. 562-591.

DESCRIPTION OF PROPERTIES

Powell Claims

Gold was found by Mike and Frank Powell in a quartz vein located near the No. 1 post of claim T.B.14,095. At the time of the writer's visit the main vein, which is from 1 to 9 feet in width, had been uncovered for a distance of 150 feet along the strike. Small irregular quartz masses are found in trenches for about 150 feet farther along the strike. The vein is largely white quartz, which contains a trace of pyrite and chalcopyrite in places. The country rock is massive basalt intersected by a number of small quartz-feldspar porphyry dikes. Two grab samples taken from the mineralized portion of the vein are reported to have assayed 0.50 and 0.04 ounces gold per ton.

Montgomery-Ackerman Claims

This group of 15 claims adjoins the Powell group on the north and contains the same kind of geological formation. Surface prospecting on these claims did not yield encouraging results. A few lenticular masses of white quartz were found.

Properties Near Port Arthur

Birch Bay Gold Mines, Limited

The property of Birch Bay Gold Mines, Limited, is located on lots 68 and 69 on the south side of the Trans-Canada highway, 36 miles west of Port Arthur. It was taken up by T. H. Rea and W. W. Smith during the summer of 1934. The writer is indebted to A. W. Jeckell, manager of the property, for information and assistance in the examination of the property in October, 1934.

Gold was found on an east-west trending ridge, which is largely covered with overburden. The deposit was opened up by surface trenching. This was followed by a diamond-drilling programme and 7 holes were put down. All the holes showed gold values, but as the grade was not commercial the property was dropped.

General Geology.—The geology of the area has been described by Tanton.[1] The rocks on the property consist of basaltic and rhyolitic lavas with interbedded chert and chert-rhyolite breccia and some associated gabbro and diorite. Quartz-feldspar porphyry also occurs in a few places. The rocks along the ridge on which the showing is located are considerably carbonated and in many places contain small irregular quartz veins and disseminated sulphides.

The basalt is a dark-green, fine-grained rock, occasionally somewhat brecciated. Thin sections of the rock contain orthoclase, plagioclase, olivine, augite, and secondary and accessory minerals. At the south end of the long trench (see Fig. 1) much green fuchsite is developed in the basalt near vein material. The rhyolite is a dense, light-coloured rock of massive appearance. Fuchsite is developed along fracture and slip planes. Microscopic examination of the rock reveals a felsitic texture with quartz, orthoclase, oligoclase, and much secondary carbonate as the chief constituent minerals.

The chert is very fine grained and consists almost entirely of cryptocrystalline silica and carbonate. It varies from light-grey to black in colour. On rare occasions evidence of bedding may be observed, but ordinarily it is quite

[1]T. L. Tanton, Geol. Surv. Can., Mem. 167, 1931.

massive and flint-like. Being a hard, competent rock, it has yielded to deforming stresses by fracturing, and quartz veinlets have filled the fractures. In certain places the chert fragments have been recemented forming a chert breccia. On the north side of the showing the chert is in sharp contact with the rhyolite.

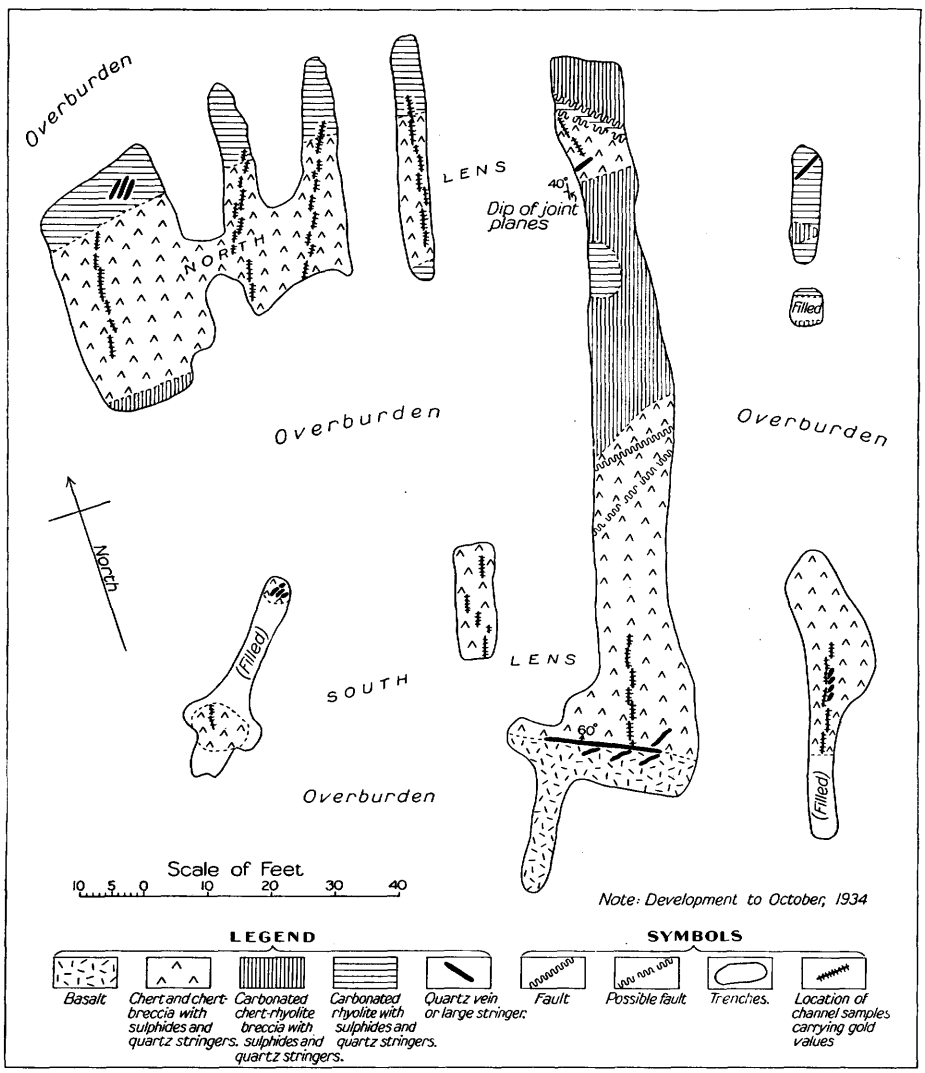


Fig. 1—Geological sketch map of the main showing, Birch Bay Gold Mines.

In the long trench a chert-rhyolite breccia occurs between the two main chert zones. This breccia contains angular to subangular fragments of rhyolite embedded in a matrix of black chert.

A few outcrops of quartz-feldspar porphyry are found on the property. West of the test pits, the porphyry is a massive, reddish-coloured rock, considerably carbonated and intersected by a large number of small quartz stringers,

which run in all directions. The porphyry contains small phenocrysts of quartz and feldspar, and pyrite is disseminated throughout the rock. In a test pit it exhibits a sharp contact with rhyolite and is probably intrusive.

Mineralization.—In the vicinity of the main test pits, the rhyolite, chert, chert breccia, and chert-rhyolite breccia have been impregnated with sulphides in the form of veinlets, irregularly shaped replacement masses, and disseminated crystals. The sulphides are pyrite with a trace of arsenopyrite. These rocks have also been considerably carbonatized. After the introduction of the sulphides the rocks underwent some deformation, and quartz veins and veinlets have been



Specimen (one-third natural size) of chert-rhyolite breccia from the property of Birch Bay Gold Mines. The dark-coloured material is chert; the lighter-coloured fragments are rhyolite. The dark material in the rhyolite is fuchsite. Pyrite (P) is scattered throughout the breccia, and white quartz veinlets intersect it.

injected along the fractures thus produced. These quartz veinlets run in all directions, although in certain spots a series of parallel veinlets occur. These are probably located along tension cracks. At several places in the pits white quartz veinlets cut across areas of sulphide mineralization. Sampling has indicated that the sulphides carry rather low gold values. The white quartz veins contain native gold, but its occurrence is spotty. It is evident that two distinct periods of gold mineralization are represented, first, in the earlier sulphides, and then in the later quartz veins.

Surface sampling has indicated that the gold values in the sulphides are largely confined to the areas of chert. Fig. 1 shows the location of samples that carry gold values. The north lens was uncovered for a length of 90 feet and has a maximum width of 20 feet. Excluding all veinlets of quartz from the samples, this zone is reported to average 0.081 ounces gold per ton. The south lens is

quite irregular in outline but smaller than the north one. It is reported to average 0.064 ounces gold per ton. Taking into consideration the quartz stringers that carry native gold the management estimated that the two lenses might average 0.095 ounces gold per ton.

Noranda Claims

These claims were taken up to the east and west of the claims of the Birch Bay Gold Mines and on the same kind of formation. Surface trenching had just been started when the writer visited the property. Gold could be panned from some of the sulphide material. As development work did not reveal any encouraging gold values, the claims were dropped.

INDEX, PART IV

A

PAGE

Abraham, Michael 33
Abraham gold claims.
  Geology; workings 33, 34
  Location, map showing 29
Access.
  Rowan-Straw Lakes area 2
  Saganaga lake 48
Acid volcanics.
  See also Rhyolite.
  Rowan-Straw Lakes area 5, 10, 11, 21
Acidic intrusives.
  See also Granite; Porphyry.
  Rowan-Straw Lakes area 17-22
Acknowledgments 2, 29
Agglomerate.
  Rowan-Straw Lakes area 5, 8, 10, 13
  Hill l., photo 7
Ajax lake 2, 19
Algoman.
  See also Granite; Porphyry.
  Rowan-Straw Lakes area 4, 17-22
  gold associated with 23
  Saganaga Lake area 48
Amphibolite.
  Lake of the Woods area 42
  Rowan-Straw Lakes area 5, 9, 19
Andesite 5, 48
Andrew bay, L. of the Woods.
  Gold mg. *See* Witch bay.
Ankerite 37
Anticlines 12, 15
Aplite.
  Lake of the Woods area 36, 44
  Rowan-Straw Lakes area 4, 21
Arkose 5, 11, 13
Aronek Gold Syndicate 29, 42
Arsenopyrite.
  Lake of the Woods area 44, 47
  Port Arthur area, gold in 51
Asheigamo lake 2

B

Bag bay, Shoal l. 43
  Gold mg. *See* Cedar is.
Bald Indian bay, L. of the Woods 42
Balsam 3
Bartley, M. W. 2
Basalt.
  See also Greenstone.
  Lake of the Woods area 33, 35, 39, 42, 44
  Port Arthur area 49
  Rowan-Straw Lakes area 5, 25
  Saganaga Lake area 48
Basic intrusives.
  Rowan-Straw Lakes area 17, 22
Basic volcanics.
  Rowan-Straw Lakes area 5-10
Basil lake 2
Bass, black 4

PAGE

Batholiths.
  Lake of the Woods area 40, 42, 45
  Rowan-Straw Lakes area 18-20
Bears 4
Bethune, Alex 2
Bethune, F. H. and Sons.
  Gold claims, description 24
Bethune lake, gold near 22, 23
Bigstone Bay Gold Mines, Ltd.
  Property, mineralization 42, 43
  location, map showing 29
Biotite gneiss 4, 10
Biotite granite 4, 19, 45
Biotite schist 10
Birch 3
Birch lake 48
Birch Bay Gold Mines, Ltd. 48-52
Bismuth telluride. *See* Tetradymite.
Bluffpoint lake 19
Boulder clay 4, 22
Boulder conglomerate 17
Breccia.
  See also Flow breccias.
  Port Arthur area, chert 49-51
  Rowan-Straw Lakes area 5, 22
Brecciation, internal 9
Bretz lake 16
Brooks lake.
  Gold claims 22
  Road to 2
  Rocks 6, 10
  Tourist camp 4
Bruce, E. L. 31
Brulé 4
Burditt lake 2, 3, 14
Burwash, E. M. 1, 7, 11, 20, 22, 24

C

Calaverite 43
Cameron island, Shoal l.
  Geology; gold mining 44, 47
  Location, map showing 29
  Map, geological, sketch 46
Canoe routes.
  Rowan-Straw Lakes area 2
  Saganaga Lake area 48
Carbonaceous sediments 12
Carbonate 22, 36, 43
Carbonated lava 9-11, 25, 27
  Quartz veins in 23
  photo 9
Carbonated schists 5, 9
Cedar 3
Cedar island, Shoal l.
  Geology; gold mining 43, 44
  Map, geological, sketch ..... *facing* 44
Cedar Island, gold m.
  Geology and workings 43, 44
  Location, map showing 29

PAGE
Chalcopyrite.
Lake of the Woods area..... 33, 37, 41-47
Wendigo g.m., photo..... 38
Rowan-Straw Lakes area.....22-24, 26
Chert.
Port Arthur area..... 49
auriferous vein in..... 51
Rowan-Straw Lakes area..... 12
Chert-rhyolite breccia..... 49-51
Chlorite gneiss..... 10
Chlorite schist.....5, 9, 10, 24
Gold with.....26, 32, 36
Chrome mica..... 47
Claims. *See* K. and T.B. claims.
Clastic sediments, Keewatin..... 11
Clay..... 22
Coleman, A. P..... 3
Conglomerate..... 5, 13
Coniagas Mining Co..... 31
Cooper, Leslie..... 2
Cornucopia gold m..... 43
Coutchiching series..... 10
Cross, J. G.....24, 30, 44
Cross-folding.....15, 16
Crossroute lake..... 2

D

Dash lake.....2, 21, 22
Quartz veins near..... 23
Structure..... 12
Deer..... 4
Derry, D. R..... 30
Diabase porphyrite..... 9
Diagrams.
Rocks, Line bay..... 21
Structure, Thomson bay.....*facing* 14
Diorite.
Lake of the Woods area.....36, 45
Port Arthur area..... 49
Rowan-Straw Lakes area.....4, 5, 17, 22
Dogpaw lake..... 2
Drag folds.....12, 16
Iron formation, photo..... 14
Drainage, Rowan-Straw lakes area.... 3
Ducks..... 4
Duport Mining Co.
Property, geology and workings... 44-47
location, map showing..... 29

E

Economic geology. *See* Geology, economic.
Ely, Minn..... 48
Emo, route from to Rowan-Straw area. 2
Esox lake.....16, 18

F

Faults.....15, 38, 44
Feather lake..... 2
Feldspar crystals..... 7, 21
Feldspar porphyry.
See also Quartz-feldspar porphyry.
Rowan-Straw Lakes area.....4, 18, 21, 28
quartz veins in..... 27
Felsite.
Cameron island..... 45
Rowan-Straw Lakes area..... 5
Fish, Rowan-Straw Lakes area..... 4
Fish island, Pipestone l..... 11

PAGE
Float, gold-bearing.....44, 47
Flow breccias..... 8, 10
Fog lake..... 2
Folding.
See Cross-folding; Drag folds.
Forest fires..... 4
Forestry Branch..... 4
Fractures. *See* Shear zones.
Fragmental rocks. *See* Agglomerate; Breccia; Tuff.
Fuchsite.....47, 49
Photo..... 51
Furlonge lake.....3, 16, 21
Sulphide bodies..... 23

G

Gabbro.
Lake of the Woods area..... 45
Port Arthur area..... 49
Rowan-Straw Lakes area.....5, 7, 17, 19
Galena.
Lake of the Woods area.....43, 44
Rowan-Straw Lakes area.....22, 26
Game, Rowan-Straw Lakes area..... 4
Gates Ajar narrows..... 6, 11
Geological Survey of Canada.....2, 3, 47, 48
Geology, economic.
Lake of the Woods area..... 31-47
Port Arthur area..... 49-52
Rowan-Straw Lakes area..... 22-28
Saganaga Lake area..... 49
Geology, general.
Lake of the Woods area
Cameron island..... 45
Cedar island..... 43
Horseshoe g. m..... 31
Wendigo g. m.....35, 36
Port Arthur area..... 49-51
Rowan-Straw Lakes area..... 4-22
Saganaga Lake area..... 48
Geology, structural.
See also Faults; Folding.
Lake of the Woods area..... 36
Rowan-Straw Lakes area.....12, 14, 16
Glacial deposits.
Rowan-Straw Lakes area..... 3, 22
Glacial striae..... 22
Gneiss..... 4, 10
Gneissic granite..... 4, 18
Gold.
Lake of the Woods area.
deposits, report on..... 29-47
ore, telluride, photomicrograph... 43
Wendigo m., photo..... 38
Mining, effect of revaluation on..... 29
Native.
Lake of the Woods area....33, 39, 42-47
Port Arthur area..... 52
Rowan-Straw Lakes area.....26, 28
Port Arthur area, occurrences..... 49-52
Rowan-Straw Lakes area.
deposits, nature and location.....22, 23
mining properties described..... 24-28
Saganaga Lake area.....48, 49
Tellurides..... 43
Values. *See* Geology, economic.
Gold Creek gold m.....29, 42
Golden Gate gold m.....29, 41, 42
Gossan, L. of the Woods area..... 44
Graham, James..... 2

PAGE

Grand Marais, Minn. 48
Granite.
Lake of the Woods area. 31, 44, 45
veins in. 31-33
Rowan-Straw Lakes area. 4, 17-20
xenoliths in, photos. 18, 19
Saganaga Lake area. 48
Granite porphyry. 4
Granodiorite. 19, 45
Graphitic quartzite. 12
Gravel. 4, 22
Greenstone.
See also Basalt.
International boundary. 48
Lake of the Woods area. 40, 44, 45
quartz veins in. 31-33, 42
Rowan-Straw Lakes area. 5-10, 14, 27
gold in. 23
granite contact, xenoliths. 18, 19
porphyry dikes in, photo. 20
pot-hole in. 22
Greenstone-sediment complex.
Rowan-Straw Lakes area, structure. 14-16
Saganaga Lake area. 48
Grout, F. F. 48
Grozelle, Fred. 25

H

Hector lake. 2, 3, 19
Hematite. 13
Hill lake.
Rocks, notes and photos. 5-8
Historical notes.
Lake of the Woods area. 29, 31
Rowan-Straw Lakes area. 1-3
Hollow lake, gold claims. 41, 42
Hopkins, P. E. 30
Hornblende gneiss. 4
Hornblende granite. 4, 19
Hornblende schist. 5, 9
Horseshoe Mines, Ltd.
Property described. 30-33
location, map showing. 29
Hurst, M. E. 7

I

Ince, Geo. H. 30
International boundary.
Rocks; canoe routes. 48
Iron formation. 5, 11, 13
Drag-folded, photo. 14

J

Jackpine. 3
Jasper. 13
Jeckell, A. W. 49
Johnson, H. 41
Johnson-Nilson gold claims.
Geology; workings. 41, 42
Location, map showing. 29

K

K. 3,655 g. claim. 33
K. 3,928 g. claim. 42
K. 3,943-44 g. claims. 25
K. 3,995 g. claim. 41
K. 4,016-17 g. claims. 27
K. 4,116 g. claim. 39
K. 4,544 g. claim. 39

PAGE

Kaiarskons lake. 3
Kakagi lake.
Game preserve. 4
Rocks, structure. 14, 20
Routes from to Rowan-Straw area. 2
Kames. 22
Katimiagamak lake. 2
Keewatin series.
See also Greenstone.
Lake of the Woods area.
see Basalt; Porphyritic lava.
Rowan-Straw Lakes area.
auriferous quartz in. 22
distribution; lithology; structure. 4, 5-12
relation to sediments. 17
Saganaga Lake area. 48
Kenora Prospectors and Miners, Ltd.
Property, geology and workings. 43, 44
location, map showing. 29
Keweenawan. 4, 22
Key maps. 1, 29
Knife lake. 48
Konigson gold claims. 27

L

Lac La Belle.
Sketch maps showing gold claims. 34, 40
Lake of the Woods area.
Gold deposits, report on. 29-47
Lamport, W. A. 30
Lamprophyre. 5, 17
Thomson bay, photo. 15
Lavas. *See* Basalt; Keewatin; Porphyritic lava; Rhyolite.
Lawrence lake.
Brulé; fishing. 4
Canoe routes. 2
Rocks. 10, 19
xenoliths, photos. 18, 19
Lawson, A. C. 3, 10
Leith, C. K. 48
"Leopard rock". 7
Hill lake, photo. 6
Lindsley, Mrs. Thayer. 30
Line bay, Pipestone l.
Gold. 2, 22, 24
Quartz veins, photo. 25
Rocks. 12
diagram. 21
Loonhaunt lake. 4, 18
Lott, R. E. L. 30
Lower Manitou lake. 16
Lucy, Wm. 27
Lumbering, Rowan-Straw Lakes area. 3

M

McInnes, Wm. 2
MacPhayden, K. A. 31
Magnetite. 26
Manitou lakes.
Rocks, correlation. 16, 17
Map, geological, coloured.
Rowan-Straw Lakes area (No. 44e) *in pocket*
Map, sketch.
Workings, Johnson-Nilson g. claims. 41
Maps, geological, sketch.
Birch Bay g. m. 50
Cameron island. 46
Cedar island. *facing* 44
Stella–Lac La Belle g. m. 40

PAGE

Maps, geological, sketch—*Continued*
Straw Lake Beach g. m.....*facing* 26
Straw Lake Mg. Syndicate....*facing* 28
Thomson bay.....*facing* 14
Wendigo g. m..... 34
Witch Bay g. m..... 39
Maps, key.
Lake of the Woods–Shoal l. gold properties..... 29
Rowan-Straw Lakes area..... 1
Marwick, Geo..... 30
Maskinonge..... 4
Mathieu gold claim..... 27
Sketch map.....*facing* 28
Microphoto. *See* Photomicrograph.
Mikado gold m.....29, 43
Mining claims. *See* K. and T.B. claims
Mining properties described.
Lake of the Woods area..... 29-47
Port Arthur area..... 49-52
Rowan-Straw Lakes area..... 24-48
Saganaga Lake area..... 49
Moneta Porcupine Mines, Ltd..... 25
Monte Cristo g. mine.
Rocks at and near.....9, 12, 22
Workings; mineralization..... 24
Montgomery-Ackerman g. claims..... 49
Moose..... 4
Moraine..... 22
Mosher, Murdock..... 25
Mosher vein.....25-27
Muir, A. K.....30, 42

N

Natural resources, Rowan-Straw Lakes area..... 3, 4
Newman, W. R..... 2, 30
Nightjar lake.....12, 18
Gold claims near..... 24
Nilson, A..... 41
Noranda gold claims..... 52
Northern Light lake..... 48

O

Ore, telluride, photomicrograph..... 43
Orthoclase crystals..... 21

P

Parsons, A. L..... 48
Partridge..... 4
Passow, F. M..... 30
Peat..... 4
Pegmatite..... 44
Petzite..... 43
Phinney, Charles, gold claim..... 24
Phinney lake..... 2, 21
Quartz veins near..... 23
Structure.....12, 15
Photomicrograph.
Telluride ore, Bigstone Bay m..... 43
Pickerel..... 4
Pike..... 4
Pillow lava.....5, 6, 10
Hill l., photo..... 5
Pine, red and white..... 3
Pine island, Shoal l..... 45

PAGE

Pipestone lake.
See also Line bay; Gates Ajar narrows; Thomson bay.
Brulé; fish; game..... 4
Canoe routes..... 2
Glaciation..... 22
Rocks.....8, 11, 13, 17
graphitic quartzite..... 12
quartz veins in lava, photo..... 9
sediments, photo..... 13
structure.....3, 12, 14
drag folds, photo..... 14
sulphide bodies..... 23
Tourist camps..... 4
Pleistocene, Rowan-Straw area..... 4, 22
Poplar..... 3
Porcupines..... 4
Porphyritic lava ("leopard rock").
Lake of the Woods area.....35, 39, 44
horizon marker..... 36
Rowan-Straw Lakes area..... 5-7
Hill l., photo..... 6
Porphyry.
See also Feldspar; Quartz porphyry.
Rowan-Straw Lakes area.....4, 17, 18
gold associated with..... 22-24
Rowan l., photo..... 20
Port Arthur.
Gold properties near..... 49-52
Pot-hole in greenstone..... 22
Powell, Frank and Mike
Gold discovery; claims.....48, 49
Pre-Algoman intrusives
Rowan-Straw Lakes area.....4, 5, 7, 17
Pre-Cambrian.
Lake of the Woods area. *See* Geology, general.
Port Arthur area..... 49
Rowan-Straw Lakes area..... 4-22
Saganaga Lake area..... 48
Priam lake..... 2, 19
Prospecting conditions.
Rowan-Straw Lakes area..... 23
Prout, J. W., gold claims..... 24
Quartz vein, photo..... 25
Provincial Assay Office..... 2
Pyrite.
Lake of the Woods area.....33, 37, 41-47
Port Arthur area..... 51
Rowan-Straw Lakes area.....9, 22, 24, 26
Pyroclastics.
See Agglomerate; Breccia; Tuff.
Pyrrhotite.
Lake of the Woods area.....37, 41, 44, 47
Rowan-Straw Lakes area..... 23

Q

Quartz diorite..... 5, 17
Quartz-feldspar porphyry.
Lake of the Woods area.....35, 36, 45
Port Arthur area..... 50
Rowan-Straw Lakes area..... 18
Saganaga Lake area..... 48
Quartz porphyry.
See also Quartz-feldspar porphyry.
Lake of the Woods area.....42, 44, 45
Rowan-Straw Lakes area..4, 18, 20, 21, 25
Quartzite.....5, 11, 13
Graphitic..... 12
Quaternary, Rowan-Straw Lakes area.. 4, 22

PAGE

R

Rabbits 4
Rea, T. H. 49
Recent deposits 4, 22
Regina bay, L. of the Woods 30
Regina g. mine. *See* Horseshoe Mines.
Regina Reef Gold Mines 31
Rhyolite.
  Port Arthur area 49
  Rowan-Straw Lakes area ..5, 10, 13, 21, 25
    carbonated 27
Rhyolite breccia 25, 50
Roads.
  Rowan-Straw Lakes area 2
  Saganaga Lake area 48
Rowan lake.
  Access to area 2
  Boulder clay 22
  Fishing, commercial 4
  Gold mg. *See* Monte Cristo g. m.
  Rocks 6, 8, 9, 19, 20
    photos 8, 11, 20
    sulphide veins 23

S

Saganaga lake, report on area 48, 49
Saganagons lake 48
Sand 4, 22
Sandhill lake 10
Schistose lake.
  Game preserve 4
  Rocks 10, 11, 13
    structure 3, 14, 17
Section, longitudinal.
  Wendigo gold m. 37
Section, vertical.
  Horseshoe gold m. 32
Schists 5, 9
  See also Biotite, Chlorite, Sericite schists.
  Silicified 26, 27, 32
Sedimentary rocks.
  Keewatin 5, 11, 12
    Rowan l., photo 11
  Timiskaming 5, 12-17
    Pipestone l., photo 13
Segsworth, W. E. 27
Sericite schist.
  Lake of the Woods area 36, 47
  Rowan-Straw Lakes area 11, 25, 27
Shear zones.
  Lake of the Woods area 33, 36, 39, 45
  Rowan-Straw Lakes area 22, 24, 26
Shoal lake.
  Gold mines, description 43-47
    locations, key map to 29
Silver, H. E. 30, 42, 43
Silver, tellurides of 43
Sketch maps. *See* Maps, sketch.
Skunks 4
Slate 5, 11-13
Smith, F. L. 31, 33
Smith, J. D. C. 30
Smith, W. H. C. 48
Smith, W. W. 49
Soil, Rowan-Straw Lakes area 22
Spencer, C. L. 30
Sphalerite (zinc blende).
  Lake of the Woods area 43, 44
  Rowan-Straw Lakes area 22, 26

PAGE

Spruce 3
Stella lake.
  Geology; gold mg.; map 40, 41
Stella–Lac La Belle Mines Syndicate.
  Property described 40, 41
    location, map showing 29
Stevens island, Shoal lake.
  Rocks, petrography 45
Stonedam lake 23
Stormy lake.
  Rocks, correlation 16
Straw creek 15
Straw lake.
  Gold, discovery 1, 2
    mining 25-28
  Rocks 8, 10, 18, 21
Straw Lake Beach Gold Mines Syndicate, Ltd.
  Property, description and map 25-27
    rhyolite near 10
Straw Lake Mining Syndicate 27, 28
Striae, glacial 22
Structural geology.
  Lake of the Woods area 36
  Rowan-Straw Lakes area 12, 14-16
Sucan lake.
  Rocks 10, 12, 18
    structure 15, 16
Suffel, G. G. 7, 35, 36
Sullivan, Geo. L. 2
  Gold claims 24
Sulphide vein 27
Sulphides.
  See also Arsenopyrite; Chalcopyrite; Galena; Pyrite; Pyrrhotite; Sphalerite.
  Rowan-Straw Lakes area, massive ... 23
Synclines.
  Rowan-Straw Lakes area 3, 12, 14-16

T

Tanton, T. L. 49
T.B.14,095 gold claim 49
Tellurides.
  Lake of the Woods area 39, 43
  Rowan-Straw Lakes area 22, 26
Tetradymite.
  Lake of the Woods area 39, 43
  Rowan-Straw Lakes area 22, 26
Thomson, J. Ellis 30, 43
Thomson, Jas. E. 1, 7, 12, 16, 17, 20, 22, 23, 25, 27
  Repts. by, on:
    Rowan-Straw Lakes area 1-28
    Gold deposits on the Lake of the Woods 29-47
    Gold occurrences west of Port Arthur 48-52
Thomson bay, Pipestone lake.
  Rocks 5, 13, 17
  Structure 3, 12, 14, 15, 18
Thunder Bay district.
  See Port Arthur; Saganaga l.
Till. *See* Boulder clay.
Timber 3
Timiskaming series.
  Rowan-Straw Lakes area 4, 5, 12-17
    photo 13
  Saganaga Lake area 48
Topographical Survey of Canada 48

PAGE
Topography, Rowan-Straw Lakes area. 3
Tourist attractions. 4
Tourmaline.
Lake of the Woods area. 41-43
Rowan-Straw Lakes area. 21, 22
Trachyte. 5, 10, 21
Trans-Canada highway. 49
Transportation, Rowan-Straw area. 2
Trees, Rowan-Straw Lakes area. 3
Trout, lake. 4
Tuff. 5, 8-10

U

University of Toronto. 30
Upper Manitou lake. 16

V

Van Hise, C. R. 48
Volcanic breccia. *See* Flow breccias.
Volcanics. *See* Lavas.

W

Weasels. 4
PAGE
Weld lake, rapids. 2
Wendigo Gold Mines, Ltd.
Property, geology and workings. 35-39
location, map showing. 29
Whitefish. 4
Wilson, B. T. 2, 10, 24
Witch bay, L. of the Woods.
Geology; gold mining. 34-41
Witch Bay Gold Mines, Ltd.
Property, geology and workings. 39-41
location, map showing. 29

X

Xenoliths.
Greenstone in granite, photos. 18, 19

Y

Yoke lake. 2, 8
Young, H. G. 30

Z

Zinc blende. *See* Sphalerite.

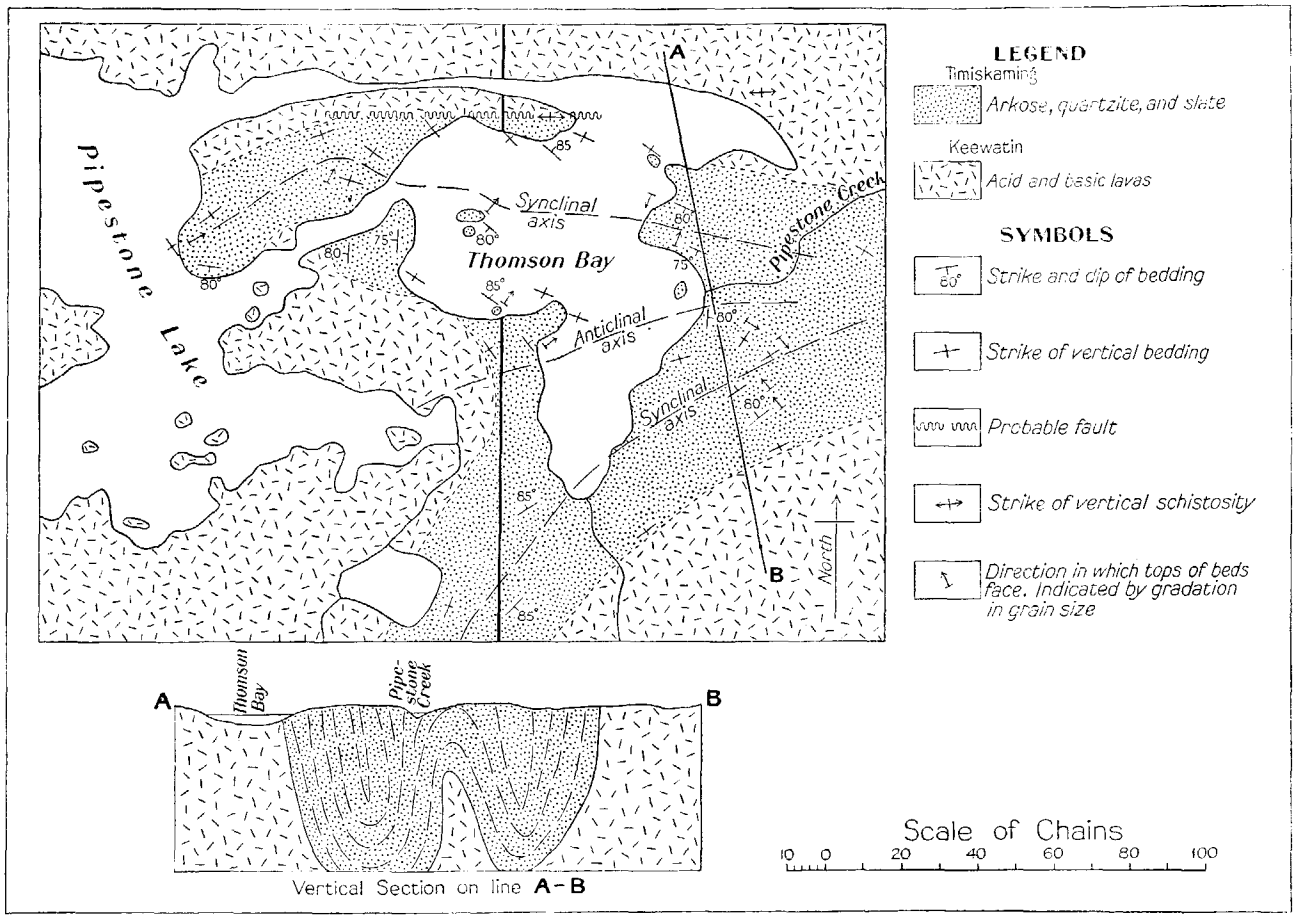


FIG. 2—DIAGRAM SHOWING THE STRUCTURE OF THE SEDIMENTS IN THE VICINITY OF THOMSON BAY, PIPESTONE LAKE.

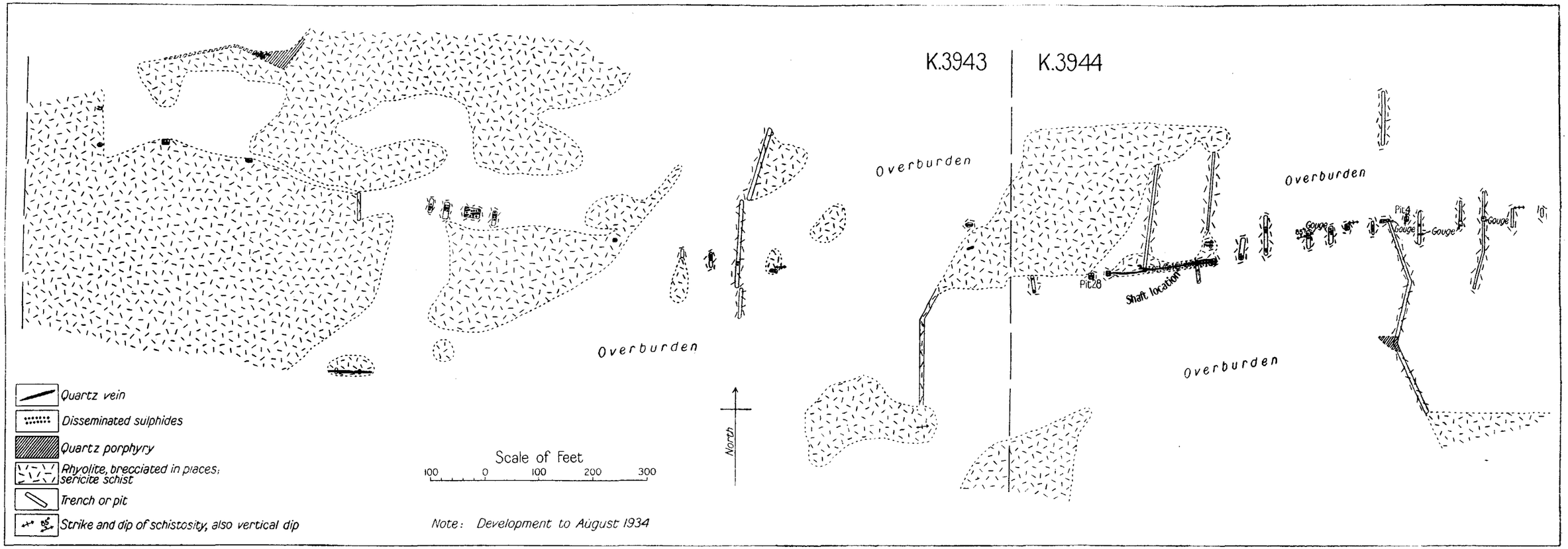


FIG. 4—GEOLOGICAL SKETCH MAP OF THE SHOWINGS ON THE CLAIMS OF STRAW LAKE BEACH GOLD MINES.

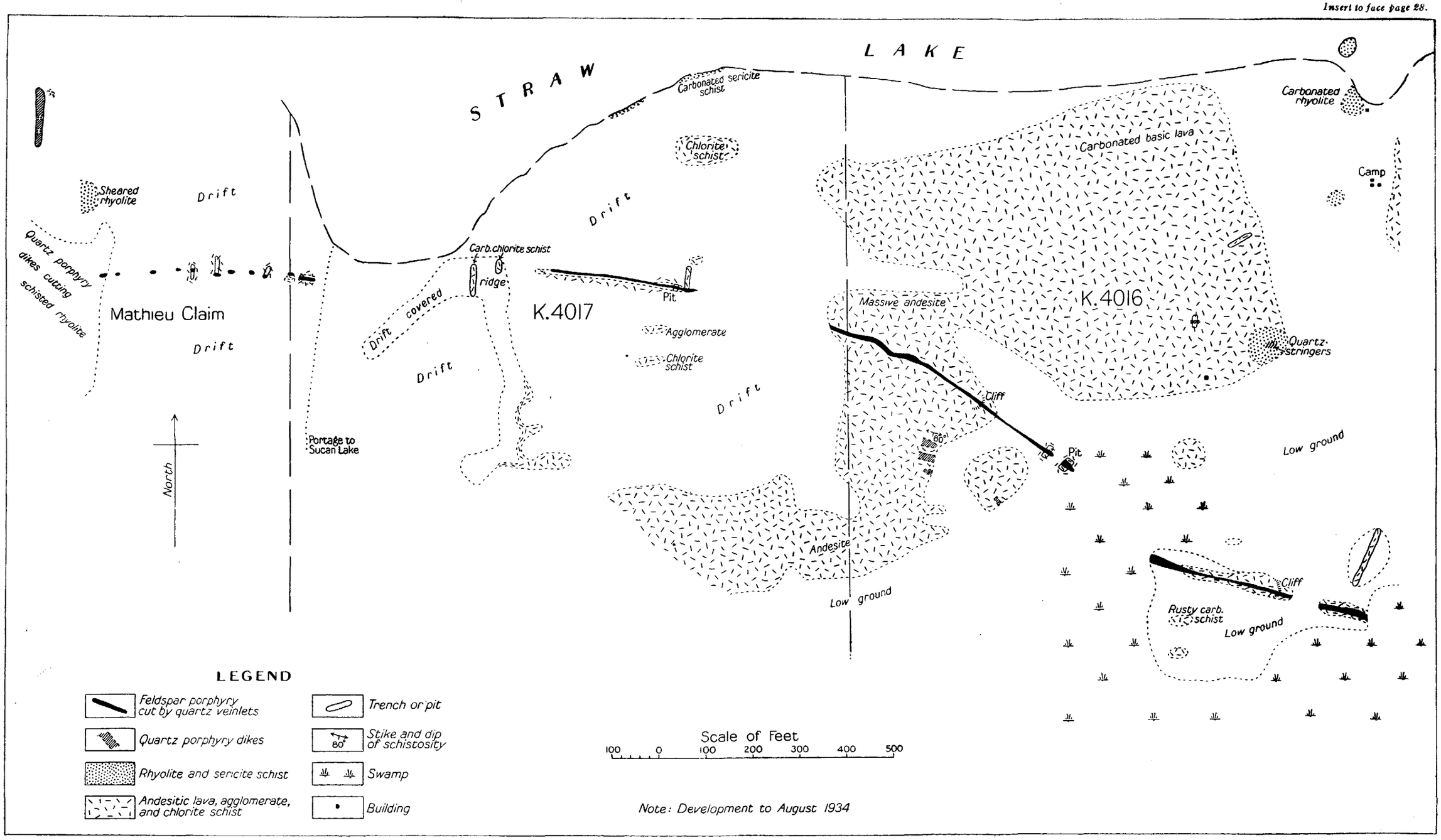


FIG. 5—GEOLOGICAL SKETCH MAP OF THE MAIN SHOWING OF THE STRAW LAKE MINING SYNDICATE AND PART OF THE MATHIEU CLAIM.

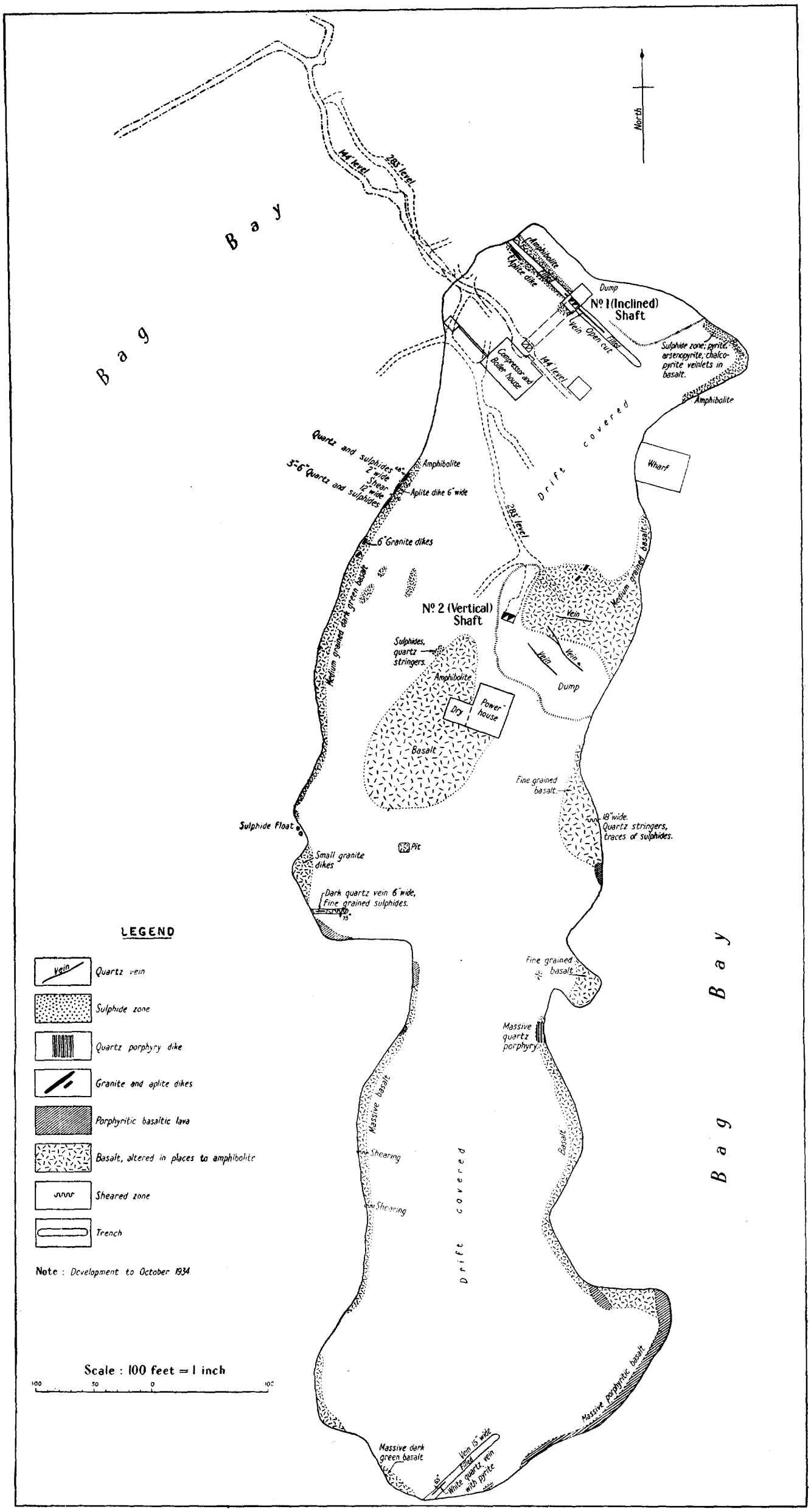
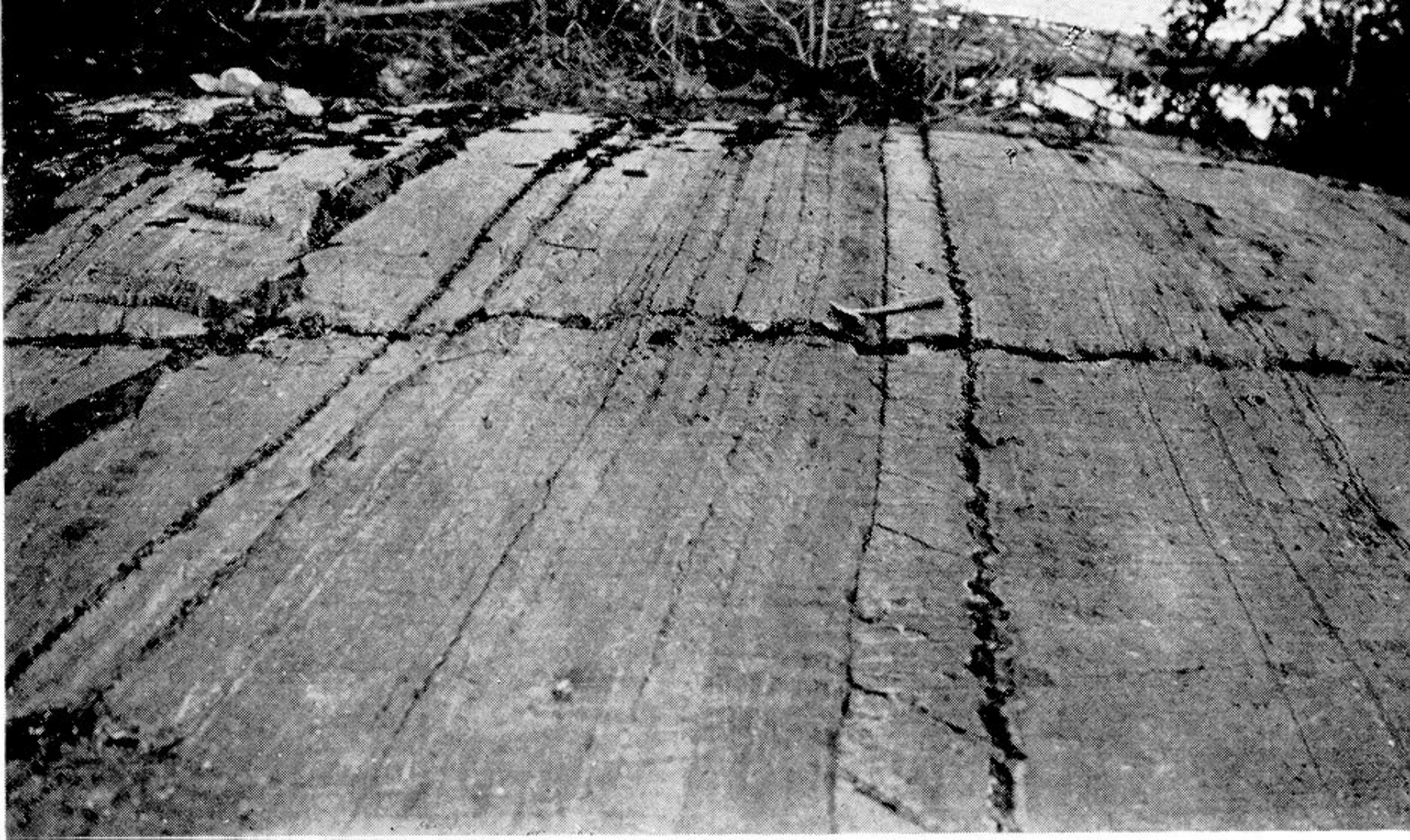


FIG. 8—GEOLOGICAL SKETCH MAP OF CEDAR ISLAND, BAG BAY, SHOAL LAKE, KENORA PROSPECTORS AND MINERS, LIMITED.









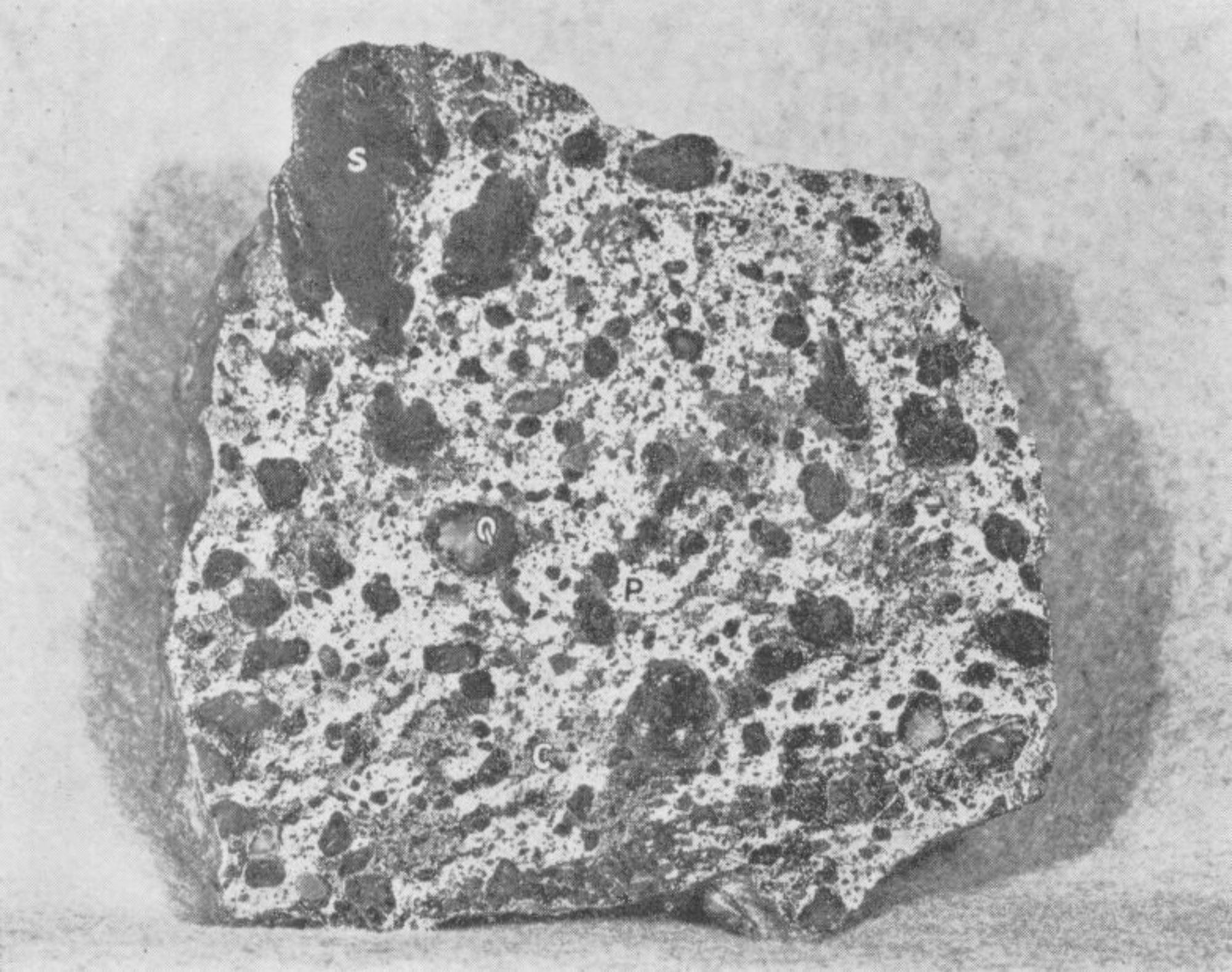


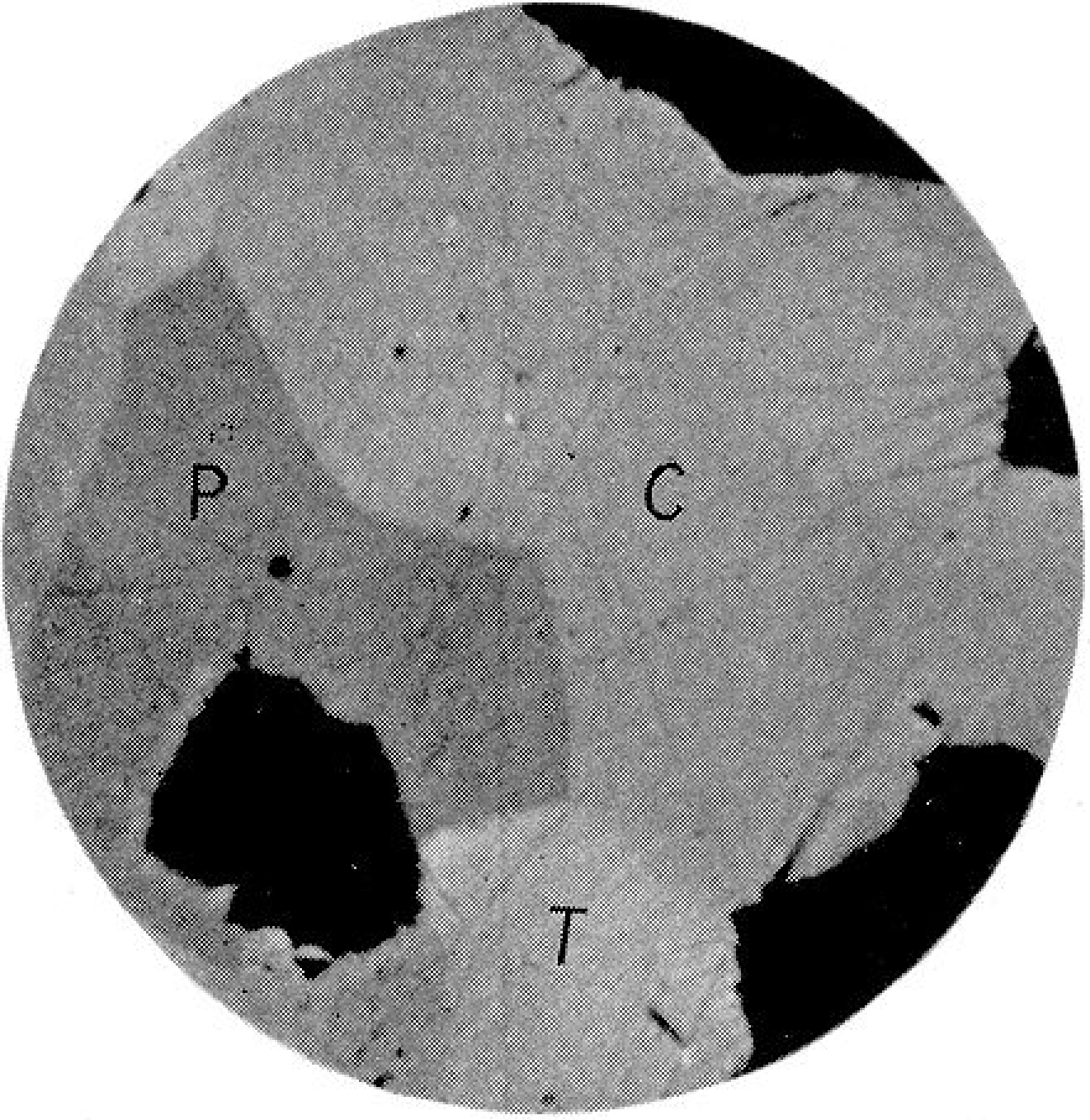




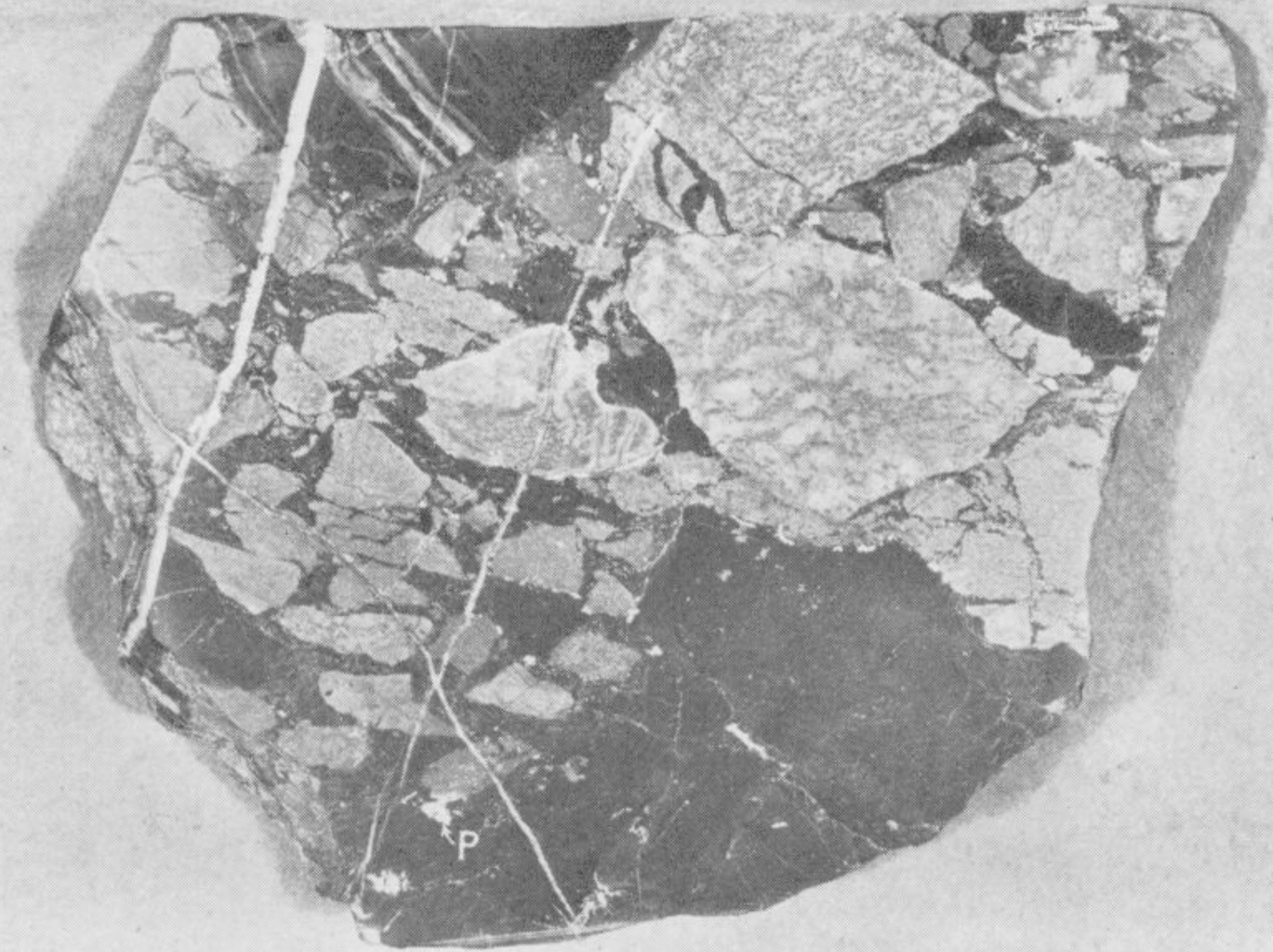





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FORTY-FOURTH ANNUAL REPORT

OF THE

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BEING

VOL. XLIV, PART V, 1935

Natural Gas in 1934, by R. B. Harkness - - - 1-66

Petroleum in 1934, by R. B. Harkness - - - 67-73

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O



TABLE OF CONTENTS

Vol. XLIV, Part V

NATURAL GAS IN 1934 — PAGE

General ... 1
Table I—Natural Gas Production by Fields, 1931–1934 ... 3
Table II—Domestic Consumption of Natural Gas, Capital Invested, and Wages Paid, 1921–1934 ... 3
Analysis of Gas Consumption ... 3
Table III—Gas Consumption in Towns and Cities, 1934 ... 4
Table IV—Gas Consumption in Townships, 1934 ... 6
Gas Wells and Their Production ... 7
Table V—Gas Wells and Their Production, 1934 ... 8
Gas Wells Drilled in 1934 ... 10
Sulphur Gas ... 11
Leakage ... 13
Table VI—Leakage in Distribution Plants, 1934 ... 14
Table VII—Leakage in Transmission Lines, 1934 ... 15
Table VIII—Leakage on Rural Lines, 1934 ... 16
Licenses Issued in 1934 ... 17
Table IX—Operators Licensed to Lease and Prospect for Natural Gas ... 17
Table X—Operators Licensed to Drill or Bore for Natural Gas ... 18
Table XI—Operators Licensed to Produce Natural Gas ... 20
Table XII—Operators Licensed to Distribute Natural Gas ... 21

PAGE

Licenses Issued in 1934—*Continued*
Table XIII—Operators Licensed to Operate Pipe Lines ... 21
Logs of Wells ... 21
Brant County ... 22
Elgin County ... 23
Haldimand County ... 24
Kent County ... 48
Lambton County ... 52
Lincoln County ... 59
Middlesex County ... 62
Norfolk County ... 62
Peel County ... 64
Welland County ... 64
Wentworth County ... 66

PETROLEUM IN 1934

General ... 67
Table I—Oil Produced in Ontario by Fields, 1926–1934 ... 68
Table II—Oil Wells and Their Production, 1934 ... 68
Exploratory Drilling ... 69
Oil in Brooke Township ... 69
Petroleum Refining ... 71
Table III—Petroleum Refining Operations, 1929–1934 ... 72
Petroleum Imported into Ontario ... 72
Table IV—Petroleum and Refined Products Imported in 1933 and 1934 ... 73

ILLUSTRATIONS

PAGE

Gas well in Dover township ... 2
Well drilled by Bon Jasperson in Lake Erie, Gosfield South township ... 10
Scene in Dover township showing four wells ... 11
Sulphur gas from a well in Bayham township ... 12
Laying welded pipe line in winter ... 13

CONTOUR MAP AND GRAPHS

PAGE

Graph of the natural gas industry in Ontario for the past forty-four years ... 1
Graph of the crude oil industry in Ontario for the past seventy-four years ... 67
Structure contour map of Brooke township and vicinity, showing oil occurrences ... *insert facing* 68
Graph showing crude oil and products distilled in Ontario refineries ... 70

MAP

(In pocket at back of report)

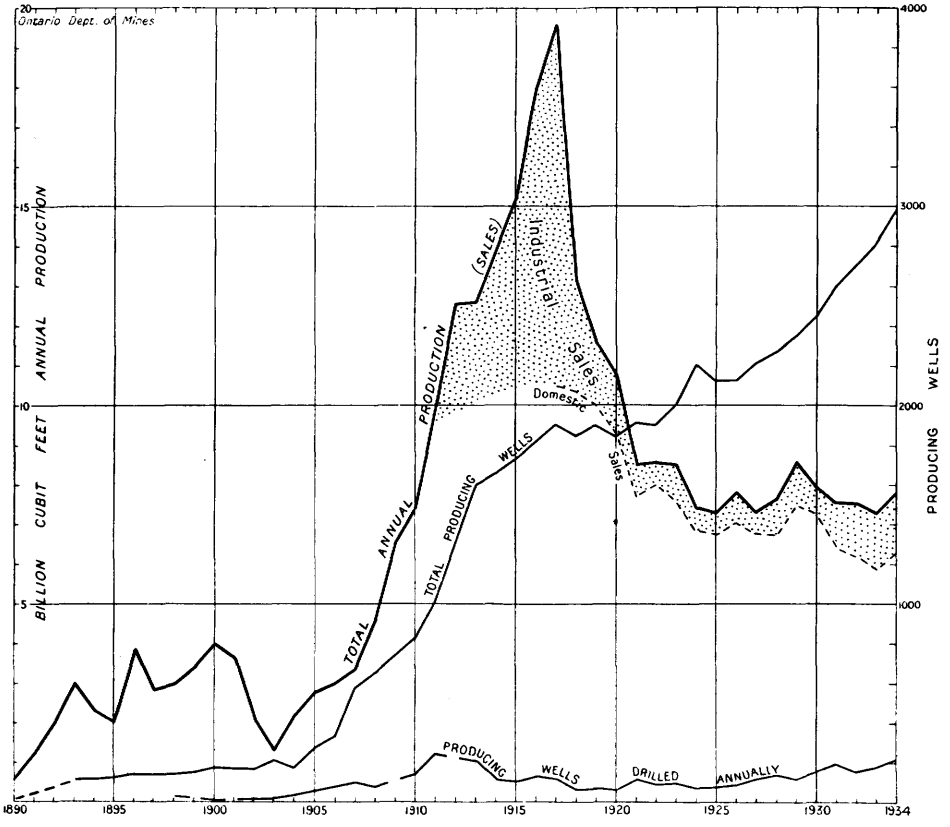
Map No. 44h—Dover Oil and Gas Field, County of Kent. Scale, 2,000 feet to the inch.

NATURAL GAS IN 1934

By R. B. Harkness

General

The year 1934 may be the turning point in this period of depression if the natural gas statistics can be taken as an index. After a steady decline from 1929 to 1933, between which years production dropped 1,417 million cubic feet, the



Graph of the natural gas industry in Ontario for the past forty-four years.

production of 1934 surpassed 1933 by 526 million cubic feet. Table I shows details by fields. After a steady decline in the quantity used per consumer since the year 1921, the year 1934 shows an increase. The number of domestic consumers also shows a satisfactory increase, and although the number of employees is less than in 1933, the wages paid them has materially increased. In Table

II will be seen a comparison with years since 1921. The number of producing wells drilled, although below 1932, the record year since 1913, is well above that of 1933; and the capacity of these wells, as measured by their open flow, is the highest recorded. The graph on page 1 illustrates these facts.

No new gas fields have been discovered, but the known fields have been extended: the Dover field in Dover township, Kent county; and the Declute field on the shore of Lake Erie in Raleigh township, Kent county. A few large



Gas well in Dover township, Kent county, showing the effect of allowing gas confined in a well at a pressure of 1,200 pounds per square inch to flow freely into the atmosphere. Gas is, of course, invisible; what is seen in the photograph is frozen moisture in the gas. The low temperature is caused by the sudden expansion.

wells in these fields account for the large increase in open flow of new wells. These additions to gas reserves come at a most opportune time, as the landward portion of the Tilbury field, after being drawn on for nearly thirty years, is being seriously depleted, as indicated by its rock pressure. There is, however, no immediate cause for alarm that it may fail to deliver its annual quota of gas.

In addition to the investment by operating companies in the natural gas industry in Ontario, as shown in Table II, the individual consumers of natural gas have invested in equipment, at a low valuation, $7,000,000. This investment is increasing annually.

TABLE I—NATURAL GAS PRODUCTION BY FIELDS, 1931–1934

County	Field	1931	1932	1933	1934
		M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Essex	Kingsville	4,376,184	4,506,072	4,201,704	4,093,186
Kent	Tilbury				
	Dover	338,422	275,958	252,694	363,344
Lambton	Dawn	130,198	170,671	265,061	517,009
	Oil Springs				
Middlesex	Crumlin	300			
Elgin	Bayham	43,536	45,708	45,968	51,483
Norfolk	Norfolk	312,535	365,638	346,621	354,274
Lincoln	Lincoln				
Haldimand	Haldimand	1,590,452	1,453,864	1,524,251	1,801,160
Wentworth	Wentworth				
Brant	Onondaga	170,521	140,612	121,578	109,486
Bruce	Amabel	516	500	500	500
Welland	Welland	377,566	351,616	333,619	318,409
Wells in surface drift	Howard and Sarnia	19,304	15,515	14,663	14,000
Private wells		60,000	60,000	60,000	60,000
Total produced		7,419,534	7,386,154	7,166,659	7,682,851
Value		$4,635,497	$4,719,297	$4,523,084	$4,741,368
		M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Imported mixed gas		102,141	111,727	97,075	102,667
Total distributed		7,521,675	7,497,881	7,263,734	7,785,518

TABLE II—DOMESTIC CONSUMPTION OF NATURAL GAS, CAPITAL INVESTED, AND WAGES PAID, 1921–1934

Year	Retail rate, cents per M cu. ft.	No. of pay consumers	Total quantity used	Quantity used per consumer	Capital invested in all natural gas operations[1]	No. of men employed	Wages paid
			M cu. ft.	M cu. ft.			
1921	47	58,609	5,937,316	101.3	$17,328,757	632	$592,606
1922	47	63,229	6,028,947	95.3	17,769,664	692	539,072
1923	50	62,352	6,210,459	99.6	25,570,972	603	633,365
1924	55	61,100	5,933,595	97.1	24,781,723	727	639,167
1925	56	62,338	5,300,424	85.6	26,111,387	692	625,826
1926	57	63,695	5,595,521	87.8	30,500,874	860	842,305
1927	60	66,818	5,210,315	78	31,987,879	1,123	1,148,339
1928	60	70,259	5,699,553	71.2	36,601,828	1,209	1,497,999
1929	58	80,991	6,336,873	78.2	35,162,736	1,323	1,529,367
1930	64	84,135	6,332,519	75.2	36,162,268	1,328	1,545,648
1931	62	86,050	5,607,744	65.1	42,921,142	1,241	1,383,286
1932	63	86,631	5,409,154	62.2	45,982,719	893	1,059,643
1933	63	84,933	5,102,340	60	51,766,592	958	958,336
1934	62	86,393	5,262,631	61	41,934,395	931	1,010,979

[1]This includes capital invested in drilling, producing, and distributing.

Analysis of Gas Consumption

Tables III and IV give in detail the statistics of gas consumed in homes and industries in all gas-consuming municipalities in Ontario during 1934.

Similar tables have been published annually since 1921, and these give an excellent comparison of the quantity of gas used at varying rates. It should be borne in mind that the price of other fuels in different localities will affect the consumption of gas, as also does the atmosphere, temperature, and wind velocity. In making a comparison of these tables, these factors should be given due consideration. The slight increase in the per capita consumption, may be due to either the late spring or to a more general use of gas.

Space does not permit of publishing the intermediate steps in the rates. The maximum and minimum rates only are given.

TABLE III—GAS CONSUMPTION IN TOWNS AND CITIES, 1934

Town or city	Population	No. of consumers		Quantity consumed			Distance from gas field	Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial		
				M cu. ft.	M cu. ft.	M. cu. ft.	miles	
Alvinston	648	190	1	11,434	6	.....	20	$0.60–.85
Aylmer	1,987	625	....	25,707	.....	.....	16	.70
Bartonville	602	128	....	4,882	.....	.....	19	.60
Belle River	719	154	....	10,443	.....	230	29	.55–.70
Belmont	317	110	....	3,400	.....	.....	9	.80–1.00
Binbrook	100	18	1	540	200	.....	1	.40
Blenheim	1,702	579	1	53,534	150	1,716	20	.50–.65
Bothwell	685	139	1	9,503	15	347	14	.60–.85
Brantford	30,611	4,480	5	195,724	1,237	10,746	140	.80
Brigden	433	149	....	9,338	.....	903	30	.55–.70
Burlington	3,562	272	....	24,359	.....	.....	48	.60–1.90
Cainsville	324	100	....	4,260	.....	.....	4	.80
Caledonia	1,475	492	1	37,819	438	13,677	7	.60
Canfield	166	60	....	4,378	.....	.....	1	.50–.60
Cayuga	693	213	1	18,693	49	241	6	.60
Chatham	16,140	4,009	3	349,599	4,081	10,832	22	.50–.75
Coatsworth	101	24	1	1,484	85	216	4	.40–.65
Comber	506	133	....	14,208	.....	3,663	19	.50–.65
Cottam	425	82	....	6,046	.....	578	35	.55
Courtland	348	50	....	2,793	.....	83	3	.60
Courtright	338	120	1	6,851	88	931	53	.55–.70
Crystal Beach	529	181	....	2,698	.....	.....	1	1.00–1.30
Delhi	1,269	386	....	28,290	.....	275	4	.60
Dorchester	403	115	....	6,934	.....	.....	95	.60–.85
Dresden and Tupperville	1,469	495	3	43,458	174	835	38	.50–.65
Dundas	5,032	1,124	1	56,133	8	4,151	172	.70
Dunnville	3,632	1,000	2	95,947	433	11,038	7	.45–.60
Dutton	798	240	3	19,966	213	870	52	.55–.80
Echo Place	732	75	....	3,371	.....	.....	5	.80
Eden	76	28	....	1,382	.....	.....	11	.60
Essex	1,786	466	2	39,277	85	570	33	.55–.70
Fairground	75	13	....	619	.....	.....	1	.60
Fenwick	328	96	....	5,856	.....	.....	18	.60–.75
Fingal	169	33	....	2,312	.....	.....	71	.55–.80
Fisherville	162	45	....	3,652	.....	78	2	.50
Florence	184	64	....	3,691	.....	.....	5	.50–.75
Fonthill	872	224	....	6,601	.....	.....	25	.75–.85
Fort Erie	5,366	1,364	5	56,186	2,332	.....	8	1.00–1.30
Galt	14,057	2,202	1	82,881	210	5,551	147	.55–.80
Grimsby	1,952	247	....	7,684	.....	.....	10	.85
Grimsby Beach		54	....	1,977	.....	.....	11	.85
Hagersville	1,355	410	....	31,158	.....	.....	14	.60
Hamilton	153,504	8,280	3	354,252	763	644,343	47	.75
Hepworth	380	5	2	100	400	.....	1	.75

TABLE III—GAS CONSUMPTION IN TOWNS AND CITIES, 1934—*Continued*

Town or city	Population	No. of consumers		Quantity consumed			Distance from gas field	Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial		
				M cu. ft.	M cu. ft.	M. cu. ft.	miles	
Hespeler	2,798	192	....	10,502	.....	.....	155	.55–.80
Highgate	343	104	2	8,648	370	.....	32	.50–.75
Ingersoll	5,104	1,026	2	42,984	274	2,956	100	.80
Inwood	250	84	....	3,897	.....	.....	14	.60–.85
Jarvis	531	208	....	17,629	.....	.....	9	.60
Kingsville	2,354	641	1	64,476	230	119	30	.55
Lake Shore	.....	292	....	4,380	.....	.....	16	1.00–1.30
Lambeth	172	108	....	8,164	.....	.....	85	.60–.85
Leamington	5,004	1,437	....	149,693	.....	.....	20	.55
Lynedoch	175	39	....	3,008	.....	.....	2	.60
Merlin	189	142	2	13,115	1,982	563	2	.45–.60
Merritton	2,487	435	....	14,869	.....	446	35	.60–.75
Nelles Corners	86	7	....	922	.....	.....	1	.60
Niagara Falls	18,193	3,209	....	97,985	.....	17,742	11	1.00–1.50
Oil Springs	462	125	....	6,613	.....	.....	2	.60–.75
Paris	4,297	868	2	42,275	153	5,181	129	.55–.80
Petrolia	2,715	744	1	72,009	394	1,136	60	.55–.70
Port Burwell	423	212	1	11,152	51	.....	3	.60
Port Colborne and Humberstone	7,859	1,779	3	78,576	314	300	5	.70–1.00
Port Dover	1,692	575	....	44,589	.....	392	1	.60
Port Rowan	692	245	....	12,816	.....	.....	1	.60
Preston	6,189	598	....	29,533	.....	2,260	151	.55–.80
Ridgetown	1,914	635	5	55,851	1,839	856	28	.55–.65
Ridgeway	1,096	229	....	10,595	.....	.....	1	1.00–1.30
Rodney	748	228	1	16,779	116	402	40	.55–.80
St. Anns	120	25	....	885	.....	.....	7	.85
St. Catharines	26,161	5,105	1	217,358	512	23,745	35	.60–.75
St. George	507	115	....	3,927	.....	.....	148	.80
St. Williams	270	105	....	5,074	.....	265	1	.60
Sarnia and Pt. Edward	18,956	5,016	4	303,963	1,582	23,341	55	.55–.80
Selkirk	196	139	1	10,899	105	.....	1	.60
Shedden	233	91	....	6,450	.....	339	63	.55–.80
Simcoe	5,174	1,772	2	177,560	1,073	12,321	20	.60
Smithville	570	177	....	7,301	.....	.....	6	.75
Sombra and Port Lambton	419	152	....	10,311	.....	71	45	.55–.70
Stevensville	418	32	....	1,278	.....	.....	1	1.00–1.30
Straffordville	253	82	....	6,130	.....	523	6	.60
Thamesville	763	220	3	15,100	101	1,099	13	.50–.75
Thorold	4,945	1,035	....	37,396	.....	502	35	.60–.75
Tilbury	1,897	530	2	46,290	575	2,318	14	.50–.65
Tillsonburg	3,380	1,041	1	80,809	475	1,477	16	.63
Vienna	222	96	1	4,073	64	.....	1	.60–.80
Vittoria	205	76	....	3,981	.....	.....	3	.60
Wallaceburg	4,457	1,171	1	99,308	297	441,358	19	.50–.65
Wallacetown	143	46	1	3,146	7	531	60	.60–.80
Waterdown	919	21	....	989	.....	.....	45	.60–.90
Waterford	1,213	167	....	9,917	.....	141	30	.60–1.48
Welland	10,655	2,784	6	80,997	934	.....	3	1.00–1.50
West Lorne	776	167	1	11,922	176	229	49	.55–.80
Wheatley	754	224	....	17,130	.....	277	12	.50–.65
Windsor (Border Cities)	93,739	12,035	....	980,857	.....	188,539	45	.55–.80
Woodstock	11,007	2,116	2	94,105	279	2,578	110	.55–.80
Wyoming	505	143	1	8,354	3	627	65	.60–.85
Total	.....	78,119	85	4,715,990	22,873	1,444,508	.....	.....

TABLE IV—GAS CONSUMPTION IN TOWNSHIPS, 1934

County and township	Population	No. of consumers		Quantity consumed, M cu. ft.			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
ESSEX:							
Gosfield North	2,164	105	3	7,042	395	373	$0.50–.55
Gosfield South	2,311	492	.....	30,985	.....	28,379	.50–.55
Maidstone	2,976	71	7	4,284	1,296	146	.70
Mersea	4,929	340	4	32,857	782	7,914	.50–.55
Rochester	2,260	193	7	12,465	948	523	.55–.70
Sandwich East	5,376	10	.....	207	.....	.....	.55–.70
Sandwich South	2,066	111	.....	7,808	.....	248	.55–.70
Tilbury North	1,920	31	.....	1,333	.....	126	.55–.70
Tilbury West	1,554	20	2	1,295	144	.....	.55–.70
LAMBTON:							
Brooke	2,217	21	.....	517	.....	.....	.55–.80
Dawn	2,160	76	3	4,540	669	854	.45–.60
Enniskillen	2,725	129	.....	6,021	.....	383	.55–.70
Moore	2,873	329	.....	17,969	.....	1,874	.55–.70
Plympton	2,681	6	.....	472	.....	.....	.55–.70
Sarnia	3,156	.....	10	.....	2,208	.....	.55–.70
Sombra	2,746	58	.....	2,208	.....	951	.55–.70
KENT:							
Camden	2,152	15	.....	571	.....	.....	.55–.70
Chatham	5,832	80	.....	5,904	.....	.....	.45–.60
Dover	3,906	424	1	36,144	148	8,812	.45–.60
Harwich	5,010	457	9	32,304	3,779	.....	.50–.75
Howard	2,813	168	3	11,850	907	.....	.50–.75
Orford	1,718	17	2	1,651	201	.....	.50–.75
Raleigh	4,230	585	21	47,767	7,585	1,131	.45–.75
Romney	1,456	67	38	4,945	12,535	.....	.40–.65
Tilbury East	3,406	236	71	18,247	22,763	1,984	.45–.60
Zone	859	17	.....	698	.....	.....	.55–.70
ELGIN:							
Aldborough	2,708	19	1	869	358	.....	.55–.75
Bayham	3,265	74	18	3,061	3,065	380	.60–.70
Dunwich	2,357	54	2	3,175	130	.....	.55–.80
Malahide	2,714	44	3	1,321	318	.....	.60–.70
Southwold	2,397	104	.....	6,848	.....	48	.55–.80
MIDDLESEX:							
North Dorchester	2,932	14	1	756	86	.....	.60–.85
Westminster	6,730	168	.....	20,246	.....	.....	.60–.85
NORFOLK:							
Charlotteville	2,978	15	5	1,037	1,001	.....	.60
Middleton	2,493	46	2	3,224	362	.....	.60
North Walsingham	2,118	6	1	641	185	.....	.60
South Walsingham	1,711	21	5	1,698	704	.....	.60
Townsend	2,968	30	.....	2,607	.....	.....	.60
Windham	3,618	2	3	210	590	.....	.60
Woodhouse	2,308	176	10	15,590	1,528	.....	.60
BRANT:							
Brantford	7,336	47	.....	2,218	.....	.....	.55–.80
Burford	3,697	3	.....	140	.....	.....	.55–.80
Onondaga	964	48	12	2,620	1,621	.....	.50–.70
South Dumfries	2,523	25	.....	586	.....	.....	.55–.80
Tuscarora	2,654	8	.....	524	.....	.....	.25
OXFORD:							
East Oxford	1,957	7	.....	327	.....	.....	.55–.80
West Oxford	1,796	53	.....	2,102	.....	.....	.55–.80

TABLE IV—GAS CONSUMPTION IN TOWNSHIPS, 1934—*Continued*

County and township	Population	No. of consumers		Quantity consumed, M cu. ft.			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
HALDIMAND:							
Canborough	840	95	48	6,299	8,069	140	.50–.60
Dunn	805	151	10	6,373	914	.....	.60
Moulton	1,590	153	16	7,321	2,482	.....	.60
North Cayuga	1,282	51	9	3,461	3,790	.....	.60
Oneida	1,301	53	12	5,603	1,783	.....	.50–.60
Rainham	1,608	156	26	8,473	4,547	598	.50–.60
Seneca	1,589	149	28	9,045	5,128	.....	.60
Sherbrooke	346	59	7	2,613	877	.....	.60
South Cayuga	580	53	15	2,135	2,737	.....	.60
Walpole	3,145	331	56	19,933	8,617	72	.60
LINCOLN:							
Caistor	1,260	62	1	2,114	117	136	.60–.85
Gainsborough	2,091	78	1	1,768	50	.....	.50–.75
Grantham	5,010	8	.....	549	.....	.....	.75
Louth	2,903	10	.....	607	.....	.....	.75
WELLAND:							
Bertie	4,174	176	61	10,297	9,532	.....	.75–1.30
Crowland	5,082	74	13	2,946	524	.....	.75–1.30
Humberstone	2,368	266	30	12,331	4,392	.....	.70–1.30
Pelham	2,690	62	1	3,648	80	.....	1.00–1.30
Stamford	8,020	85	4	4,953	616	.....	1.00–1.30
Wainfleet	2,718	190	21	4,101	3,592	.....	.60–1.00
Willoughby	905	30	26	1,670	4,004	.....	1.00–1.30
WENTWORTH:							
Ancaster	3,606	122	.....	14,048	.....	.....	.70
Barton	1,840	260	.....	22,217	.....	.....	.60–.75
Binbrook	1,080	83	21	6,646	3,656	349	.40–.60
East Flamborough	3,705	51	.....	2,908	.....	.....	.60
Glanford	1,265	126	4	10,774	1,126	467	.60–.75
Saltfleet	4,837	307	.....	13,660	.....	.....	.55–.75
WATERLOO:							
Waterloo	7,591	11	....	264	.....	.....	.55–.80
Total	.....	8,274	654	546,641	130,941	55,888	.....

SUMMARY

	M cu. ft.
Total distribution to customers	6,916,841
Used by companies for all purposes	59,919
Used by private well-owners	74,000
Leakage in transmission lines	368,738
Leakage in distribution plants	349,673
Leakage in rural lines	16,347
Total amount of gas distributed	7,785,518

Gas Wells and Their Production

In Table V is given a summary by townships of the number of gas wells in Ontario, their production, and the number abandoned; the number of new wells drilled, with their open flow; the rock pressure of each township; and the acreage under lease and the rentals paid.

TABLE V—GAS WELLS AND THEIR PRODUCTION, 1934

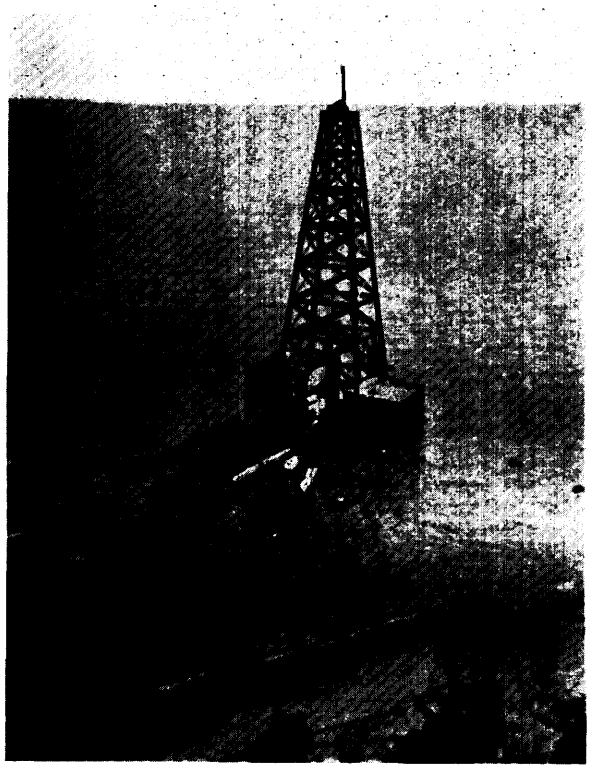
County	Township	No. of wells producing	No. of wells abandoned	Wells drilled			Production	Rock pressure, lbs. per sq. in.	Acres under lease	Rental paid
				No. dry	No. producing	Open flow				
						M cu. ft.	M cu. ft.			
Essex	Gosfield South	23		1	1	75		150	744	$427
	Maidstone									
	Mersea	3						276		
Kent	Harwich						4,093,186			
	Orford									
	Raleigh	42	1	3	5	31,089		544	54,897	
	Romney	142	2					215		140,089
	Tilbury East	153			3	516		215		
	Dover	12		2	3	9,860	363,344	1,140	7,607	
Lambton	Dawn	23		4	1	198	508,596	656	19,763	
	Euphemia		3	1						
	Enniskillen	4					6,613	247	1,000	
	Moore								4,000	
	Sarnia	13					1,800	70	5,000	
	Sombra			3					7,998	
Middlesex	Mosa	3						706		
	North Dorchester	3						50		
Elgin	Aldborough			1						
	Bayham	39		2	4	2,157	51,483	595		
	Dunwich									
	Malahide	1						210		
Norfolk	Charlotteville	13						225		
	Houghton	5	2					400		
	Middleton	46		2	7	1,927		600		
	North Walsingham	10						319		
	South Walsingham	16			1	95	354,274	361		
	Townsend	2			1	17		195		
	Windham	10		1	2	190		230		
	Woodhouse	59		1	4	225		241		

Haldimand	Canborough	186	3	1	16	415		95		
	Dunn	52	5	1	7	267		196		
	Moulton	132	3	1	13	417		120		
	North Cayuga	178	.....	4	18	922		190		
	Oneida	61	1	4	8	458		126	305,543	111,031
	Rainham	280	1	2	8	779		235		
	Seneca	176	12	2	17	1,344		94		
	Sherbrooke	18	.....	.....	.....	.....		254		
	South Cayuga	54	.....	1	1	16	1,801,160	147		
	Walpole	327	1	29	55	3,967		250		
Wentworth	Ancaster	1	.....	.....	1	20		40		
	Binbrook	53	1	.....	1	48		72		
	Glanford	11	.....	.....	.....	.....		56		
Lincoln	Caistor	61	2	.....	2	110		69		
	Gainsborough	15	.....	5	10	261		126		
Welland	Bertie	99	1	.....	4	79		120		
	Crowland	29	7	.....	.....	.....		170		
	Humberstone	60	2	.....	.....	.....	318,409	65		
	Wainfleet	27	.....	.....	.....	.....		56		
	Willoughby	42	3	2	2	42		230		
Brant	Onondaga	41	9	2	8	431	109,486	82	45,100	102
	Tuscarora	76	1	.....	11	486		98		
Bruce	Amabel	2	.....	1	.....	.....	500	100	50	.....
Peel	Caledon	5	1	.....	.....	.....	.....	.....	.....	.....
	Chinguacousy	.....	.....	1	.....	.....	.....	.....	.....	.....
Surface wells	Harwich	69	.....	.....	.....	.....	14,000[1]	.....	.....	.....
	Howard									
Private wells[2]	.....	300	.....	.....	.....	.....	60,000[3]	.....	.....	.....
Total	.....	2,977	61	77	214	56,411	7,682,851	.....	451,702	251,649

[1]This gas is not metered and therefore must be estimated. The wells are owned privately, and the gas is used for domestic purposes
[2]Principally in Haldimand, Norfolk, and Welland counties.
[3]Estimated

Gas Wells Drilled in 1934

The year 1934 has the record in new production since the period, 1910 to 1914, when the Tilbury field reached its peak of development. Until 1919, no figures were compiled to show the increase in open flow by years, and from 1919 to 1921 the figures were not complete; a comparison of these figures shows that 1934 exceeds all years since 1919 in open flow of new wells. This, as will be seen in Table V, is principally the result of drilling in the Declute field in Raleigh township. This field has now been extended a considerable distance to the east;



Well drilled by Bon Jasperson in Lake Erie opposite lot 8, concession I, Eastern Division, Gosfield South township. The water is about 1½ feet deep. The drilling rig and engine were hauled to position by horses and after being jacked up were set in timbers. Storms interfered considerably with drilling.

how much farther it can be extended is uncertain. It is scarcely likely to be more than doubled in area on land, but its limits under Lake Erie are impossible to estimate.

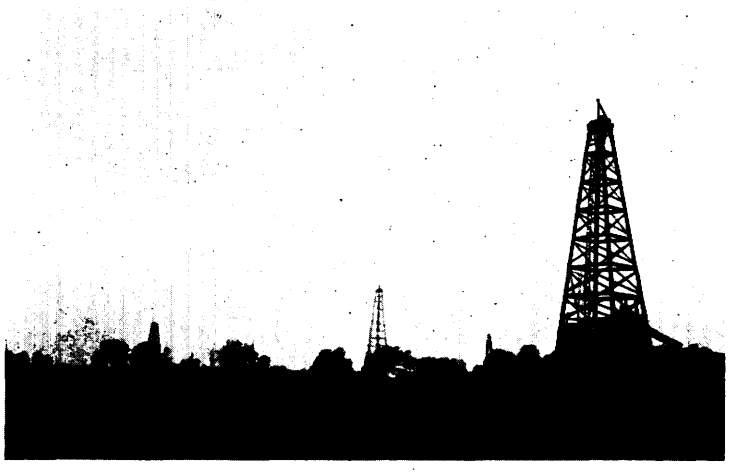
Second in importance are the extensions made in the Dover field. As early as 1923,[1] it was thought probable that the gas and oil in the Dover field lay along a fault. Subsequent drilling has proved the existence of the fault, which is part of a general east-west system of faulting in Kent and Lambton counties, and has traced it for a distance of 3 miles. Accumulation is on the

[1]Ont. Dept. Mines, Vol. XXXII, pt. V, 1923, p. 89.

downthrow side of the fault, and the largest wells appear to be those nearest the foot of the scarp. The Southern Ontario Gas Company have completed a 4-inch pipe line from the Dover field to connect with their 12-inch pipe line from the Tilbury field to Hamilton. The first delivery was made early in December, 1934.

Third in importance is the Eden gas field in Bayham and Middleton townships, which was discovered in 1932. The gas occurs in a sandstone, which resembles, lithologically, the Grimsby sandstone. Walpole township again takes the lead in Haldimand county for activity in drilling. The ratio of dry holes to producing wells is high, but the producing wells were more than average in production.

Fifty-two drilling rigs were in operation in 1934; and 217 producing wells, with a total footage of 187,430, and 77 dry holes, with a footage of 85,781, were drilled, a grand total of 273,211 feet, or 38,342 feet more than in 1933. The dry



Scene in Dover township, Kent county, showing four wells which produce oil and gas from 3,000 feet below surface. Corn, sugar beets, and tobacco are grown here. The photograph shows wheat and barley fence-high.

holes show an increase of 10, and the producing wells an increase of 41 over 1933. The acres under lease show a decided increase.

Drillers in Ontario have an investment of $282,032 in drilling rigs and equipment. They employed 136 men and paid wages amounting to $171,406 in 1934. These figures are included in Table II.

Sulphur Gas

A new find of natural gas with a high percentage of hydrogen sulphide has been made in the Eden gas field, about 8 miles south of Tillsonburg. The principal gas horizon in the Eden field is in the Grimsby sandstone, which is about 350 feet deeper than the horizon from which this sulphur gas comes. The sulphur gas comes from the same formation as the gas in the Tilbury field, i.e. the Salina or Guelph, or both. It is accompanied by a large volume of sulphur water, which is separated from the gas and discharged into a nearby stream.

An analysis of the gas, made in the Fuel Testing Laboratories of the Department of Mines, Ottawa, from a sample collected by the Natural Gas Commissioner of Ontario, follows:—

	Per cent. by volume
Hydrogen sulphide	0.7
Carbon dioxide	.1
Oxygen	.4
Methane	84.9
Ethane	5.4
Propane	1.4
Butane	.4
Pentanes and higher hydrocarbons	.2
Helium	.19
Nitrogen (by difference)	6.31

Specific gravity, 0.647.
Heating value gross per cu. ft. at 60°F., 937 B.t.u.



Sulphur gas from a well in lot 28, concession X, Bayham township. A flow of sulphur gas, estimated at several million cubic feet per day, and sulphur water, estimated at over a thousand gallons per minute, were encountered between 800 and 900 feet below surface.

In all probability, the presence of oxygen in the gas is due to the faulty method of sampling. Where a gas contains a quantity of hydrogen sulphide, the sample cannot be taken by the usual method of water displacement; and in collecting samples in dry containers, it is very difficult to purge them of air. If the oxygen is eliminated, the nitrogen content would be reduced to 4.71 per cent., and the methane and all other fractions would be proportionately increased. The heating value would no doubt approach 1,000 B.t.u.

Up to date, the volume of gas underground cannot be calculated. Probably at the end of the year pressure tests will give some light on the point.

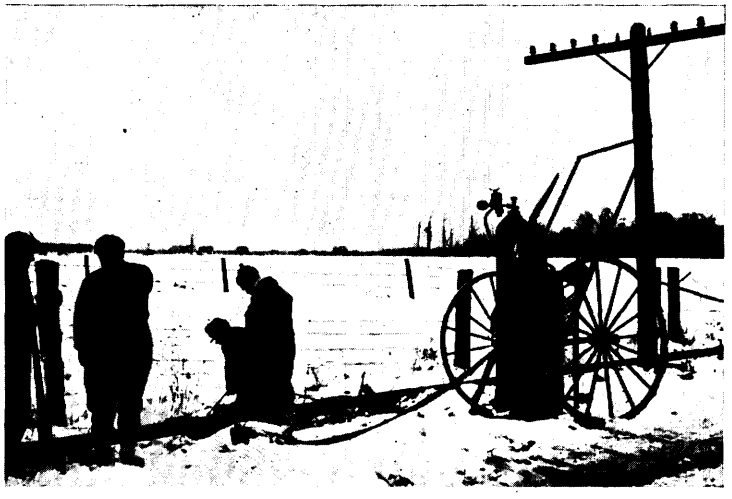
Large volumes of sulphur gas at this same horizon have been previously encountered, but the owners have never had faith in its commercial value. The high hydrogen sulphide content renders it unfit for domestic use, and to get to an industrial market, a special pipe line must be laid. It so happened that in this locality a market was found about 6 miles distant, and the gas is used

for raising steam under boilers in the Borden Milk Company's plant on the outskirts of Tillsonburg.

Leakage

Tables VI, VII, and VIII give details of the leakage in distribution plants, transmission lines, and intermediate pressure rural lines on nearly every individual system in Ontario. It is not feasible to measure the gas from the Haldimand, Norfolk, or Welland fields. The short transmission lines to Hamilton and Niagara Falls are such a small part of the total pipe lines, that the result to be obtained does not merit the installation of the necessary meters. This unmeasured leakage would probably increase the reported leakage by 25 per cent.

There is, and has been, a decided increase in the leakage over the past two years, and in several places it has increased alarmingly. The following is a list of places where leakage is much too great: Dorchester, Dundas, Dunnville,



LAYING WELDED PIPE LINE IN WINTER

In December, 1934, the Southern Ontario Gas Company laid a 4-inch welded line from their purification station at Glenwood to the Declute gas field, Raleigh township. Pipe was purchased in 40-foot lengths and welded. It was buried underground in 1935.

Hagersville, Leamington, Petrolia, Ridgetown, St. Catharines, Sarnia, Simcoe, Wheatley.

The leakage in transmission lines has increased nearly 100,000,000 cubic feet; and in the rural lines an increase is noted.

Gas companies, feeling the pinch of hard times in general with the rest of the world, have economized in every possible way, one of which has been a reduction of staff. The wage economies in all branches of the industry in 1933 were $100,000 over 1932; and in 1934, $52,000 over 1933, or $48,000 decrease from 1932. But the increase in leakage over 1933, valued at a retail price of 60 cents, is $132,000.

The total length of pipe lines of all sizes used in collecting and transmission is 1,534 miles; and for distribution 1,555 miles. To form a basis for comparison, all sizes of pipe are figured at their equivalent length in 3-inch pipe, which gives a total for collecting and transmission of 2,972 miles and for distribution, 1,689 miles.

TABLE VI—LEAKAGE IN DISTRIBUTION PLANTS, 1934

Cities and towns	Company	Equivalent miles of 3-inch pipe in distribution plants	Volume received	Volume delivered	Leakage for year		Average No. of consumers	Leakage per consumer	Pressure distribution plants, ounces per sq. in.
					Actual	Allowable			
			M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.		cu. ft.	
Belle River	Union Gas Co.	4.34	11,380	10,667	713	868	152	4,690	6
Belmont	Ontario Salt Co.	6.00	5,320	3,400	1,920	1,200	110	17,451	6
Blenheim	Union Gas Co.	12.78	56,767	55,587	1,180	2,556	580	2,034	5
Brantford	Brantford Gas Co.	93.44	225,046	207,881	17,165	18,688	4,488	3,824	4
Brigden	Union Gas Co.	3.88	10,656	10,151	505	776	149	3,389	5
Cainsville	Dominion Natural Gas Co.	5.52	10,033	7,631	2,402	1,104	175	13,725	4
Chatham	Union Gas Co.	80.28	376,289	364,501	11,788	16,056	4,012	2,938	5
Comber	Union Gas Co.	3.47	18,596	17,872	724	694	133	5,443	5
Corunna	Union Gas Co.	5.28	9,889	8,989	900	1,056	251	3,588	6
Courtright	Union Gas Co.	3.83	8,373	7,868	505	766	121	4,173	5
Dorchester	Southern Ontario Gas Co.	2.86	9,455	7,778	1,677	572	130	12,900	4
Dresden	Union Gas Co.	8.88	46,408	44,468	1,940	1,776	497	3,903	5
Dundas	Dominion Natural Gas Co.	12.68	67,664	60,292	7,372	2,536	1,125	6,553	4
Dunnville	Dominion Natural Gas Co.	13.87	104,811	97,373	7,438	2,774	994	7,482	4
Essex	Union Gas Co.	11.48	40,551	39,971	580	2,296	468	1,243	5
Fenwick	Dominion Natural Gas Co.	1.37	6,681	6,146	535	274	96	5,573	4
Fonthill	Fonthill Gas Co.	5.33	7,973	6,601	1,372	1,066	224	6,125	4
Galt	Dominion Natural Gas Co.	32.41	95,938	87,491	8,447	6,482	2,203	3,834	4
Hagersville	Dominion Natural Gas Co.	7.31	36,656	31,158	5,498	1,462	410	13,409	4
Ingersoll	Dominion Natural Gas Co.	21.09	47,499	43,427	4,072	4,218	1,028	3,961	4
Kingsville	Southern Ontario Gas Co.	13.49	73,038	67,096	5,942	2,698	640	9,284	8
Leamington	Leamington Corporation	25.47	174,998	149,693	25,305	5,094	1,437	17,609	6
Merlin	Union Gas Co.	2.77	16,243	15,659	584	554	144	4,055	4
Mount Hamilton	Dominion Natural Gas Co.	22.67	54,213	47,547	6,666	4,534	2,500	2,666	4
Paris	Dominion Natural Gas Co.	14.90	49,604	44,697	4,907	2,980	870	5,640	5
Petrolia	Union Gas Co.	15.80	85,844	73,539	12,305	3,160	745	16,516	6
Port Burwell	Dominion Natural Gas Co.	3.84	7,208	6,204	1,004	768	130	7,723	4
Port Lambton	Union Gas Co.	2.02	4,581	4,014	567	404	70	8,100	5
Ridgetown	Union Gas Co.	18.02	66,618	59,143	7,475	3,604	640	11,679	5
St. Catharines	Dominion Natural Gas Co.	58.56	337,987	302,266	35,721	11,712	5,541	6,446	4
St. George	Dominion Natural Gas Co.	2.11	4,504	3,928	576	422	115	5,008	4
Sarnia	Union Gas Co.	89.16	348,466	314,369	34,097	17,832	5,020	6,792	5
Shedden-Fingal	Southern Ontario Gas Co.	6.11	11,344	9,101	2,243	1,222	124	18,088	4
Simcoe	Dominion Natural Gas Co.	29.52	204,135	191,588	12,547	5,904	1,774	7,072	4

Sombra	Union Gas Co.	2.57	6,666	6,373	293	514	82	3,573	5
South London	Southern Ontario Gas Co.	8.87	20,659	16,651	4,008	1,774	168	23,857	4
Straffordville	Dominion Natural Gas Co.	1.39	7,690	6,785	905	278	84	10,773	4
Thorold	Dominion Natural Gas Co.	13.37	46,122	40,294	5,828	2,674	1,035	5,621	4
Tilbury	Union Gas Co.	9.20	50,380	49,184	1,196	1,840	532	2,248	5
Tillsonburg	Dominion Natural Gas Co.	23.48	92,787	83,454	9,333	4,696	1,042	8,956	4
Vienna	Dominion Natural Gas Co.	1.04	1,597	1,506	91	208	21	4,333	4
Wallaceburg	Union Gas Co.	21.05	111,314	104,381	6,933	4,210	1,172	5,915	6
West Hamilton	Southern Ontario Gas Co.	3.81	9,216	8,215	1,001	762	250	4,004	4
Wheatley	Southern Ontario Gas Co.	3.46	19,773	17,407	2,366	692	224	10,562	4
Windsor (Border Cities)	Union Gas Co.	477.36	1,252,043	1,174,703	77,340	95,472	12,035	6,426	4
Woodstock	Dominion Natural Gas Co.	48.40	110,601	96,963	13,638	9,680	2,118	6,439	4
Wyoming	Union Gas Co.	4.93	8,994	8,925	69	986	144	479	5
Total		1,259.47	4,372,610	4,022,937	349,673	251,894			

TABLE VII—LEAKAGE IN TRANSMISSION LINES, 1934

Transmission line	Size of pipe line	Equivalent miles of 3-in. pipe	Volume received	Volume delivered	Actual leakage	Average pressure on pipe lines
			M cu. ft.	M cu. ft.	M cu. ft.	lbs. per sq. in.
Dundas to Hamilton	6-inch	8.8	142,575	140,192	2,383	20
Gas field to Sarnia and Petrolia	6-, 8-, 10-, 12-inch	380.91	1,698,862	1,619,891	78,971	40–80
Leamington to Hamilton	8-, 10-, 12-inch	710.5	1,417,903	1,234,502	183,401	75
Gas field to Windsor	8-, 10-, 12-, 18-inch	423.08	1,440,876	1,401,456	39,420	30–80
Gas field to Ridgetown	6-, 8-inch	81.42	232,486	197,812	34,674	25–80
Gas field to Bothwell	4-, 6-inch	32	32,184	31,213	971	30–50
Gas field to Hamilton	8-inch	58.24	124,820	111,141	13,679	30–50
Dunnville to St. Catharines	8-inch	57.1	373,214	357,975	15,239	50
Total		1,752.05	5,462,920	5,094,182	368,738	

TABLE VIII—LEAKAGE ON RURAL LINES, 1934

Township	Equivalent feet of 3-inch pipe in all rural lines	Volume received	Volume delivered	Leakage for year		Average No. of consumers	Leakage per consumer	Average pressure on pipe lines	
				Actual	Allowable			Low pressure	High pressure
		M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.		cu. ft.	ozs.	lbs.
Chatham	2,265	334	288	46	86	8	5,750	5	3
Dawn	13,581	2,724	2,695	29	514	19	1,526	6	.....
Dover	85,320	28,526	25,457	3,069	3,231	285	10,768	5	9
Enniskillen	10,173	2,753	2,611	142	385	40	3,550	6	.....
Harwich	102,851	28,178	25,259	2,919	3,895	422	6,917	6	6
Howard	18,905	7,197	6,581	616	716	88	7,000	6	3
Moore	11,214	2,504	2,010	494	425	56	8,821	6	.....
Raleigh	124,794	33,512	30,444	3,068	4,726	325	9,440	6	6
Raleigh (Blake system)	32,319	6,941	3,112	3,829	1,224	87	44,011	4	.....
Rochester	6,041	5,238	4,965	273	228	61	4,475	5	.....
Sandwich, East	2,386	778	698	80	90	11	7,272	5	.....
Sandwich, South	21,799	6,226	5,898	328	825	71	4,619	5	6
Sombra	2,052	447	406	41	78	10	4,100	6	.....
Tilbury, East	53,754	23,385	21,972	1,413	2,036	183	7,721	6	7
Total	487,454	148,743	132,396	16,347	18,459	1,666	.....	.....	.....

Licenses Issued in 1934

The Natural Gas Conservation Act, R.S.O., 1927, The Well Drillers' Act, R.S.O., 1927, and the Regulations made under these Acts require that the several operations carried out shall be done under license. Tables IX to XIII show a list of those to whom licenses were issued during 1934.

The licenses required under the above Acts are as follows:—

To Lease and Prospect for Natural Gas	$5.00
To Drill or Bore for Natural Gas or Oil	5.00
To Produce Natural Gas	10.00
To Distribute Natural Gas	10.00
To Operate Natural Gas Pipe-Lines	10.00

TABLE IX—OPERATORS LICENSED TO LEASE AND PROSPECT FOR NATURAL GAS, 1934

License No.	Name	Address
675	Acme Gas and Oil Co., Ltd.	Toronto, Ont.
717	Adams, L. W.	London, Ont.
681	Ajax Oil and Gas Co., Ltd.	Toronto, Ont.
698	Barnum, R. G.	Detroit, Mich.
721	Barr, D.	St. Thomas, Ont.
708	Beattie, James A.	Glencoe, Ont.
714	Bell, George E.	Petrolia, Ont.
691	Blacklock, S. C.	Toronto, Ont.
697	Blain, Dr. E. B.	Hamilton, Ont.
685	Cameron, R. B.	Detroit, Mich.
740	Campbell's Cross Oil Syndicate	Toronto, Ont.
728	Cascaden, C. H.	Detroit, Mich.
741	Comfort, B. F., and Son	Gore Bay, Ont.
688	Craft, Fred W.	Detroit, Mich.
743	Dicker, Reginald	Wardsville, Ont.
738	Domestic Gas Syndicate	Toronto, Ont.
676	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
692	Dominion Petroleum Co., Ltd.	Glencoe, Ont.
673	Erie Gas, Limited	Toronto, Ont.
763	Ferris, T. Gordon, Sr.	Toronto, Ont.
732	Forshee, C. S.	Dresden, Ont.
748	Gaul, Henry J.	Stratford, Ont.
668	Geddes, E. W.	Chatham, Ont.
662	Gray, Ira	Merlin, Ont.
700	Haldimand Natural Gas Syndicate	Stevensville, Ont.
690	Heal, A. A.	Petrolia, Ont.
720	Henry, A. H.	Detroit, Mich.
713	High Grade Natural Gas Co.	Chatham, Ont.
712	Highbank Oil, Limited	Chatham, Ont.
674	Holmes, A. B.	Toronto, Ont.
684	Hoover, May, Limited	Selkirk, Ont.
693	Horn, W. C.	Glencoe, Ont.
702	House, Charles C.	Stevensville, Ont.
663	Howard, W. C.	Leamington, Ont.
705	Hussey, W. J.	Petrolia, Ont.
687	Industrial Natural Gas Co., Ltd.	Port Robinson, Ont.
735	James, F. L.	Tillsonburg, Ont.
678	Jasperson, Bon	Kingsville, Ont.
744	Kehlet, F. W.	Detroit, Mich.
749	Lewis, James R.	Williamsville, N.Y.
737	Lochron, Virgil L.	Detroit, Mich.
680	Lymburner, M. G.	Dunnville, Ont.
787	Lynn Valley Natural Gas Syndicate	Toronto, Ont.
716	McDougall, A. S.	Melbourne, Ont.
727	McGill, Joseph	Petrolia, Ont.

TABLE IX—OPERATORS LICENSED TO LEASE AND PROSPECT FOR NATURAL GAS, 1934—*Continued*

License No.	Name	Address
730	McNinch, S. E.	Canboro, Ont.
711	Medina Natural Gas Co., Ltd.	Chatham, Ont.
742	Merritt, Fred H.	Sarnia, Ont.
731	Midwal Oil and Gas Co., Ltd.	Toronto, Ont.
725	Mossop, H. T.	Toronto, Ont.
671	Neath, Charles	Chatham, Ont.
679	Newton, Roy	Petrolia, Ont.
745	Parmenter, M. D.	Toronto, Ont.
686	Patterson, William C.	Jamestown, N.Y.
699	Picard, E. M.	Toronto, Ont.
723	Port Colborne-Welland Natural Gas and Oil Co., Ltd.	Port Colborne, Ont.
709	Rawlings, George H.	Chatham, Ont.
669	Reaume, Earl	Chatham, Ont.
706	Reichheld, O. E.	Fisherville, Ont.
734	Roberts, J. R.	Windsor, Ont.
739	Rodgers, Alexander	Tillsonburg, Ont.
724	Rons, Murray D.	Toronto, Ont.
747	Rose Valley Natural Gas Syndicate	Toronto, Ont.
719	Rowe, E. P.	Toronto, Ont.
733	Ryan, John J.	Toronto, Ont.
710	Savage, Louis	Detroit, Mich.
726	Schafer, Le Roy K.	Delhi, Ont.
729	Schollenberger, Christian	Wallacetown, Ont.
670	Scullard, Fred B.	Chatham, Ont.
718	Simpson, Chas. A.	Simcoe, Ont.
672	Smith, E. W.	Toronto, Ont.
736	Smith, H. W.	Troy, Ont.
703	Smith, Dr. Luke	Oakville, Ont.
682	Smith, Robt. H.	Lowbanks, Ont.
667	Snyder, A. D.	Breslau, Ont.
677	Southern Ontario Gas Co., Ltd.	Buffalo, N.Y.
746	Stewart, Elgin Russell	Jarvis, Ont.
689	Sullivan, George F.	Sarnia, Ont.
664	Topp, Nathan	Cayuga, Ont.
694	Wainfleet Oil and Gas Co , Ltd.	Toronto, Ont.
695	Welch, James A.	Flint, Mich.
701	Welland County Gas Syndicate	Stevensville, Ont.
696	White, Roy	Tillsonburg, Ont.
750	Wilson, Abel A.	Hamilton, Ont.
666	Wilson, Bert	Sarnia, Ont.
707	Wooster, Joseph T.	Detroit, Mich.

TABLE X—OPERATORS LICENSED TO DRILL OR BORE FOR NATURAL GAS, 1934

License No.	Name	Address
590	Ajax Oil and Gas Co., Ltd.	Toronto, Ont.
668	Allen, A. J.	Dunnville, Ont.
593	Central Pipe Line Co., Ltd.	Chatham, Ont.
600	Central Pipe Line Co., Ltd.	Chatham, Ont.
537	Culver, W. H., Jr.	Dunnville, Ont.
538	Culver, W. H., Jr.	Dunnville, Ont.
539	Culver, W. H., Jr.	Dunnville, Ont.
541	Goit, Lorne R.	Dunnville, Ont.
568	Gregory, George F., and Son	Petrolia, Ont.
569	Gregory, George F., and Son	Petrolia, Ont.
557	Heal, A. A.	Petrolia, Ont.

TABLE X—OPERATORS LICENSED TO DRILL OR BORE FOR NATURAL GAS, 1934—*Continued*

License No.	Name	Address
577	Heal, A. A.	Petrolia, Ont.
540	Holmes, A. B.	Toronto, Ont.
552	Hoover, May, Limited	Selkirk, Ont.
553	Hoover, May, Limited	Selkirk, Ont.
554	Hoover, May, Limited	Selkirk, Ont.
564	House, Charles C.	Stevensville, Ont.
562	Hussey, W. J.	Petrolia, Ont.
558	Jackson, Percy L.	Dunnville, Ont.
559	Jackson, Percy L.	Dunnville, Ont.
560	Jackson, Percy L.	Dunnville, Ont.
542	Jasperson, Bon	Kingsville, Ont.
566	Kells, E.	Petrolia, Ont.
555	Kervin and Dawson	Merlin, Ont.
547	Kiser Bros.	Chatham, Ont.
548	Kiser Bros.	Chatham, Ont.
567	Lauer, D. G.	Tillsonburg, Ont.
585	Lauer, D. G.	Tillsonburg, Ont.
601	Lewis, James R.	Williamsville, N.Y.
543	Lymburner Bros. and Webber	Dunnville, Ont.
556	McCutcheon, Thomas J.	Dunnville, Ont.
594	McCutcheon, Thomas J.	Dunnville, Ont.
597	McCutcheon, Thomas J.	Dunnville, Ont.
574	McGaffey, Roy	Bothwell, Ont.
578	McKechnie, S.	Dunnville, Ont.
579	McKechnie, S.	Dunnville, Ont.
580	McKechnie, S.	Dunnville, Ont.
581	McKechnie, S.	Dunnville, Ont.
563	McKillop, William	Brantford, Ont.
588	McLister, J. J.	Dunnville, Ont.
571	McMaster, W. R.	Flesherton, Ont.
565	McNinch, S. E.	Canboro, Ont.
591	McNinch, S. E.	Canboro, Ont.
587	Merchant, Frank	Petrolia, Ont.
595	Merritt, Fred H.	Sarnia, Ont.
572	Millar, James	Petrolia, Ont.
589	Nisbit, James F.	Petrolia, Ont.
570	Ogletree, F. A.	Sarnia, Ont.
544	Perkins, J. E.	Dunnville, Ont.
576	Port Colborne–Welland Natural Gas and Oil Co., Ltd.	Port Colborne, Ont.
586	Raeburn, James	Glencoe, Ont.
599	Ricker, Arthur	Canboro, Ont.
545	Smith, Robert H.	Lowbanks, Ont.
598	Stewart, Elgin Russell	Jarvis, Ont.
535	Stover, F. H., and Son	Chatham, Ont
536	Stover, F. H., and Son	Chatham, Ont.
596	Stubble, H. H.	Merlin, Ont.
583	Sundy, Basil K.	Tillsonburg, Ont.
534	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
602	Wainfleet Oil and Gas Co., Ltd.	Toronto, Ont.
603	Wainfleet Oil and Gas Co., Ltd.	Toronto, Ont.
582	Walker, Geoffrey	Port Franks, Ont.
546	Walter Gas Syndicate	Orchard Park, N.Y.
618	Willits, G. E. and D. E.	Bothwell, Ont.
619	Willits, G. E. and D. E.	Bothwell, Ont.
620	Willits, G. E. and D. E.	Bothwell, Ont.
573	Wilson, Bert	Sarnia, Ont.
584	Wright, David	Sarnia, Ont.

TABLE XI—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1934

License No.	Name	Address
655	Acme Gas and Oil Co., Ltd.	Toronto, Ont.
668	Ajax Oil and Gas Co., Ltd.	Toronto, Ont.
785	Aragain Gold and Natural Gas Syndicate	Toronto, Ont.
733	Bertie Township Gas and Oil Syndicate	Selkirk, Ont.
689	Broadway Gas Syndicate	Cayuga, Ont.
671	Canadian Natural Gas Syndicate	Simcoe, Ont.
691	Canfield Natural Gas Co., Ltd.	Canfield, Ont.
696	Central Pipe Line Co., Ltd.	Chatham, Ont.
688	Central Seneca Gas Syndicate	Cayuga, Ont.
693	Colonial Natural Gas and Oil Co., Ltd.	Hamilton, Ont.
780	Continental Gas Corporation, Ltd.	Toronto, Ont.
663	Cyclops Gas Syndicate	Toronto, Ont.
672	Dawson, Ralph	Merlin, Ont.
792	Domestic Gas Syndicate	Toronto, Ont.
657	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
662	Emerald Gas Syndicate	Toronto, Ont.
714	Emerson, Harry L.	Dunnville, Ont.
703	Empire Natural Gas, Ltd.	Toronto, Ont.
649	Erie Gas, Ltd.	Toronto, Ont.
783	Fisherville Gas Co.	Fisherville, Ont.
699	Gifford, Arthur, and Son	Cayuga, Ont.
710	Grand River Gas and Oil Syndicate	Canfield, Ont.
716	Grand River Natural Gas Co., Ltd.	Welland, Ont.
730	Grimsby Natural Gas Co., Ltd.	Grimsby, Ont.
685	Haldimand Gas Syndicate	Cayuga, Ont.
680	Haldimand Natural Gas Syndicate	Stevensville, Ont.
697	Highbank Oil, Ltd.	Chatham, Ont.
650	Hope Gas Syndicate	St. Catharines, Ont.
682	House and Harris	Stevensville, Ont.
654	Ideal Gas Syndicate	Fisherville, Ont.
675	Industrial Natural Gas Co., Ltd.	Port Robinson, Ont.
659	Jasperson, Bon	Kingsville, Ont.
652	Lincoln Gas Co., Ltd.	Toronto, Ont.
665	Lymburner Bros. and Webber	Dunnville, Ont.
793	Lynn Valley Natural Gas Syndicate	Toronto, Ont.
673	McKinney, John F.	Niagara Falls, N.Y
670	Midwal Oil and Gas Co., Ltd.	Toronto, Ont.
718	Mohawk Gas and Oil Syndicate, Ltd.	Hamilton, Ont.
790	Niagara Natural Gas Co., Ltd.	Buffalo, N.Y.
711	Norhal Gas and Oil Syndicate	Toronto, Ont.
653	North Cayuga Gas Syndicate, The	North Cayuga, Ont.
701	Otterville Natural Gas Syndicate	Otterville, Ont.
674	Patterson, William C.	Jamestown, N.Y.
782	Petrol Oil and Gas Co., Ltd.	Toronto, Ont.
706	Port Colborne–Welland Gas and Oil Co., Ltd.	Port Colborne, Ont.
794	Prairie Gas and Oil Co., Ltd.	Toronto, Ont.
798	Premier Oils, Ltd.	Toronto, Ont.
677	Provincial Natural Gas and Fuel Co. of Ontario, Ltd.	Fort Erie North, Ont.
686	Rainham Gas Syndicate	Cayuga, Ont.
731	Randolph Syndicate	Toronto, Ont.
664	Regal Gas Syndicate	Toronto, Ont.
777	Rich Gas Company	Toronto, Ont.
651	Salina Gas Co., Ltd., The	Chatham, Ont.
648	Selected Natural Gas and Oil Syndicate	Toronto, Ont.
666	Sherbrooke Gas Syndicate	Lowbanks, Ont.
669	Smith, Robert H.	Lowbanks, Ont.
658	Southern Ontario Gas Co., Ltd.	Buffalo, N.Y.
683	Springvale Gas and Oil Co., Ltd.	Hagersville, Ont.
694	Standard Gas and Oil Syndicate	Fisherville, Ont.
784	Sterling Gas Co., Ltd.	Toronto, Ont.
679	Stevensville Natural Gas and Fuel Co.	Stevensville, Ont.
660	Superior Gas Syndicate	Fisherville, Ont.
695	Sweets Corners Gas and Oil Syndicate	Fisherville, Ont.
725	Tillsonburg Oil and Gas Co., Ltd.	Tillsonburg, Ont.

TABLE XI—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1934—*Continued*

License No.	Name	Address
647	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
687	Walpole Gas Syndicate	Cayuga, Ont.
681	Welland County Gas Syndicate	Stevensville, Ont
727	Western Ontario Natural Gas Co., Ltd.	Dunnville, Ont.
684	White Oil and Gas Co., Ltd., The	Sarnia, Ont.
676	Yager, J. J.	Selkirk, Ont.

TABLE XII—OPERATORS LICENSED TO DISTRIBUTE NATURAL GAS, 1934

License No.	Name	Address
441	Brantford Gas Co.	Buffalo, N.Y.
453	Canfield Natural Gas Co.	Canfield, Ont.
454	Central Pipe Line Co., Ltd.	Chatham, Ont.
442	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
473	Fisherville Gas Co.	Fisherville, Ont.
450	Grimsby Natural Gas Co., Ltd.	Grimsby, Ont.
458	Leamington, Town of	Leamington, Ont.
461	Lincoln Gas Co., Ltd.	Toronto, Ont.
443	Manufacturers Natural Gas Co., Ltd.	Buffalo, N.Y.
446	Oil Springs Oil and Gas Co., Ltd.	Oil Springs, Ont.
456	Port Colborne-Welland Gas and Oil Co., Ltd.	Port Colborne, Ont.
447	Provincial Natural Gas and Fuel Co. of Ontario, Ltd.	Fort Erie North, Ont.
444	Southern Ontario Gas Co., Ltd.	Buffalo, N.Y.
451	Springvale Gas and Oil Co., Ltd.	Hagersville, Ont.
439	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
445	United Gas and Fuel Co. of Hamilton, Ltd.	Hamilton, Ont
440	Windsor Gas Co., Ltd.	Windsor, Ont.

TABLE XIII—OPERATORS LICENSED TO OPERATE PIPE LINES, 1934

License No.	Name	Address
98	Central Pipe Line Co., Ltd.	Chatham, Ont.
96	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
97	Southern Ontario Gas Co., Ltd.	Buffalo, N.Y.
95	Union Gas Co. of Canada, Ltd.	Chatham, Ont.

Logs of Wells

The logs of oil and gas wells drilled in Ontario in 1934, as given by the drillers, are shown on the pages following. It will be noted that, for the first time, the production of gas wells is not given. This decision is the result of protests from several companies who were doing exploratory work and who felt that the publication of the results of this work would adversely affect them. All information as regards water and gas horizons are given, which should be sufficient to indicate the sources of oil and gas to those familiar with the gas fields of the province.

Samples of drill-cuttings from representative wells throughout the province are available to the public.

ABBREVIATIONS

B.F.	Broken front.
C.	From Canborough.
Con.	Concession.
Cor.	Corner.
E.	East.
E. ½	East half.
E. ¼	East quarter.
E.S.C.R.	East of Stoney Creek Road.
F.C.	Front concession.
L.R.E.	Lake Road East.
N.	North.
N. ½	North half.
N.E. ¼	Northeast quarter.
N.F.R.	North of Forks Road.
N.R.	Niagara River survey.
N.T.R.	North of Talbot Road.
N.W. ¼	Northwest quarter.
Pt.	Part.
R.R.	River range.
S.	South.
S. ½	South half.
S.E. ¼	Southeast quarter.
S.M.R.	South of Middle Road.
St.	Street.
S.T.R.	South of Talbot Road.
S.W.	Southwest.
S.W. ¼	Southwest quarter.
Tp.	Township.
W.	West.
W. ½	West half.
W.R.	Welland river.
W.S.C.R.	West of Stoney Creek Road.

Brant County

PORT COLBORNE-WELLAND NATURAL GAS AND OIL CO., LTD.

Lot 72, R.R., Onondaga tp.

Completed August 10, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	33
Lime and shale	75
Niagara	260
Casing shale	31
Clinton	32
Red Medina	28
Grey shale	47
White Medina	12
Red shale	5
Total depth	523

Sulphur water at 40 feet.

PORT COLBORNE-WELLAND NATURAL GAS AND OIL CO., LTD.

Lot 77, R.R., Onondaga tp.

Completed September 19, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	38
Lime and shale	62
Niagara	262
Casing shale	27
Clinton	32
Red Medina	27
Grey shale	47
White Medina	11
Red shale	3
Total depth	509

Fresh water at 12 feet.

PORT COLBORNE-WELLAND NATURAL GAS AND OIL CO., LTD.

Lot 78, R.R., Onondaga tp.

Completed November 5, 1934.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	64
Lime and shale	46
Niagara	256
Casing shale	27
Clinton	34
Red Medina	25
Grey shale	47
White Medina	13
Red shale	53
Total depth	565

Gas at 399 feet.
Sulphur water at 110 feet.

PORT COLBORNE-WELLAND NATURAL GAS AND OIL CO., LTD.

Lot 70, R.R., Onondaga tp.

Completed July 14, 1934.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	23
Lime and shale	75
Niagara	255
Casing shale	26
Clinton	31
Red Medina	30
Grey shale	47
White Medina	11
Red shale	75
Total depth	573

Gas at 500 feet.
Fresh water at 12 feet.

PORT COLBORNE-WELLAND NATURAL GAS AND OIL CO., LTD.

Lot 79, R.R., Onondaga tp.

Completed December 3, 1934.
Producing gas well.
Rock pressure: 190 lbs.

Formation	Thickness, ft.
Surface	51
Lime and shale	49
Niagara	255
Casing shale	28
Clinton	35
Red Medina	25
Grey shale	50
White Medina	12
Red shale	76
Total depth	581

Gas at 504 feet.
Sulphur water at 50 feet.

PORT COLBORNE-WELLAND NATURAL GAS AND OIL CO., LTD.

Lot 24, E. ½, con. III, Onondaga tp.

Completed October 12, 1934.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	34
Lime and shale	46
Niagara	256
Casing shale	25
Clinton	31
Red Medina	23
Grey shale	47
White Medina	13
Red shale	75
Total depth	550

Gas at 464 feet.
Fresh water at 12 feet; sulphur water at 100 feet.

RANDOLPH SYNDICATE

Lot 5, E. ½, con. II, Onondaga tp.

Completed December 28, 1934.
Producing gas well.
Rock pressure: 140 lbs.

Formation	Thickness, ft.
Clay	108
Hardpan	23
Salina	26
Guelph and Niagara	245
Rochester	50
Clinton	21
Red Medina	20
Cabot Head	59
White Medina	15
Queenston	175
Total depth	742

Gas at 454 and 563 feet.
Fresh water at 134 feet.

PETROL OIL AND GAS CO., LTD.

Lot 2, con. VI, Tuscarora tp.

Completed October 20, 1934.
Producing gas well.
Rock pressure: 190 lbs.

Formation	Thickness, ft.
Surface	50
Salina	113
Niagara	231
Rochester	50
Clinton	34
Red Medina	11
Cabot Head	61
White Medina	15
Red shale	50
Total depth	615

Gas at 447 and 562 feet.
Fresh water at 95 feet.

PETROL OIL AND GAS CO., LTD.

Lot 2, B.F., Tuscarora tp.

Completed September 26, 1934.
Producing gas well.
Rock pressure: 192 lbs.

Formation	Thickness, ft.
Surface	45
Salina	105
Niagara	246
Rochester	48
Clinton	38
Red Medina	11
Cabot Head	58
White Medina	16
Red shale	50
Total depth	617

Gas at 447 and 553 feet.
Fresh water at 45 and 90 feet; sulphur water at 140 feet.

PETROL OIL AND GAS CO., LTD.

Lot 3, con. VI, Tuscarora tp.

Completed November 7, 1934.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	62
Salina	95
Niagara	234
Rochester	51
Clinton	29
Red Medina	13
Cabot Head	64
White Medina	12
Red shale	50
Total depth	610

Gas at 444 and 550 feet.

Elgin County

LAWRENCE P. MYTINGER

Lot 5, E. ¼ of N. ½, con. II, Aldborough tp.

Completed October 20, 1934.
Dry hole.

Formation	Thickness, ft.
Sand and gravel	5
Clay	90
Hardpan	35
Gravel	15
Hardpan	100
Upper soap	25
Middle lime	15
Lower soap	18
Dark streak	6
Lower lime	94
Lime and sand	77
Lime	5
Water sand	5
Total depth	490

Very small show of oil and water at 385 feet.
Salt water at 495 to 500 feet.

LAWRENCE P. MYTINGER

Lot 4, con. I, Aldborough tp.

Completed November 6, 1934.
Dry hole.

Formation	Thickness, ft.
Sand	6
Clay	89
Hardpan	135
Upper soap	57
Middle lime	10
Lower soap	25
Dark streak	5
Lower lime	88
Total depth	415

Fresh water at 145 and 215 feet.

UNION GAS CO. OF CANADA, LTD.
Lot D, con. X, Aldborough tp.

Completed January 2, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	235
Hamilton beds	80
Dark lime	5
Brown and grey lime	165
Grey lime	25
Brown and grey lime	410
Very hard brown lime	65
Grey and brown lime	95
Brown lime and gypsum	10
Brown lime	20
Blue lime and shale	75
Brown and grey lime	120
Total depth	1,305

Fresh water at 225 feet; sulphur water at 490 feet.

GEO. WALWARK AND C. A. SIMPSON
Lot 27, con. IX, Bayham tp.

Completed December 20, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	222
Brown lime	178
Flint	110
Lime and shale	110
Lime shell gypsum	305
Niagara lime	305
Blue shale	45
Clinton sand	26
Red shale	3
Total depth	1,304

Show of sulphur gas at 1,025 feet.
Show of oil at 230, 335, and 345 feet.
Sulphur water at 225 and 280 feet.

Haldimand County

ARAGAIN GAS CO.
Lot 13, E. pt., con. I, Canborough tp.

Completed March 5, 1934.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	54
Lime and shale	76
Niagara	225
Shale	54
Clinton	30
Red Medina	36
Shale	54
White Medina	15
Red shale	50
Total depth	594

Gas at 439 and 525 feet.
Fresh water at 55 feet; black water at 125 feet.

ARAGAIN GAS CO.
Lot 13, W. pt., con. I, Canborough tp.

Completed November 6, 1934.
Producing gas well.
Rock pressure: 90 lbs.

Formation	Thickness, ft.
Surface	73
Lime and shale	55
Niagara	225
Shale	54
Clinton	28
Red Medina	30
Grey shale	65
White Medina	10
Red shale	5
Total depth	545

Gas at 412 and 460 feet.
Fresh water at 81 feet; sulphur water at 120 feet.

ARAGAIN GAS CO.
Lot 13, E. pt., con. I, Canborough tp.

Completed May 30, 1934.
Producing gas well.
Rock pressure: 95 lbs.

Formation	Thickness, ft.
Surface	67
Shale	58
Niagara	210
Limestone	15
Shale	48
Clinton	31
Red Medina	37
Grey shale	56
White Medina	11
Red shale	50
Total depth	583

Gas at 429 and 522 feet.
Fresh water at 50 feet; sulphur water at 80 feet; black water at 210 feet.

ARAGAIN GAS CO.
Lot 13, E. pt., con. I, Canborough tp.

Completed April 9, 1934.
Producing gas well.
Rock pressure: 100 lbs.

Formation	Thickness, ft.
Surface	63
Lime and shale	70
Niagara	200
Guelph lime	25
Shale	53
Clinton	30
Red Medina	32
Grey shale	60
White Medina	11
Red shale	50
Total depth	594

Gas at 341 and 433 feet.
Fresh water at 80 feet; sulphur water at 200 feet.

J. L. FRANCIS
Lot 5, con. III, Canborough tp.

Completed July 17, 1934.
Producing gas well.
Rock pressure: 105 lbs.

Formation	Thickness, ft.
Surface	45
Lime and shale	182
Niagara	210
Guelph lime	18
Shale	52
Clinton	31
Red Medina	40
Blue shale	59
White Medina	16
Red shale	50
Total depth	703

Gas at 507, 538, and 637 feet.
Fresh water at 46 feet; sulphur water at 55 feet; black water at 360 feet.

MAY GOLD AND NATURAL GAS SYNDICATE
Lot 13, con. I, Canborough tp.

Completed June 22, 1934.
Producing gas well.
Rock pressure: 100 lbs.

Formation	Thickness, ft.
Surface	62
Shale	95
Niagara	243
Grey shale	16
Casing shale	18
Clinton	31
Red Medina	38
Grey shale	55
White Medina	10
Red shale	30
Total depth	598

Gas at 465 and 558 feet.
Fresh water at 65 feet.

MAY GOLD AND NATURAL GAS SYNDICATE
Lot 13, con. I, Canborough tp.

Completed July 21, 1934.
Producing gas well.
Rock pressure: 100 lbs.

Formation	Thickness, ft.
Surface	72
Shale	93
Niagara	236
Grey shale	18
Casing shale	25
Clinton	31
Red Medina	58
White Medina	10
Red shale	50
Total depth	593

Gas at 503 and 541 feet.
Fresh water at 65 feet.

MAY GOLD AND NATURAL GAS SYNDICATE
Lot 13, con. I, Canborough tp.

Completed August 12, 1934.
Producing gas well.
Rock pressure: 100 lbs.

Formation	Thickness, ft.
Surface	80
Shale	100
Niagara	241
Grey shale	18
Casing shale	21
Clinton	28
Red Medina	37
Shale	60
White Medina	10
Red shale	30
Total depth	625

Gas at 498 and 590 feet.
Fresh water at 65 feet.

MAY GOLD AND NATURAL GAS SYNDICATE
Lot 13, con. I, Canborough tp.

Completed August 29, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	57
Shale	102
Niagara	241
Grey shale	19
Casing shale	17
Clinton	25
Red Medina	38
Grey shale	61
White Medina	10
Red shale	5
Total depth	575

Fresh water at 65 feet.

MAY GOLD AND NATURAL GAS SYNDICATE
Lot 13, con. I, Canborough tp.

Completed September 29, 1934.
Producing gas well.
Rock pressure: 100 lbs.

Formation	Thickness, ft.
Surface	57
Shale	103
Niagara	223
Grey lime	18
Casing shale	21
Clinton	31
Red Medina	40
Grey shale	60
White Medina	10
Red shale	35
Total depth	598

Gas at 557 feet.
Fresh water at 68 feet.

MAY GOLD AND NATURAL GAS SYNDICATE
Lot 13, con. I, Canborough tp.

Completed November 2, 1934.
Producing gas well.
Rock pressure: 100 lbs.

Formation	Thickness, ft.
Surface	80
Shale	100
Niagara	241
Grey shale	18
Casing shale	21
Clinton	28
Red Medina	37
Shale	60
White Medina	10
Red shale	30
Total depth	625

Gas at 513 and 593 feet.
Fresh water at 82 feet.

SENECA GAS CO.
Lot 14, con. II, Canborough tp.

Completed April 3, 1934.
Producing gas well.
Rock pressure: 110 lbs.

Formation	Thickness, ft.
Surface	62
Lime and shale	120
Niagara	220
Shale	55
Clinton	28
Red Medina	42
Shale	60
White Medina	10
Red shale	50
Total depth	647

Gas at 457 and 587 feet.
Fresh water at 82 feet; sulphur water at 240 feet.

SENECA GAS CO.
Lot 14, E. pt., con. II, Canborough tp.

Completed August 2, 1934.
Producing gas well.
Rock pressure: 108 lbs.

Formation	Thickness, ft.
Surface	59
Lime and shale	124
Niagara	220
Shale	56
Clinton	28
Red Medina	38
Grey shale	59
White Medina	12
Red shale	50
Total depth	646

Gas at 487 feet.
Fresh water at 70 feet.

SENECA GAS CO.
Lot 14, con. II, Canborough tp.

Completed May 4, 1934.
Producing gas well.
Rock pressure: 108 lbs.

Formation	Thickness, ft.
Surface	39
Lime and shale	136
Niagara	227
Shale	55
Clinton	28
Red Medina	38
Shale	60
White Medina	12
Red shale	35
Total depth	630

Gas at 457 and 583 feet.
Fresh water at 55 feet; black water at 182 feet.

SENECA GAS CO.

Lot 14, con. II, Canborough tp.

Completed May 23, 1934.
Producing gas well.
Rock pressure: 110 lbs.

Formation	Thickness, ft.
Surface	46
Lime and shale	130
Niagara	215
Shale	52
Clinton	30
Red Medina	38
Grey shale	55
White Medina	13
Red shale	45
Total depth	624

Gas at 443 and 566 feet.
Fresh water at 37 feet; sulphur water at 95 and 145 feet.

SENECA GAS CO.

Lot 14, con. II, Canborough tp.

Completed June 12, 1934.
Producing gas well.
Rock pressure: 110 lbs.

Formation	Thickness, ft.
Surface	39
Lime and shale	113
Niagara	220
Shale	57
Clinton	32
Red Medina	35
Grey shale	60
White Medina	12
Red shale	39
Total depth	607

Gas at 429 and 461 feet.
Fresh water at 47 feet; black water at 140 and 217 feet.

SENECA GAS CO.

Lot 14, N. pt., con. II, Canborough tp.

Completed July 10, 1934.
Producing gas well.
Rock pressure: 110 lbs.

Formation	Thickness, ft.
Surface	63
Lime and shale	123
Niagara	220
Shale	57
Clinton	28
Red Medina	35
Grey shale	55
White Medina	10
Red shale	35
Total depth	626

Gas at 491 and 581 feet.
Clear water at 67 feet; sulphur water at 90 feet; black water at 350 feet.

COLUMBIA NATURAL GAS AND OIL CO.

Lot 12, Earl tract, Dunn tp.

Completed June 6, 1934.
Producing gas well.
Rock pressure: 225 lbs.

Formation	Thickness, ft.
Surface	3
Limestone and flint	60
Blue shale	130
Brown lime	200
Niagara lime	205
Grey lime	49
Casing shale	42
Clinton	28
Red Medina	40
Grey shale	62
White Medina	16
Red shale	50
Total depth	885

Gas at 692, 741, and 829 feet; sulphur gas at 400 feet.
Sulphur water at 80 and 360 feet.

COLUMBIA NATURAL GAS AND OIL CO.

Lot 13, Earl tract, Dunn tp.

Completed July 24, 1934.
Producing gas well.
Rock pressure: 250 lbs.

Formation	Thickness, ft.
Surface	3
Limestone and flint	62
Blue shale	140
Brown lime	180
Niagara lime	205
Grey lime	52
Casing shale	42
Clinton	29
Red Medina	40
Grey shale	60
White Medina	16
Red shale	50
Total depth	879

Gas at 688, 739, and 820 to 823 feet; sulphur gas at 360 feet.
Sulphur water at 65 to 360 feet.

COLUMBIA NATURAL GAS AND OIL CO.

Lot, 4, Earl tract, Dunn tp.

Completed December 8, 1934.
Producing gas well.
Rock pressure: 305 lbs.

Formation	Thickness, ft.
Surface	65
Blue shale	150
Brown lime	165
Niagara lime	200
Grey lime	50
Casing shale	42
Clinton	29
Red Medina	41
Grey shale	60
White Medina	18
Red shale	50
Total depth	870

Gas at 814 feet.
Sulphur water at 67 and 400 feet.

W. C. PATTERSON

Lot 8, con. I S., Dunn tp.

Completed January 25, 1934.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Thickness, ft.
Surface	21
Lime and shale	410
Niagara	200
Shale	53
Clinton	30
Red Medina	43
Shale	60
White Medina	12
Shale	3
Total depth	831

Gas at 687 and 724 to 739 feet.
Fresh water at 22 feet; sulphur water at 430 feet.

W. C. PATTERSON

Lot 10, Sheehan tract, Dunn tp.

Completed August 28, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	10
Lime and shale	394
Niagara	215
Shale	50
Clinton	32
Red Medina	40
Shale	58
White Medina	11
Red shale.	
Total depth	810

Fresh water at 40 feet; sulphur water at 525 feet.

WESTERN ONTARIO NATURAL GAS CO., LTD.
Lot 8, Earl tract, Dunn tp.

Completed January 15, 1934.
Producing gas well.
Rock pressure: 150 lbs.

Formation	Thickness, ft.
Surface	19
Good hard rock	100
Lime and shale	307
Niagara	225
Shale	55
Clinton rock	32
Red Medina	40
Grey shale	52
White Medina	18
Red shale	24
Total depth	872

Fresh water at 27 feet; salt water at 500 feet.

WESTERN ONTARIO NATURAL GAS CO., LTD.
Lot 8, Earl tract, Dunn tp.

Completed March 7, 1934.
Producing gas well.
Rock pressure: 150 lbs.

Formation	Thickness, ft.
Surface	20
Flint	18
Good hard lime	70
Lime and shale	324
Niagara	225
Shale	55
Clinton rock	29
Red Medina	40
Grey shale	50
White Medina	18
Red shale	25
Total depth	874

Fresh water at 25, 37, and 48 feet; salt water at 500 feet.

WESTERN ONTARIO NATURAL GAS CO., LTD.
Lot 8, Earl tract, Dunn tp.

Completed August 4, 1934.
Producing gas well.
Rock pressure: 150 lbs.

Formation	Thickness, ft.
Surface	42
Lime and shale	385
Niagara	225
Shale	55
Clinton rock	32
Red Medina	40
Grey shale	52
White Medina	18
Red shale	56
Total depth	905

Fresh water at 75 and 80 feet; salt water at 500 feet.

D. DASHWOOD AND SON
Town of Dunnville

Completed March 15, 1934.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	70
Lime and shale	240
Niagara	210
Guelph lime	25
Shale	50
Clinton	30
Red Medina	45
Grey shale	60
White Medina	13
Red shale	40
Total depth	783

Black water at 130 feet.

P. L. JACKSON
Alder St., Town of Dunnville

Completed December 11, 1934.
Producing gas well.

Formation	Thickness, ft.
Surface	71
Lime and shale	197
Niagara	268
Shale	58
Clinton	27
Red Medina	43
Blue shale	61
White Medina	9
Red shale	47
Total depth	781

Gas at 609 and 730 feet.
Fresh water at 78 feet; sulphur water at 270 feet.

CANADIAN NATURAL GAS SYNDICATE
Lot 20, N.F.R., Moulton tp.

Completed March 8, 1934.
Producing gas well.
Rock pressure: 235 lbs.

Formation	Thickness, ft.
Surface	72
Lime and shale	179
Niagara	220
Shale	63
Clinton	30
Red Medina	36
Shale	60
White Medina	10
Red shale	14
Total depth	684

Gas at 581 feet.
Sulphur water at 67 feet.

CANADIAN NATURAL GAS SYNDICATE
Lot 20, N.F.R., Moulton tp.

Completed April 5, 1934.
Producing gas well.
Rock pressure: 195 feet.

Formation	Thickness, ft.
Surface	86
Lime and shale	167
Niagara	220
Shale	59
Clinton	31
Red Medina	35
Shale	58
White Medina	12
Red shale	50
Total depth	718

Gas at 585 and 666 feet.
Sulphur water at 82 and 90 feet.

CANADIAN NATURAL GAS SYNDICATE
Lot 18, N.F.R., Moulton tp.

Completed December 22, 1934.
Producing gas well.
Rock pressure: 120 lbs.

Formation	Thickness, ft.
Surface	82
Lime and shale	163
Niagara	220
Shale	63
Clinton	32
Red Medina	36
Shale	58
White Medina	11
Red shale	50
Total depth	715

Gas at 655 feet.
Sulphur water at 80 and 87 feet.

CANADIAN NATURAL GAS SYNDICATE
Lot 18, N.F.R., Moulton tp.

Completed July 5, 1934.
Producing gas well.
Rock pressure: 185 lbs.

Formation	Thickness, ft.
Surface	84
Lime and shale	158
Niagara	220
Shale	62
Clinton	29
Red Medina	37
Shale	58
White Medina	11
Red shale	50
Total depth	709

Gas at 656 feet.
Sulphur water at 85 and 180 feet.

CONSOLIDATED NATURAL GAS CO., LTD.
Lot 1, S.E. ¼, Range I, Grand river, Moulton tp.

Completed August 4, 1934.
Producing gas well.
Rock pressure: 195 lbs.

Formation	Thickness, ft.
Surface	86
Lime and shale	224
Niagara	220
Casing shale	53
Clinton	25
Red Medina	42
Grey shale	60
White Medina	12
Red shale	55
Total depth	777

Gas at 586, 620 to 636, and 720 feet.
Fresh water at 90 feet; black water at 390 feet.

LOWBANKS DRILLERS SYNDICATE
Lot 5, S. pt., con. I, Moulton tp.

Completed September 9, 1934.
Producing gas well.
Rock pressure: 240 lbs.

Formation	Thickness, ft.
Surface	110
Lime and shale	180
Niagara	220
Shale	61
Clinton	30
Red Medina	42
Shale	55
White Medina	10
Red shale	58
Total depth	766

Gas at 708 feet.
Sulphur water at 109 and 115 feet.

LOWBANKS DRILLERS SYNDICATE
Lot 4, con I, Moulton tp.

Completed November 5, 1934.
Producing gas well.
Rock pressure: 275 lbs.

Formation	Thickness, ft.
Surface	130
Lime and shale	170
Niagara	220
Shale	62
Clinton	32
Red Medina	42
Shale	55
White Medina	10
Red shale	50
Total depth	771

Gas at 721 feet.
Sulphur water at 125 and 135 feet.

LOWBANKS DRILLERS SYNDICATE
Lot 5, S. pt., con. I, Moulton tp.

Completed August 2, 1934.
Producing gas well.
Rock pressure: 195 lbs.

Formation	Thickness, ft.
Surface	127
Lime and shale	163
Niagara	220
Shale	62
Clinton	37
Red Medina	37
Shale	54
White Medina	10
Red shale	52
Total depth	762

Gas at 619 feet.
Sulphur water at 126 and 133 feet.

LYMBURNER BROS. AND WEBBER
Lot 11, con. II C., Moulton tp.

Completed January 5, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	75
Lime and shale	191
Niagara	212
Shale	39
Clinton	29
Red Medina	35
Grey shale	60
White Medina	12
Red shale	3
Total depth	656

Fresh water at 79 and 80 feet.

R. H. SMITH
Lot 11, W. ½, con. II, Moulton tp.

Completed January 4, 1934.
Producing gas well.
Rock pressure: 29 lbs.

Formation	Thickness, ft.
Surface	72
Lime and shale	158
Niagara	218
Shale	53
Clinton	31
Red Medina	36
Shale	56
White Medina	13
Red shale	40
Total depth	677

Gas at 511 and 520 feet.
Sulphur water at 72 feet.

R. H. SMITH
Lot 11, W. ½, con. II, Moulton tp.

Completed February 2, 1934.
Producing gas well.
Rock pressure: 50 lbs.

Formation	Thickness, ft.
Surface	66
Lime and shale	159
Niagara	220
Shale	58
Clinton	32
Red Medina	36
Shale	58
White Medina	14
Red shale	1
Total depth	644

Gas at 512 feet.
Sulphur water at 66 feet.

STROMWELL GAS SYNDICATE
Lot 10, con. II, Moulton tp.

Completed June 21, 1934.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Thickness, ft.
Surface	144
Lime and shale	252
Niagara	193
Shale	41
Clinton	34
Red Medina	42
Shale	57
White Medina	10
Total depth	773

Gas at 656 feet.
Fresh water at 130 feet; sulphur water at 153 feet.

STROMWELL GAS SYNDICATE
Lot 9, con. II, Moulton tp.

Completed July 10, 1934.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Thickness, ft.
Surface	157
Lime and shale	211
Niagara	222
Shale	51
Clinton	31
Red Medina	47
Shale	58
White Medina	10
Red shale	1
Total depth	788

Gas at 667 and 688 feet.
Fresh water at 145 feet; sulphur water at 165 feet.

ESMOND AVERY AND ASSOCIATES
Lot 11, con. I, N.T.R., North Cayuga tp.

Completed November 24, 1934.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Thickness, ft.
Surface	55
Shale	177
Niagara	230
Shale	52
Clinton	29
Red Medina	41
Shale	60
White Medina	10
Red shale	50
Total depth	704

Gas at 518, 533, and 649 feet.
Water at 60 feet.

ESMOND AVERY AND ASSOCIATES
Lot 12, con. I, N.T.R., North Cayuga tp.

Completed October 2, 1934.
Producing gas well.
Rock pressure: 240 lbs.

Formation	Thickness, ft.
Surface	55
Shale	182
Niagara	223
Shale	63
Clinton	31
Red Medina	40
Shale	60
White Medina	10
Red shale	50
Total depth	714

Gas at 542 and 661 feet.
Water at 60 feet.

ESMOND AVERY AND ASSOCIATES
Lot 12, con. I, N.T.R., North Cayuga tp.

Completed October 30, 1934.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Thickness, ft.
Surface	60
Shale	178
Niagara	230
Shale	52
Clinton	30
Red Medina	37
Shale	60
White Medina	10
Red shale	51
Total depth	708

Gas at 523 and 651 feet.
Water at 61 feet.

CANFIELD GAS SYNDICATE
Lot 15, con. XI, North Cayuga tp.

Completed December 10, 1934.
Producing gas well.
Rock pressure: 290 lbs.

Formation	Thickness, ft.
Surface	68
Lime and shale	246
Niagara	225
Shale	56
Clinton	30
Red Medina	40
Grey shale	51
White Medina	16
Red shale	39
Total depth	771

Gas at 625 to 665 feet.
Fresh water at 70 feet; salt water at 400 feet.

CANFIELD GAS SYNDICATE
Lot 15, con. II, North Cayuga tp.

Completed December 31, 1934.
Producing gas well.
Rock pressure: 285 lbs.

Formation	Thickness, ft.
Surface	66
Lime and shale	246
Niagara	225
Shale	56
Clinton	30
Red Medina	40
Grey shale	51
White Medina	16
Red shale	40
Total depth	770

Gas at 623 to 663 feet.
Fresh water at 70 feet; salt water at 400 feet.

GAS FINDERS CO.
Gore lots A and B, con. I, N.T.R. North Cayuga tp.

Completed October 19, 1934.
Producing gas well.
Rock pressure: 250 lbs.

Formation	Thickness, ft.
Surface	58
Lime and shale	115
Niagara	200
Clinton	28
Shale	52
Red Medina	43
Grey shale	55
White Medina	12
Red shale	50
Total depth	613

Fresh water at 55 feet; sulphur water at 110 feet.

GAS FINDERS CO.

Gore lots A and B, con. I, N.T.R., North Cayuga tp

Completed November 7, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	54
Lime and shale	122
Niagara	200
Shale	50
Clinton	30
Red Medina	36
Grey shale	55
White Medina	12
Red shale	4
Total depth	563

Fresh water at 40 feet; sulphur water at 65 feet; black water at 75 feet.

GAS FINDERS CO.

Gore lots A and B, con. I, N.T.R., North Cayuga tp.

Completed November 24, 1934.
Producing gas well.
Rock pressure: 245 lbs.

Formation	Thickness, ft.
Surface	38
Lime and shale	112
Niagara	200
Shale	50
Clinton	32
Red Medina	37
Grey shale	56
White Medina	12
Red shale	50
Total depth	587

Fresh water at 38 feet; sulphur water at 80 feet; black water at 200 feet.

GRAND RIVER GAS AND OIL SYNDICATE

Lot 6, Jones tract, North Cayuga tp.

Completed June 9, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	46
Lime and shale	254
Niagara	200
White lime	50
Casing shale	30
Clinton	25
Red Medina	35
Total depth	640

Water at 100 feet.

GRAND RIVER GAS AND OIL SYNDICATE

Lots 15 and 16, con. III, North Cayuga tp.

Completed December 31, 1934.
Producing gas well.
Rock pressure: 305 lbs.

Formation	Thickness, ft.
Surface	54
Lime and shale	257
Niagara	200
White lime	50
Casing shale	34
Clinton	30
Red Medina	35
Blue shale	65
White Medina	10
Red shale	15
Total depth	750

Gas at 624, 647, and 730 feet.
Water at 100 feet.

GRAND RIVER GAS AND OIL SYNDICATE

Lot 6, Jones tract, North Cayuga tp.

Completed July 11, 1935.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Thickness, ft.
Surface	48
Lime and shale	257
Niagara	200
White lime	50
Casing shale	30
Clinton	25
Red Medina	35
Blue shale	30
Total depth	675

Gas at 605 and 628 feet.
Water at 100 feet.

GRAND RIVER GAS AND OIL SYNDICATE

Lot 3, Jones tract, North Cayuga tp.

Completed August 21, 1934.
Producing gas well.
Rock pressure: 325 lbs.

Formation	Thickness, ft.
Surface	60
Lime and shale	265
Niagara	200
White lime	50
Casing shale	35
Clinton	28
Red Medina	35
Blue shale	30
Total depth	703

Gas at 614 and 659 feet.

GRAND RIVER GAS AND OIL SYNDICATE

Lot 4, Jones tract, North Cayuga tp.

Completed September 18, 1934.
Producing gas well.
Rock pressure: 305 lbs.

Formation	Thickness, ft.
Surface	38
Lime and shale	267
Niagara	200
White lime	50
Casing shale	34
Clinton	28
Red Medina	35
Blue shale	65
White Medina	10
Red shale	2
Total depth	729

Gas at 609 and 634 feet.
Salt water at 110 feet.

GRAND RIVER GAS AND OIL SYNDICATE

Lots 15 and 16, con. III, North Cayuga tp.

Completed November 7, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	62
Lime and shale	265
Niagara	195
White lime	50
Shale	35
Clinton	25
Red shale	45
Blue shale	65
White Medina	8
Total depth	750

Water at 90 feet.

NORTH CAYUGA GAS SYNDICATE
Lot 19, con. II, S.T.R., North Cayuga tp.
Completed November 28, 1934.
Producing gas well.
Rock pressure: 325 lbs.

Formation	Thickness, ft.
Surface	57
Lime and shale	274
Niagara	230
Shale	56
Clinton	28
Red Medina	40
Grey shale	51
White Medina	18
Red shale	35
Total depth	789

Gas at 685 to 754 feet.
Fresh water at 110 feet; salt water at 400 feet.

NORTH CAYUGA GAS SYNDICATE
Lot 19, con. II, S.T.R., North Cayuga tp.
Completed November 28, 1934.
Producing gas well.
Rock pressure: 325 lbs.

Formation	Thickness, ft.
Surface	49
Lime and shale	275
Niagara	230
Shale	56
Clinton	28
Red Medina	40
Grey shale	51
White Medina	17
Red shale	26
Total depth	772

Gas at 638 to 678 feet.
Fresh water at 120 feet; salt water at 400 feet.

NORTH CAYUGA GAS SYNDICATE
Lot 19, con. II, S.T.R., North Cayuga tp.
Completed September 3, 1934.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Thickness, ft.
Surface	47
Lime and shale	277
Niagara	230
Shale	56
Clinton	28
Red Medina	40
Grey shale	51
White Medina	18
Red shale	25
Total depth	772

Gas at 638 to 678 feet.
Fresh water at 80 feet; salt water at 400 feet.

NORTH CAYUGA GAS SYNDICATE
Lot 19, con. II, S.T.R., North Cayuga tp.
Completed September 17, 1934.
Producing gas well.
Rock pressure: 325 lbs.

Formation	Thickness, ft.
Surface	53
Lime and shale	261
Niagara	230
Shale	55
Clinton	28
Red Medina	40
Grey shale	53
White Medina	18
Red shale	25
Total depth	763

Gas at 627 to 667 feet.
Fresh water at 55 feet; salt water at 400 feet.

NORTH CAYUGA GAS SYNDICATE
Lots 1 and 2, Huff tract, North Cayuga tp.
Completed October 13, 1934.
Producing gas well.
Rock pressure: 250 lbs.

Formation	Thickness, ft.
Surface	58
Lime and shale	255
Niagara	230
Shale	55
Clinton	28
Red Medina	40
Grey shale	52
White Medina	16
Red shale	25
Total depth	759

Gas at 626 to 666 feet.
Fresh water at 65 feet; salt water at 425 feet.

NORTH CAYUGA GAS SYNDICATE
Lots 1 and 2, Huff tract, North Cayuga tp.
Completed October 26, 1934.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Thickness, ft.
Surface	51
Lime and shale	245
Niagara	230
Shale	55
Clinton	28
Red Medina	40
Grey shale	50
White Medina	18
Red shale	26
Total depth	743

Gas at 609 to 649 feet.
Fresh water at 65 feet; salt water at 425 feet.

NORTH CAYUGA GAS SYNDICATE
Lots 1 and 2, Huff tract, North Cayuga tp.
Completed November 13, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	50
Lime and shale	239
Niagara	230
Shale	55
Clinton	28
Red Medina	40
Grey shale	51
White Medina	17
Red shale	5
Total depth	715

Fresh water at 70 feet; salt water at 425 feet.

WESTERN ONTARIO NATURAL GAS CO., LTD.
Lot 7, con. II, North Cayuga tp.
Completed October 25, 1934.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	67
Lime and shale	211
Niagara	225
Shale	53
Clinton rock	28
Red Medina	40
Grey shale	51
White Medina	17
Red shale	56
Total depth	748

Fresh water at 70 feet; salt water at 350 feet.

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 19, con. II, Oneida tp.

Completed June 26, 1934.
Producing gas well.
Rock pressure: 385 lbs.

Formation	Thickness, ft.
Surface	80
Lime and shale	240
Niagara lime	250
Shale	47
Clinton and lime	24
Red Medina	32
Medina shale	70
White Medina	16
Red shale	30
Total depth	789

Gas at 637, 657, and 751 feet.
Fresh water at 60 feet; black water at 370 feet.

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 20, con. II, Oneida tp.

Completed July 27, 1934.
Producing gas well.
Rock pressure: about 385 lbs.

Formation	Thickness, ft.
Surface	80
Lime and shale	238
Niagara	255
Shale	46
Clinton	30
Red Medina	32
Shale	70
White Medina	16
Red shale	35
Total depth	802

Gas at 641, 667, and 760 feet.
Fresh water at 60 feet; black water at 328 feet.

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 3, con. II, Oneida tp.

Completed August 28, 1934.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	88
Lime and shale	256
Niagara lime	248
Shale	48
Clinton lime	24
Red Medina	32
Medina shale	66
White Medina	18
Red shale	32
Total depth	812

Gas at 658 feet.
Fresh water at 84 feet; black water at 358 feet.

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 2, con. II, Oneida tp.

Completed September 21, 1934.
Producing gas well.
Rock pressure: 340 lbs.

Formation	Thickness, ft.
Surface	91
Lime and shale	260
Niagara lime	250
Shale	43
Clinton lime	24
Red Medina	32
Medina shale	62
White Medina	17
Red shale	36
Total depth	815

Gas at 659, 683, and 772 feet.
Fresh water at 80 feet; black water at 520 feet.

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 2, con. II, Oneida tp.

Completed October 20, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	125
Lime and shale	250
Niagara lime	249
Shale	35
Clinton	26
Red Medina	31
Medina shale	64
White Medina	16
Total depth	796

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 20, con. II, Oneida tp.

Completed November 26, 1934.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	7
Broken lime	83
Lime and shale	270
Niagara	225
Casing shale	67
Clinton	27
Red Medina	40
Grey shale	55
White Medina	15
Red shale	25
Total depth	814

Gas at 652, 670, and 787 feet.
Fresh water at 80 feet; black water at 200 feet.

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 2, con. II, Oneida tp.

Completed December 19, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	5
Broken lime	90
Lime and shale	290
Niagara	235
Shale	49
Clinton	21
Red Medina	25
Blue shale	62
White Medina	21
Red shale	5
Total depth	803

Fresh water at 82 feet; black water at 140 feet.

LYNN VALLEY NATURAL GAS SYNDICATE
Lot 2, con. II, Oneida tp.

Completed December 29, 1934.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	4
Broken lime	80
Lime and shale	281
Niagara	240
Casing shale	45
Clinton	25
Red Medina	37
Grey shale	48
White Medina	16
Red shale	35
Total depth	811

Gas at 670 and 775 feet.
Fresh water at 80 feet; black water at 375 feet.

PETROL OIL AND GAS CO., LTD.
Lot 1, B.F., Oneida tp.
Completed August 30, 1934.
Producing gas well.
Rock pressure: 190 lbs.

Formation	Thickness, ft.
Surface	51
Salina	94
Niagara	242
Rochester	50
Clinton	33
Red Medina	12
Cabot Head	64
White Medina	6
Red shale	50
Total depth	602

Gas at 439 and 548 feet.
Fresh water at 90 feet.

PETROL OIL AND GAS CO., LTD.
Lot 1, B.F., Oneida tp.
Completed August 17, 1934.
Producing gas well.
Rock pressure: 195 lbs.

Formation	Thickness, ft.
Surface	51
Salina	96
Niagara	229
Rochester	57
Clinton	37
Red Medina	14
Cabot Head	60
White Medina	8
Red shale	50
Total depth	602

Gas at 435 and 545 feet.
Fresh water at 59 feet.

SELECTED NATURAL GAS AND OIL SYNDICATE
Lot 17, con. V, Oneida tp.
Completed May 25, 1934.
Producing gas well.
Rock pressure: 183 lbs.

Formation	Thickness, ft.
Surface	21
Lime and shale	174
Niagara	215
Shale	55
Clinton	28
Red Medina	35
Grey shale	55
White Medina	12
Red shale	30
Total depth	625

Gas at 473 and 593 feet.
Fresh water at 25 feet.

SELECTED NATURAL GAS AND OIL SYNDICATE
Lot 16, con. V, Oneida tp.
Completed June 14, 1934.
Producing gas well.
Rock pressure: 190 lbs.

Formation	Thickness, ft.
Surface	28
Lime and shale	192
Niagara	214
Casing shale	50
Clinton	27
Red Medina	30
Grey shale	55
White Medina	10
Red shale	30
Total depth	636

Gas at 489, 502, 539, and 605 feet
Fresh water at 45 feet.

SELECTED NATURAL GAS AND OIL SYNDICATE
Lot 16, con. V, Oneida tp.
Completed July 10, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	28
Lime and shale	182
Niagara	224
Casing shale	45
Clinton	27
Red Medina	30
Grey shale	60
White Medina	12
Red shale	2
Total depth	610

Fresh water at 40 feet.

GAS FINDERS GAS CO.
Lot 18, con. V, Ardross block, Oneida tp.
Completed December 28, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	40
Lime and shale	180
Niagara	200
Shale	45
Clinton	18
Red Medina	25
Grey shale	60
White Medina	12
Red shale	1
Total depth	581

Fresh water at 38 and 45 feet.
Black water at 175 feet.

NORHAL GAS AND OIL SYNDICATE
Lot 1, S.E. ¼, con. I, Rainham tp.
Completed May 26, 1934.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	23
Flint	80
Lime and shale	347
Niagara	276
Shale	55
Clinton	28
Medina	35
Grey shale	60
White shale	15
Red shale	2
Total depth	921

Gas at 786 and 836 feet.
Fresh water at 50 feet.

W. C. PATTERSON
Lot 1, con. VII, Rainham tp.
Completed December 3, 1934.
Producing gas well.
Rock pressure: 420 lbs.

Formation	Thickness, ft.
Surface	21
Flint	47
Shale and lime	374
Niagara	258
Shale	43
Clinton	25
Red Medina	38
Grey shale	52
White Medina	12
Total depth	870

Fresh water at 55 feet; sulphur water at 435 feet.

W. C. Patterson
Lot 1, S.W. ¼, con. VII, Rainham tp.
Completed November 7, 1934.
Producing gas well.
Rock pressure: 500 lbs.

Formation	Thickness, ft.
Surface	22
Flint	70
Shale and lime	350
Niagara	260
Shale	44
Clinton	26
Red Medina	38
Grey shale	40
Total depth	850

Fresh water at 60 feet; sulphur water at 440 feet.

W. C. Patterson
Lot 1, con. VII, Rainham tp.
Completed October 9, 1934.
Producing gas well.
Rock pressure: 500 lbs.

Formation	Thickness, ft.
Surface	16
Flint	76
Shale and lime	354
Niagara	260
Shale	44
Clinton	30
Red Medina	39
Shale	58
White Medina	12
Red shale	1
Total depth	890

Fresh water at 55 feet; sulphur water at 449 feet.

W. C. Patterson
Lot 7, con. VII, Rainham tp.
Completed November 17, 1934.
Producing gas well.
Rock pressure: 410 lbs.

Formation	Thickness, ft.
Surface	4
Flint	60
Lime and shale	364
Niagara	232
Shale	58
Clinton	28
Red Medina	42
Grey shale	62
White Medina	15
Red shale	50
Total depth	915

Fresh water at 43 feet, black water at 676 feet.

W. C. Patterson
Lot 7, con. VII, Rainham tp.
Completed December 21, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	24
Flint	60
Lime and shale	351
Niagara	228
Shale	52
Clinton	28
Red Medina	42
Grey shale	60
White Medina	13
Red shale	5
Total depth	863

Black water at 90 feet.

Superior Gas Syndicate
Lot 9, con. III, Rainham tp.
Completed April 20, 1934.
Producing gas well.
Rock pressure: 295 lbs.

Formation	Thickness, ft.
Surface	41
Flint	75
Lime and shale	344
Niagara	240
Shale	54
Clinton	25
Red Medina	40
Grey shale	62
White Medina	15
Red shale	2
Total depth	898

Gas at 769 and 797 feet.
Sulphur water at 50 feet.

Superior Gas Syndicate
Lot 9, con. III, Rainham tp.
Completed February 28, 1934.
Producing gas well.
Rock pressure: 325 lbs.

Formation	Thickness, ft.
Surface	33
Flint	75
Lime and shale	347
Niagara	239
Shale	60
Clinton	25
Red Medina	35
Grey shale	71
White Medina	14
Red shale	7
Total depth	906

Gas at 834 feet.
Sulphur water at 550 feet.

Superior Gas Syndicate
Lot 9, con. III, Rainham tp.
Completed January 20, 1934.
Producing gas well.
Rock pressure: 240 lbs.

Formation	Thickness, ft.
Surface	28
Flint	75
Lime and shale	352
Niagara	239
Shale	60
Clinton	30
Red Medina	35
Grey shale	65
White Medina	14
Red shale	40
Total depth	938

Gas at 769 and 897 feet.
Sulphur water at 35 feet.

Superior Gas Syndicate
Lot 8, con. III, Rainham tp.
Completed March 28, 1934.
Producing gas well.
Rock pressure: 270 lbs.

Formation	Thickness, ft.
Surface	27
Flint	75
Lime and shale	353
Niagara	245
Shale	53
Clinton	27
Red Medina	40
Grey shale	60
White Medina	15
Red shale	5
Total depth	900

Gas at 756 and 800 feet.
Fresh water at 45 feet.

AVERY, EALEY AND BLACKHEATH GAS CO.
Lot 5, W.S.C.R., Seneca tp.

Completed September 4, 1934.
Producing gas well.
Rock pressure: 105 lbs.

Formation	Thickness, ft.
Surface	59
Shale	50
Niagara	238
Shale	44
Clinton	27
Red Medina	33
Shale	60
White Medina	10
Shale	1
Total depth	522

Gas at 394 and 411 feet.
Water at 62 feet.

BLACKHEATH GAS CO., LTD.
Lot 5, E.S.C.R., Seneca tp.

Completed May 19, 1934.
Producing gas well.
Rock pressure: 80 lbs.

Formation	Thickness, ft.
Surface	67
Shale and lime	20
Niagara	250
Lime	25
Casing shale	16
Clinton	24
Red Medina	45
Blue shale	60
White Medina	12
Red shale	36
Total depth	555

Gas at 378 feet.

BLACKHEATH GAS CO., LTD.
Lot 5, E.S.C.R., Seneca tp.

Completed June 26, 1934.
Producing gas well.
Rock pressure: 70 lbs.

Formation	Thickness, ft.
Surface	57
Lime and shale	25
Niagara	260
Casing shale	20
Grey shale	40
Clinton	30
Red Medina	40
Blue shale	28
White Medina	18
Red shale	40
Total depth	558

Gas at 412 feet.

CENTRAL SENECA GAS SYNDICATE
Lot 6, E.S.C.R., Seneca tp.

Completed April 6, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	73
Lime and shale	97
Niagara	185
Casing shale	40
Clinton	30
Red Medina	15
Red Medina shale	20
Grey shale	55
White Medina	15
Red shale	3
Total depth	533

Fresh water at 75 feet.

CENTRAL SENECA GAS SYNDICATE
Lot 17, N. ½, con. IV, Seneca tp.

Completed December 12, 1934.
Producing gas well.
Rock pressure: 95 lbs.

Formation	Thickness, ft.
Surface	56
Lime and shale	102
Niagara	190
Casing shale	42
Clinton	26
Red Medina	29
Red shale	7
Grey shale	50
White Medina	9
Red shale	49
Total depth	560

Gas at 413, 508, and 511 feet.
Fresh water at 61 feet.

CENTRAL SENECA GAS SYNDICATE
Lot 17, con. IV, Seneca tp.

Completed February 1, 1934.
Producing gas well.
Rock pressure: 105 lbs.

Formation	Thickness, ft.
Surface	63
Lime and shale	102
Niagara	200
Casing shale	40
Clinton	25
Red Medina	30
Red Medina shale	5
Grey shale	47
White Medina	12
Red shale	35
Total depth	559

Gas at 420 and 517 feet.
Fresh water at 65 feet.

CENTRAL SENECA GAS SYNDICATE
Lot 16, N. ½, con. IV, Seneca tp.

Completed February 24, 1934.
Producing gas well.
Rock pressure: 93 lbs.

Formation	Thickness, ft.
Surface	57
Lime and shale	113
Niagara	178
Casing shale	35
Clinton	21
Red Medina	18
Red Medina shale	12
Grey shale	56
White Medina	18
Red shale	32
Total depth	540

Gas at 506 feet.
Fresh water at 65 feet.

CENTRAL SENECA GAS SYNDICATE
Lot 17, N. ½, con. IV, Seneca tp.

Completed February 1, 1934.
Producing gas well.
Rock pressure: 105 lbs.

Formation	Thickness, ft.
Surface	63
Lime and shale	102
Niagara	200
Casing shale	40
Clinton	25
Red Medina	30
Red Medina shale	5
Grey shale	47
White Medina	12
Red shale	35
Total depth	559

Gas at 420 and 517 feet.
Fresh water at 65 feet.

CENTRAL SENECA GAS SYNDICATE
Lot 15, N. ½, con. IV, Seneca tp.

Completed March 17, 1934.
Producing gas well.
Rock pressure: 95 lbs.

Formation	Thickness, ft.
Surface	53
Lime and shale	112
Niagara	165
Casing shale	48
Clinton	23
Red Medina	30
Red Medina shale	6
Grey shale	60
White Medina	15
Red shale	15
Total depth	527

Gas at 381, 500, and 421 feet.
Fresh water at 60 feet.

CENTRAL SENECA GAS SYNDICATE
Lot 17, N. ½, con. IV, Seneca tp.

Completed January 16, 1934.
Producing gas well.
Rock pressure: 105 lbs.

Formation	Thickness, ft.
Surface	58
Lime and shale	107
Niagara	180
Casing shale	35
Clinton	23
Red Medina	20
Red Medina shale	10
Grey shale	67
White Medina	12
Red shale	3
Total depth	515

Gas at 403 feet.
Fresh water at 68 feet.

DOMESTIC GAS SYNDICATE
Lot 16, con. IV, Seneca tp.

Completed August 21, 1934.
Producing gas well.
Rock pressure: 190 lbs.

Formation	Thickness, ft.
Surface	55
Lime and shale	87
Niagara	220
Guelph	35
Shale	25
Clinton	19
Red Medina	41
Shale	62
White Medina	13
Red shale	65
Total depth	622

Gas at 440 and 546 feet.
Fresh water at 60 feet; black water at 280 feet.

DOMESTIC GAS SYNDICATE
Lot 16, con. IV, Seneca tp.

Completed September 13, 1934.
Producing gas well.
Rock pressure: 120 lbs.

Formation	Thickness, ft.
Surface	60
Lime and shale	91
Niagara	225
Guelph	30
Shale	37
Clinton	21
Red Medina	39
Shale	59
White Medina	12
Red shale	50
Total depth	624

Gas at 450 and 565 feet.
Fresh water at 60 feet; sulphur water at 175 feet; black water at 300 feet.

DOMESTIC GAS SYNDICATE
Lot 17, con. III, Seneca tp.

Completed October 11, 1934.
Producing gas well.
Rock pressure: 120 lbs.

Formation	Thickness, ft.
Surface	65
Lime and gypsum	77
Niagara lime	250
Shale	45
Clinton	26
Red Medina	30
Blue shale	65
White Medina	12
Red shale	60
Total depth	630

Gas at 455 and 567 feet.

DOMESTIC GAS SYNDICATE
Lot 18, con. IV, Seneca tp.

Completed December 31, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	63
Lime and gypsum	70
Niagara lime	240
Shale	53
Clinton	32
Red Medina	30
Blue shale	70
White Medina	14
Red shale	13
Total depth	585

Fresh water at 63 feet; sulphur water at 210 feet.

DOMESTIC GAS SYNDICATE
Lot 17, con. III, Seneca tp.

Completed November 7, 1934.
Producing gas well.
Rock pressure: 110 lbs.

Formation	Thickness, ft.
Surface	66
Lime and gypsum	77
Niagara lime	250
Shale	45
Clinton	26
Red Medina	30
Blue shale	65
White Medina	12
Red shale	60
Total depth	631

Gas at 564 feet.
Fresh water at 66 feet; sulphur water at 240 feet.

DOMESTIC GAS SYNDICATE
Lot 18, con. IV, Seneca tp.

Completed November 30, 1934.
Producing gas well.
Rock pressure: 135 lbs.

Formation	Thickness. ft.
Surface	68
Lime and gypsum	75
Niagara	250
Shale	45
Clinton	26
Red Medina	30
Blue shale	65
White Medina	12
Red shale	30
Total depth	601

Fresh water at 70 feet; sulphur water at 210 feet.

NATIONAL GAS SYNDICATE
Lot 14, con. III, Seneca tp.

Completed November 26, 1934.
Producing gas well.
Rock pressure: 175 lbs.

Formation	Thickness, ft.
Surface	89
Lime and shale	94
Niagara	233
Shale	44
Clinton	25
Red Medina	40
Grey shale	55
White Medina	14
Red shale	41
Total depth	635

Gas at 470 and 589 feet.
Fresh water at 93 feet.

NATIONAL GAS SYNDICATE
Lot 16, S. ½, con. II, Seneca tp.

Completed December 21, 1934.
Producing gas well.
Rock pressure: 160 lbs.

Formation	Thickness, ft.
Surface	66
Lime and shale	113
Niagara	233
Shale	44
Clinton	27
Red Medina	40
Grey shale	55
White Medina	17
Red shale	40
Total depth	635

Gas at 459, 481, and 593 feet.
Fresh water at 69 feet.

SECURITY OIL AND GAS CO.
Lots 5, 6, and 7, con. I, W.S.C.R., Berry No. 1, Seneca tp.

Completed October 2, 1934.
Producing gas well.
Rock pressure: 55 lbs.

Formation	Thickness, ft.
Surface	80
Lime and shale	15
Niagara	245
Shale and lime	50
Clinton	20
Blue shale	30
Red Medina	12
Shale	30
White Medina	10
Red shale	10
Total depth	502

Gas at 395 and 490 feet.
Water at 100 and 305 feet.

SECURITY OIL AND GAS CO.
Lots 5, 6, and 7, con. I, W.S.C.R., Munn No. 1 Seneca tp.

Completed August 29, 1934.
Producing gas well.
Rock pressure: 70 lbs.

Formation	Thickness, ft.
Surface	78
Lime and shale	15
Niagara	245
Shale and lime	45
Clinton	20
Blue shale	25
Red Medina	12
Shale	25
White Medina	16
Red shale	19
Total depth	500

Gas at 474 feet.
Water at 98 and 300 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 22, con. V, South Cayuga tp.

Completed September 13, 1934.
Producing gas well.
Rock pressure: 220 lbs.

Formation	Thickness, ft.
Surface	14
Lime and shale	400
Niagara	210
Casing shale	78
Clinton	28
Red Medina	42
Grey shale	55
White Medina	12
Red shale	35
Total depth	874

Gas at 837 feet.
Fresh water at 125 feet, black water at 420 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 23, con. IV, South Cayuga tp.

Completed October 5, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	17
Lime and shale	400
Niagara	215
Casing shale	70
Clinton	28
Red Medina	43
Grey shale	60
White Medina	12
Red shale	2
Total depth	847

BROADWAY GAS SYNDICATE
Lot 19, N. ½, con. V, Walpole tp.

Completed January 25, 1934.
Producing gas well.
Rock pressure: 410 lbs.

Formation	Thickness, ft.
Surface	26
Flint	100
Lime and shale	352
Niagara	278
Casing shale	42
Clinton	23
Red Medina	28
Red shale	20
Grey shale	48
White Medina	12
Total depth	929

Gas at 803 and 846 feet.
Fresh water at 98 feet.

BROADWAY GAS SYNDICATE
Lot 21, N. ¾, con. VI, Walpole tp.

Completed January 24, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	20
Flint	94
Lime and shale	348
Niagara	267
Casing shale	50
Clinton	23
Red Medina	43
Grey shale	55
White Medina	8
Red shale	6
Total depth	913

Fresh water at 44 feet.

BROADWAY GAS SYNDICATE

Lot 21, N. ¾, con. V, Walpole tp.

Completed March 23, 1934.
Producing gas well.
Rock pressure: 405 lbs.

Formation	Thickness, ft.
Surface	8
Flint	92
Lime and shale	354
Niagara	253
Casing shale	53
Clinton	22
Red Medina	30
Red shale	12
Grey shale	57
White Medina	9
Red shale	2
Total depth	892

Gas at 788 and 807 feet.
Fresh water at 53 feet.

BROADWAY GAS SYNDICATE

Lot 21, N. ¾, con. VI, Walpole tp.

Completed February 17, 1934.
Producing gas well.
Rock pressure: 425 lbs.

Formation	Thickness, ft.
Surface	12
Flint	81
Lime and shale	359
Niagara	256
Casing shale	52
Clinton	23
Red Medina	15
Shale	27
Grey shale	55
White Medina	8
Red shale	6
Total depth	894

Gas at 782 and 816 feet.
Fresh water at 50 feet.

BROADWAY GAS SYNDICATE

Lot 17, E. ½, con. VIII, Walpole tp.

Completed June 15, 1934.
Producing gas well.
Rock pressure: 415 lbs.

Formation	Thickness, ft.
Surface	15
Flint	85
Lime and shale	360
Niagara	210
White lime	85
Casing shale	33
Clinton	23
Red Medina	42
Grey shale	51
White Medina	12
Total depth	916

Gas at 811, 821, and 829 feet.
Fresh water at 70 feet.

BROADWAY GAS SYNDICATE

Lot 20, con. V, Walpole tp.

Completed March 9, 1934.
Producing gas well.
Rock pressure: 395 lbs.

Formation	Thickness, ft.
Surface	20
Flint	110
Lime and shale	345
Niagara	210
White lime	61
Casing shale	40
Clinton	25
Red Medina	45
Grey shale	54
White Medina	12
Red shale	1
Total depth	923

Gas at 802 and 831 feet.
Fresh water at 70 feet.

BROADWAY GAS SYNDICATE

Lot 17, W. ½, con. VIII, Walpole tp.

Completed May 11, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	15
Flint	85
Lime and shale	360
Niagara	210
White lime	81
Casing shale	40
Clinton	22
Red Medina	45
Grey shale	52
White Medina	12
Red shale	2
Total depth	924

Show of gas at 801 feet.
Fresh water at 95 feet.

BROADWAY GAS SYNDICATE

Lot 20, N. ½, con. VI, Walpole tp.

Completed December 13, 1934.
Producing gas well.
Rock pressure: 405 lbs.

Formation	Thickness, ft.
Surface	19
Flint	76
Lime and shale	398
Niagara	220
Casing shale	72
Clinton	30
Red Medina sand	20
Red Medina shale	20
Grey shale	57
White Medina	12
Red shale	4
Total depth	928

Gas at 832 feet.
Fresh water at 70 feet.

BROADWAY GAS SYNDICATE

Lot 17, W. ½, con. VIII, Walpole tp.

Completed May 11, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	15
Flint	85
Lime and shale	360
Niagara	210
White lime	81
Casing shale	40
Clinton	22
Red Medina	45
Grey shale	52
White Medina	12
Red shale	2
Total depth	924

Gas at 801 feet.
Fresh water at 95 feet.

BROADWAY GAS SYNDICATE

Lot 20, N. ½, con. VI, Walpole tp.

Completed November 19, 1934.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	19
Flint	76
Lime and shale	395
Niagara	220
Casing shale	72
Clinton	30
Red Medina	40
Grey shale	57
White Medina	12
Red shale	4
Total depth	925

Gas at 829 feet.
Fresh water at 70 feet.

EMPIRE NATURAL GAS, LIMITED
Lot 4, con. II, Walpole tp.

Completed November 10, 1934.
Producing gas well.

Formation	Thickness, ft.
Surface	4
Flint	155
Lime and shale	341
Niagara	295
Shale	40
Clinton	23
Red Medina	40
Grey shale	61
White Medina	14
Red shale	2
Total depth	975

Gas at 839 and 885 feet.
Water at 80 feet.

EMPIRE NATURAL GAS, LIMITED
Lot 4, con. II, Walpole tp.

Completed September 3, 1934.
Producing gas well.

Formation	Thickness, ft.
Surface	25
Flint	154
Lime and shale	354
Niagara lime	289
Shale	48
Clinton	23
Red Medina	46
Blue shale	63
White Medina	13
Total depth	1,015

Gas at 875 and 898 feet.
Fresh water at 68 feet; sulphur water at 320 feet; black water at 635 feet.

EMPIRE NATURAL GAS, LIMITED
Lot 5, con. I, Walpole tp.

Completed October 19, 1934.
Producing gas well.

Formation	Thickness, ft.
Surface	12
Flint	155
Lime and shale	363
Niagara	277
Shale	45
Clinton	25
Red Medina	40
Grey shale	50
White Medina	15
Red shale	2
Total depth	984

Gas at 895 feet.
Fresh water at 55 feet.

EMPIRE NATURAL GAS, LIMITED
Lot 2, con. II, Walpole tp.

Completed May 30, 1934.
Producing gas well.
Rock pressure: 475 lbs.

Formation	Thickness, ft.
Surface	30
Flint	149
Lime and shale	361
Niagara	297
Shale	47
Clinton	26
Red Medina	45
Grey shale	57
White Medina	12
Red shale	42
Total depth	1,066

Gas at 1,020 feet.
Black water at 97 feet.

EMPIRE NATURAL GAS, LIMITED
Lot 1, con. II, Walpole tp.

Completed July 4, 1934.
Producing gas well.
Rock pressure: 470 lbs.

Formation	Thickness, ft.
Surface	25
Flint	164
Lime and shale	384
Niagara	266
Shale	41
Clinton	27
Red Medina	46
Shale	62
White Medina	12
Red shale	43
Total depth	1,070

Gas at 888, 953, and 1,020 feet.
Fresh water at 92 feet; black water at 230 feet.

EMPIRE NATURAL GAS, LIMITED
Lot 3, con. II, Walpole tp.

Completed September, 1934.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Thickness, ft.
Surface	18
Flint	147
Lime and shale	385
Niagara	281
Shale	34
Clinton	19
Red Medina	53
Grey shale	47
Shale and White Medina	18
White Medina	14
Red shale	50
Total depth	1,066

Gas at 869, 965 to 971, and 1,011 to 1,014 feet.
Fresh water at 50 feet; black water at 110 feet.

EMPIRE NATURAL GAS, LIMITED
Lot 5, con. I, Walpole tp.

Completed September 27, 1934.
Producing gas well.
Rock pressure: 410 lbs.

Formation	Thickness, ft.
Surface	30
Flint	165
Lime and shale	345
Niagara	272
Shale	55
Clinton	27
Red Medina	40
Grey shale	50
White Medina	15
Red shale	50
Total depth	1,049

Gas at 901 and 987 feet.
Salt water at 100 feet.

FIRELITE GAS AND OIL CO., LTD.
Lot 12, con. IV, Walpole tp.

Completed April 14, 1934.
Producing gas well.
Rock pressure: 240 lbs.

Formation	Thickness, ft.
Surface	30
Flint	105
Lime and shale	390
Niagara	262
Shale	53
Clinton	24
Red Medina	31
Grey shale	64
White Medina	13
Red shale	3
Total depth	975

Gas at 879 and 889 feet.
Sulphur water at 85 feet.

FIRELITE GAS AND OIL CO., LTD.
Lot 12, con. IV, Walpole tp.

Completed June 9, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	3
Flint	102
Lime and shale	380
Niagara	274
Shale	55
Clinton	24
Red Medina	30
Shale	68
White Medina	13
Red shale	3
Total depth	952

Sulphur water at 55 feet.

KELLY GAS SYNDICATE
Lot 18, W. ½ con. III, Walpole tp.

Completed May 2, 1934.
Producing gas well.
Rock pressure: 345 lbs.

Formation	Thickness, ft.
Surface	15
Flint	115
Lime and shale	357
Niagara	278
Casing shale	54
Clinton	29
Red Medina	42
Grey shale	59
White Medina	15
Red shale	3
Total depth	967

Gas at 821 and 874 feet.
Fresh water at 48 feet.

KELLY GAS SYNDICATE
Lot 21, N. ½, con. V, Walpole tp.

Completed July 7, 1934.
Producing gas well.
Rock pressure: 415 lbs.

Formation	Thickness, ft.
Surface	26
Flint	81
Lime and shale	369
Niagara	241
Casing shale	61
Clinton	28
Red Medina	28
Red shale	12
Grey shale	55
White Medina	10
Red shale	3
Total depth	914

Gas at 780 and 798 feet.
Fresh water at 37 feet.

KELLY GAS SYNDICATE
Lot 18, S. ½, con. III, Walpole tp.

Completed May 29, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	27
Flint	104
Lime and shale	354
Niagara	284
Casing shale	53
Clinton	30
Red Medina	41
Grey shale	62
White Medina	8
Red shale	3
Total depth	966

Fresh water at 57 feet.

LYMBURNER BROS. AND WEBBER
Pt. lot 24, con. IV, Walpole tp.

Completed May 30, 1934.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Thickness, ft.
Surface	10
Flint	120
Lime and shale	360
Niagara lime	250
Shale	63
Clinton	27
Red Medina	44
Shale	60
White Medina	10
Red shale	50
Total depth	994

Gas at 841 and 926 feet.
Fresh water at 72 feet.

LYMBURNER BROS. AND WEBBER
Lot 24, con. IV, Walpole tp.

Completed February 15, 1934.
Producing gas well.
Rock pressure: 275 lbs.

Formation	Thickness, ft.
Surface	28
Flint	82
Lime and shale	365
Niagara	233
Shale	64
Clinton	25
Red Medina	38
Shale	60
White Medina	10
Red shale	51
Total depth	956

Gas at 787 and 902 feet.
Sulphur water at 80 feet.

LYMBURNER BROS. AND WEBBER
Pt. lot 24, con. IV, Walpole tp.

Completed March 28, 1934.
Producing gas well.
Rock pressure: 458 lbs.

Formation	Thickness, ft.
Surface	5
Flint	95
Lime and shale	384
Niagara lime	230
Shale	75
Clinton	27
Red Medina	45
Shale	60
White Medina	10
Red shale	1
Total depth	932

Gas at 792 and 844 feet.
Fresh water at 30 and 60 feet.

MOHAWK GAS AND OIL SYNDICATE
Lot 23, con. X, Walpole tp.

Completed June 12, 1934.
Producing gas well.
Rock pressure: 420 lbs.

Formation	Thickness, ft.
Surface	4
Flint	50
Lime and shale	371
Niagara	241
Shale	46
Clinton	27
Red Medina	35
Grey shale	63
White Medina	10
Red shale	4
Total depth	851

Gas at 720 and 751 feet.
Fresh water at 22 feet.

MOHAWK GAS AND OIL SYNDICATE
Lot 22, con. X, Walpole tp.

Completed February 7, 1934.
Producing gas well.
Rock pressure: 375 lbs.

Formation	Thickness, ft.
Surface	2
Flint	50
Lime and shale	380
Niagara	250
Shale	53
Clinton	28
Red Medina	30
Grey shale	60
White Medina	10
Red shale	5
Total depth	868

MOHAWK GAS AND OIL SYNDICATE
Lot 22, con. X, Walpole tp.

Completed March 6, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	5
Flint	50
Lime and shale	380
Niagara	250
Shale	49
Clinton	30
Red Medina	35
Grey shale	57
White Medina	10
Red shale	3
Total depth	869

MONARCH GAS AND OIL SYNDICATE
Lot 23, W. ½, con. VI, Walpole tp.

Completed October 25, 1934.
Producing gas well.
Rock pressure: 407 lbs.

Formation	Thickness, ft.
Surface	22
Flint	90
Lime and shale	355
Niagara	210
White lime	47
Casing shale	39
Clinton	23
Red Medina	45
Grey shale	53
White Medina	12
Red shale	1
Total depth	897

Gas at 773, 801, and 814 feet.
Fresh water at 610 feet.

MONARCH GAS AND OIL SYNDICATE
Lot 23, W. ½, con. VI, Walpole tp.

Completed November 21, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	19
Flint	90
Lime and shale	346
Niagara	210
White lime	60
Casing shale	39
Clinton	22
Red Medina	45
Grey shale	53
White Medina	12
Red shale	2
Total depth	898

Show of gas at 776 feet.
Fresh water at 56 feet.

MONARCH GAS AND OIL SYNDICATE
Lot 23, W. ½, con. VI, Walpole tp.

Completed September 6, 1934.
Producing gas well.
Rock pressure: 415 lbs.

Formation	Thickness, ft.
Surface	12
Flint	81
Lime and shale	353
Niagara	256
Casing shale	52
Clinton	28
Red Medina	28
Shale	12
Grey shale	58
White Medina	10
Red shale	4
Total depth	894

Gas at 762, 797, and 810 feet.
Fresh water at 57 feet.

NORHAL GAS AND OIL, LIMITED
Lot 14, con. V, Walpole tp.

Completed August 28, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	15
Flint	125
Lime and shale	355
Niagara	274
Shale	60
Clinton	25
Red Medina	38
Grey shale	64
White Medina	12
Red shale	4
Total depth	972

Sulphur water at 130 feet.

NORHAL GAS AND OIL, LIMITED
Lot 14, S.E. ¼, con. V, Walpole tp.

Completed October 2, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	11
Flint	125
Lime and shale	359
Niagara	271
Shale	60
Clinton	23
Red Medina	38
Grey shale	63
White Medina	12
Red shale	5
Total depth	967

Gas at 830 and 867 feet.
Water at 140 feet.

NORHAL GAS AND OIL SYNDICATE
Lot 14, S.E. ¼, con. V, Walpole tp.

Completed July 14, 1934.
Producing gas well.
Rock pressure: 480 lbs.

Formation	Thickness, ft.
Surface	13
Flint	125
Lime and shale	357
Niagara	273
Shale	60
Clinton	27
Red Medina	35
Grey shale	60
White Medina	15
Red shale	8
Total depth	973

Gas at 843 feet; show of gas in Red Medina.
Fresh water at 55 feet.

NORHAL GAS AND OIL SYNDICATE
Lot 14, S.E. ¼, con. V, Walpole tp.

Completed June 16, 1934.
Producing gas well.
Rock pressure: 480 lbs.

Formation	Thickness, ft.
Surface	14
Flint	125
Lime and shale	361
Niagara	263
Shale	60
Clinton	27
Red Medina	35
Grey shale	60
White Medina	15
Red shale	2
Total depth	962

Gas at 833 to 835 feet.
Fresh water at 45 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 17, con. V, Walpole tp.

Completed March 12, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	16
Flint	100
Lime and shale	346
Niagara	278
Shale	62
Clinton	25
Red Medina	40
Grey shale	55
White Medina	12
Red shale	1
Total depth	935

Fresh water at 60 feet; black water at 300 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 23, con. V, Walpole tp.

Completed April 21, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	28
Flint	100
Lime and shale	352
Niagara	265
Casing shale	60
Clinton	27
Red Medina	35
Grey shale	55
White Medina	12
Red shale	3
Total depth	937

Fresh water at 50 feet; black water at 400 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 2, con. II, Walpole tp.

Completed May 24, 1934.
Producing gas well.
Rock pressure: 470 lbs.

Formation	Thickness, ft.
Surface	33
Flint	156
Lime and shale	371
Niagara	255
Shale	75
Clinton	18
Red Medina	55
Shale	58
White Medina	12
Total depth	1,033

Gas at 767 and 801 feet.
Fresh water at 65 feet.

OTTERVILLE NATURAL GAS SYNDICATE No. 1
Lot 1, con. III, Walpole tp.

Completed August 24, 1934.
Producing gas well.
Rock pressure: 430 lbs.

Formation	Thickness, ft.
Surface	47
Flint	142
Lime and shale	381
Niagara lime	250
Shale	51
Clinton	20
Red Medina	45
Grey shale	54
White Medina	12
Red shale	40
Total depth	1,042

Gas at 897, 910, and 995 feet.
Fresh water at 115 feet; black water at 360 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 5, con. I, Walpole tp.

Completed September 24, 1934.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	23
Flint	141
Lime and shale	376
Niagara	255
Shale	64
Clinton	29
Red Medina	49
Shale	50
White Medina	16
Red shale	40
Total depth	1,043

Gas at 874, 909, and 996 feet.
Fresh water at 60 feet; black water at 180 feet; sulphur water at 465 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 5, con. I, Walpole tp.

Completed November 6, 1934.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Thickness, ft.
Surface	12½
Flint	135½
Lime and shale	371
Niagara	265
Shale	45
Clinton	23
Red Medina	47
Shale	62
White Medina	10
Total depth	971

Gas at 855 feet.
Fresh water at 12 feet; black water at 110 feet; sulphur water at 580 feet.

OTTERVILLE NATURAL GAS SYNDICATE No. 2
Lot 3, con. III, Walpole tp.

Completed April 18, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	26
Flint	162
Brown lime and shale	352
Niagara	284
Shale	48
Clinton	31
Red Medina	42
Blue shale	48
White Medina	12
Total depth	1,005

Fresh water at 110 feet; sulphur water at 400 feet.

OTTERVILLE NATURAL GAS SYNDICATE No. 3
Lot 6, con. I, Walpole tp.

Completed October 30, 1934.
Dry hole

Formation	Thickness, ft.
Surface	27
Flint	158
Lime and shale	355
Niagara	270
Shale	40
Clinton	28
Red Medina	50
Grey shale	60
White Medina	12
Total depth	1,000

Gas at 908 and 1,000 feet.
Sulphur water at 103 feet; black water at 425 feet.

OTTERVILLE NATURAL GAS SYNDICATE No. 3
Lot 5, con. I, Walpole tp.

Completed December 13, 1934.
Producing gas well.
Rock pressure: 385 lbs.

Formation	Thickness, ft.
Surface	32
Flint	151
Lime, gypsum, and shale	352
Niagara	272
Shale	42
Clinton	20
Red Medina	55
Shale	65
White Medina	12
Red shale	3
Total depth	1,004

Gas at 877 feet.
Fresh water at 30 feet; black water at 85 feet; sulphur water at 625 feet.

OTTERVILLE NATURAL GAS SYNDICATE No. 3
Lot 4, con. II, Walpole tp.

Completed December 21, 1934.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Thickness, ft.
Surface	18
Flint	146
Lime and shale	356
Niagara	290
Shale	50
Clinton	27
Red Medina	60
Grey shale	58
White Medina	12
Total depth	1,017

Gas at 892, 902, and 910 feet.
Fresh water at 56 feet; black water at 178 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 1, con. III, Walpole tp.

Completed February 2, 1934.
Producing gas well.
Rock pressure: about 450 lbs.

Formation	Thickness, ft.
Surface	41
Flint	157
Lime and shale	372
Niagara	270
Shale	52
Clinton	28
Red Medina	42
Shale	53
White Medina	12
Red shale	40
Total depth	1,067

Gas at 922, 930, and 1,020 feet.
Fresh water at 56 feet; sulphur water at 200 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 2, con. III, Walpole tp.

Completed February 3, 1934.
Producing gas well.
Rock pressure: about 450 lbs.

Formation	Thickness, ft.
Surface	34
Flint	151
Brown lime, slate, and shale	367
Niagara	280
Shale	48
Clinton	27
Red Medina	47
Shale	50
White Medina	16
Red shale	2
Total depth	1,022

Gas at 912 and 922 feet.
Fresh water at 60 feet; sulphur water at 123 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 3, con. III, Walpole tp.

Completed March 14, 1934.
Producing gas well.
Rock pressure: 320 lbs.

Formation	Thickness, ft.
Surface	26
Flint	162
Brown lime, slate, and shale	352
Niagara	284
Shale	48
Clinton	31
Red Medina	42
Blue shale	52
White Medina	14
Red shale	2
Total depth	1,013

Gas at 907 and 913 feet.
Fresh water at 108 feet; sulphur water at 400 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 24, con. VII, Walpole tp.

Completed March 20, 1934.
Producing gas well.
Rock pressure: 430 lbs.

Formation	Thickness, ft.
Surface	16
Flint	74
Lime and shale	380
Niagara	250
Shale	36
Clinton	25
Red Medina	35
Shale	70
White Medina	12
Red shale	35
Total depth	933

Gas at 762, 789, and 895 feet.
Fresh water at 78 feet; black water at 500 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 1, con. III, Walpole tp.

Completed March 26, 1934.
Producing gas well.
Rock pressure: about 450 lbs.

Formation	Thickness, ft.
Surface	47
Flint	163
Lime and shale	367
Niagara	235
Shale	60
Clinton	24
Red Medina	60
Shale	48
White Medina	12
Total depth	1,016

Gas at 919 and 924 feet.
Fresh water at 58 feet; sulphur water at 490 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 24, con. VII, Walpole tp.

Completed June 1, 1934.
Producing gas well.
Rock pressure: about 400 lbs.

Formation	Thickness, ft.
Surface	13
Flint	75
Lime and shale	380
Niagara	250
Shale	37
Clinton	25
Red Medina	35
Shale	70
White Medina	12
Red shale	35
Total depth	932

Gas at 775, 798, and 893 feet.
Fresh water at 55 feet; black water at 460 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 1, con. III, Walpole tp.

Completed July 18, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	47
Flint	151
Lime and shale	362
Niagara lime	240
Shale	73
Clinton	23
Red Medina	53
Shale	55
White Medina	10
Total depth	1,014

Fresh water at 125 feet; black water at 625 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 24, con. VII, Walpole tp.

Completed February 3, 1934.
Producing gas well.
Rock pressure: 375 lbs.

Formation	Thickness, ft.
Surface	15
Flint	70
Lime and shale	390
Niagara	240
Shale	43
Clinton	25
Red Medina	32
Shale	70
White Medina	14
Red shale	2
Total depth	901

Gas at 763, 789, and 805 feet.
Fresh water at 60 feet; black water at 580 feet.

OTTERVILLE NATURAL GAS SYNDICATE
Lot 24, con. VII, Walpole tp.

Completed April 23, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	12
Flint	70
Lime and shale	385
Niagara	240
Shale	45
Clinton	28
Red Medina	35
Shale	66
White Medina	15
Red shale	2
Total depth	898

Fresh water at 70 feet; black water at 350 feet.

W. C. PATTERSON
Lot 13, E. ½, con. VII, Walpole tp.

Completed October 19, 1934.
Producing gas well.
Rock pressure: 500 lbs.

Formation	Thickness, ft.
Surface	31
Flint	65
Lime and shale	387
Niagara	255
Shale	57
Clinton	25
Red Medina	37
Grey shale	57
White Medina	12
Red shale	4
Total depth	930

Fresh water at 53 feet; black water at 480 feet.

W. C. PATTERSON
Lot 12, con. VII, Walpole tp.

Completed May 26, 1934.
Producing gas well.
Rock pressure: 500 lbs.

Formation	Thickness, ft.
Surface	19
Flint	65
Lime and shale	396
Niagara	254
Shale	54
Clinton	25
Red Medina	40
Grey shale	61
White Medina	9
Red shale	51
Total depth	974

Gas at 808 and 920 feet.
Sulphur water at 45 feet.

W. C. PATTERSON
Lot 6, S. ½, con. II, Walpole tp.

Completed October 11, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	23
Flint	157
Lime and shale	362
Niagara	303
Shale	30
Clinton	23
Red Medina	40
Shale	60
White Medina	5
Red shale	5
Total depth	1,008

Fresh water at 90 feet; sulphur water at 670 feet

W. C. PATTERSON
Lot 5, N. pt., con. I, Walpole tp.

Completed December 20, 1934.
Producing gas well.
Rock pressure: 320 feet.

Formation	Thickness, ft.
Surface	6
Flint	150
Lime and shale	358
Niagara	301
Shale	44
Clinton	27
Red Medina	35
Shale	65
White Medina	17
Red shale	50
Total depth	1,053

Gas at 906 and 1,000 feet.
Sulphur water at 45 feet.

W. C. Patterson
Lot 12, E. ½, con. VII, Walpole tp.
Completed August 16, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	17
Flint	70
Lime and shale	388
Niagara	265
Shale	50
Clinton	30
Red Medina	40
Grey shale	50
White Medina	9
Red shale	2
Total depth	921

Fresh water at 38 feet; black water at 494 feet.

W. C. Patterson
Lot 7, N. ½, con. II, Walpole tp.
Completed August 25, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	30
Flint	156
Lime and shade	363
Niagara	303
Shale	30
Clinton	26
Red Medina	30
Grey shale	70
White Medina	10
Red shale	4
Total depth	1,022

Fresh water at 40 feet.

W. C. Patterson
Lot 8, N. ½, con. VIII, Walpole tp.
Completed April 18, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	9
Flint	61
Lime and shale	405
Niagara	255
Shale	45
Clinton	30
Red Medina	45
Grey shale	47
White Medina	8
Red shale	5
Total depth	910

Fresh water at 40 feet; sulphur water at 475 feet.

W. C. Patterson
Lot 6, S. ½, con. III, Walpole tp.
Completed July 12, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	4
Flint	146
Lime and shale	355
Niagara	285
Shale	50
Clinton	27
Red Medina	37
Blue shale	60
White Medina	13
Red Medina	3
Total depth	980

Fresh water at 75 feet; black water at 500 feet.

W. C. Patterson
Lot 12, con. VIII, Walpole tp.
Completed February 3, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	7
Flint	66
Lime and shale	392
Niagara	248
Shale	63
Clinton	28
Red Medina	35
Grey shale	49
White Medina	10
Red shale	2
Total depth	900

Fresh water at 23 feet; sulphur water at 450 feet.

W. C. Patterson
Lot 12, con. VIII, Walpole tp.
Completed March 14, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	4
Flint	65
Lime and shale	392
Niagara	251
Shale	56
Clinton	35
Red Medina	31
Shale	51
White Medina	10
Red shale	5
Total depth	900

Fresh water at 23 feet; sulphur water at 450 feet.

W. C. Patterson
Lot 13, W. ½, con. VII, Walpole tp.
Completed July 19, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	20
Flint	68
Lime and shale	397
Niagara	255
Shale	50
Clinton	28
Red Medina	35
Grey shale	59
White Medina	14
Red shale	2
Total depth	928

Clear water at 45 feet; black water at 490 feet.

W. C. Patterson
Lot 6, con. II, Walpole tp.
Completed April 20, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	17
Flint	160
Lime and shale	348
Niagara	308
Shale	45
Clinton	24
Red Medina	40
Shale	61
White Medina	15
Red shale	4
Total depth	1,022

Fresh water at 25 feet.

W. C. Patterson
Lot 6, con. II, Walpole tp.

Completed June 4, 1934.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Thickness, ft.
Surface	5
Flint	155
Lime and shale	336
Niagara	308
Shale	45
Red Medina	45
Shale	65
White Medina	16
Red shale	5
Total depth	980

Fresh water at 40 feet; sulphur water at 496 feet.

W. C. Patterson
Lot 10, E. ½, con. VII, Walpole tp.

Completed September 19, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	6
Flint	74
Lime and shale	384
Niagara	265
Shale	47
Clinton	25
Red Medina	40
Grey shale	60
White Medina	12
Red shale	4
Total depth	917

Fresh water at 23 feet; black water at 465 feet.

Fred W. Reicheld
Lot 10, con. V, Walpole tp.

Completed October 27, 1934.
Producing gas well.
Rock pressure: 475 lbs.

Formation	Thickness, ft.
Surface	6
Flint	125
Lime and shale	354
Niagara	272
Shale	45
Clinton	24
Red Medina	37
Grey shale	60
White Medina	10
Red shale	4
Total depth	937

Gas at 835 and 840 feet.
Sulphur water at 55 feet.

Fred W. Reicheld
Lot 10, con. V, Walpole tp.

Completed November 21, 1934.
Producing gas well.
Rock pressure: 475 lbs.

Formation	Thickness, ft.
Surface	7
Flint	125
Lime and shale	353
Niagara	263
Shale	49
Clinton	28
Red Medina	40
Grey shale	60
White Medina	10
Red shale	5
Total depth	940

Gas at 801 and 840 feet.
Sulphur water at 60 feet.

Fred W. Reicheld
Lot 10, con. V, Walpole tp.

Completed December 22, 1934.
Producing gas well.
Rock pressure: 475 lbs.

Formation	Thickness, ft.
Surface	25
Flint	125
Lime and shale	350
Niagara	264
Shale	50
Clinton	29
Red Medina	40
Grey shale	60
White Medina	11
Red shale	5
Total depth	959

Gas at 845 and 855 feet.
Fresh water at 42 feet.

Fred W. Reicheld
Lot 10, E. ½, con. IV, Walpole tp.

Completed October 26, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	20
Flint	90
Lime and shale	380
Niagara	276
Casing shale	47
Clinton	28
Red Medina	38
Grey shade	60
White Medina	9
Red shale	2
Total depth	950

Fresh water at 66 feet.

Fred W. Reicheld
Lot 11, S. ½, con. V, Walpole tp.

Completed November 19, 1934.
Producing gas well.
Rock pressure: 515 lbs.

Formation	Thickness, ft.
Surface	26
Flint	94
Lime and shale	370
Niagara	273
Casing shale	57
Clinton	27
Red Medina	40
Grey shale	55
White Medina	9
Red shale	18
Total depth	969

Gas at 835, 844, 851, and 951 feet.
Fresh water at 72 feet.

Fred W. Reicheld
Lot 10, E. ½, con. IV, Walpole tp.

Completed October 4, 1934.
Producing gas well.
Rock pressure: 455 lbs.

Formation	Thickness, ft.
Surface	17
Flint	120
Lime and shale	358
Niagara	274
Casing shale	47
Clinton	26
Red Medina	38
Grey shale	65
White Medina	7
Red shale	28
Total depth	980

Gas at 827, 864, and 952 feet.
Fresh water at 94 feet.

SANDUSK GAS AND OIL SYNDICATE
Lot 13, W. ½, con. VI, Walpole tp.

Completed July 9, 1934.
Producing gas well.
Rock pressure: 500 lbs.

Formation	Thickness, ft.
Surface	20
Flint	107
Lime and shale	363
Niagara	285
Shale	49
Clinton	28
Red Medina	42
Grey shale	46
White Medina	14
Red shale	1
Total depth	955

Gas at 853 and 868 feet.
Black water at 97 feet.

SOVEREIGN GAS SYNDICATE
Lot 22, con. II, Walpole tp.

Completed December 10, 1934.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	8
Flint	160
Lime and shale	347
Niagara	283
Shale	60
Clinton	30
Red Medina	35
Grey shale	60
White Medina	15
Red shale	5
Total depth	1,003

Gas at 868 feet.
Sulphur water at 560 feet.

STANDARD GAS AND OIL SYNDICATE
Lot 24, con. IV, Walpole tp.

Completed May 24, 1934.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	21
Flint	85
Lime and shale	366
Niagara	237
Shale	56
Clinton	29
Red Medina	42
Grey shale	57
White Medina	18
Red shale	4
Total depth	915

Gas at 770 and 824 feet.
Sulphur water at 72 feet.

STANDARD GAS AND OIL SYNDICATE
Lot 24, con. IV, Walpole tp.

Completed August 24, 1934.
Producing gas well.
Rock pressure: 375 lbs.

Formation	Thickness, ft.
Surface	18
Flint	90
Lime and shale	366
Niagara	243
Shale	55
Clinton	29
Red Medina	42
Grey shale	56
White Medina	15
Red shale	5
Total depth	919

Gas at 775, 790, and 826 feet.
Black water at 550 feet.

STANDARD GAS AND OIL SYNDICATE
Lot 24, S. ½, con. IV, Walpole tp.

Completed April 27, 1934.
Producing gas well.
Rock pressure: 360 lbs.

Formation	Thickness, ft.
Surface	26
Flint	82
Lime and shale	371
Niagara	240
Shale	50
Clinton	29
Red Medina	43
Grey shale	55
White Medina	18
Red shale	5
Total depth	919

Gas at 774, 809, and 827 feet.
Sulphur water at 30 feet.

STANDARD GAS AND OIL SYNDICATE
Lot 24, con. IV, Walpole tp.

Completed July 4, 1934.
Producing gas well.
Rock pressure: 470 lbs.

Formation	Thickness, ft.
Surface	25
Flint	164
Lime and shale	384
Niagara	266
Shale	41
Clinton	27
Red Medina	46
Shale	62
White Medina	12
Red shale	43
Total depth	1,070

Gas at 888, 953, and 1,020 feet.
Fresh water at 92 feet; black water at 230 feet.

STANDARD GAS AND OIL SYNDICATE
Lot 24, S. ½, con. IV, Walpole tp.

Completed February 2, 1934.
Producing gas well.
Rock pressure: 460 lbs.

Formation	Thickness, ft.
Surface	30
Flint	80
Lime and shale	365
Niagara	243
Shale	56
Clinton	29
Red Medina	42
Grey shale	55
White Medina	18
Red shale	2
Total depth	920

Gas at 774, 794, 799, 813, and 823 feet.
Black water at 62 feet.

STANDARD GAS AND OIL SYNDICATE
Lot 24, S. ½, con. IV, Walpole tp.

Completed March 16, 1934.
Producing gas well.
Rock pressure: 355 lbs.

Formation	Thickness, ft.
Surface	31
Flint	74
Lime and shale	365
Niagara	238
Shale	54
Clinton	29
Red Medina	42
Grey shale	60
White Medina	17
Red shale	4
Total depth	914

Gas at 767, 788, 804, and 822 feet.
Sulphur water at 42 feet.

WALPOLE GAS SYNDICATE

Lot 18, con. VII, Walpole tp.

Completed September 15, 1934.
Producing gas well.
Rock pressure: 375 lbs.

Formation	Thickness, ft.
Surface	26
Flint	100
Lime and shale	329
Niagara	220
White lime	73
Casing shale	35
Clinton	22
Red Medina	46
Grey shale	51
Red shale	12
Total depth	914

Gas at 813 feet.
Fresh water at 110 feet.

WALPOLE GAS SYNDICATE

Lot 18, S. ½, con. VI, Walpole tp.

Completed August 8, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	29
Flint	90
Lime and shale	358
Niagara	210
White lime	68
Casing shale	36
Clinton	28
Red Medina	45
Grey shale	54
White Medina	12
Red shale	1
Total depth	931

WALPOLE GAS SYNDICATE

Lot 18, S. ½, con. VI, Walpole tp.

Completed July 11, 1934.
Producing gas well.
Rock pressure: 375 lbs.

Formation	Thickness, ft.
Surface	32
Flint	90
Lime and shale	358
Niagara	210
White lime	68
Casing shale	36
Clinton	28
Red Medina	45
Grey shale	53
White Medina	12
Red shale	1
Total depth	933

Gas at 809 and 848 feet.
Fresh water at 65 feet.

WALPOLE GAS SYNDICATE

Lot 19, S. ½, con. VI, Walpole tp.

Completed July 30, 1934.
Producing gas well.
Rock pressure: 415 lbs.

Formation	Thickness, ft.
Surface	29
Flint	91
Lime and shale	345
Niagara	278
Casing shale	59
Clinton	27
Red Medina	23
Red shale	18
Grey shale	54
White Medina	11
Red shale	3
Total depth	938

Gas at 836, 843, and 850 feet.
Fresh water at 97 feet.

POPE AND RYAN

Lot 13, con. IV, Walpole tp.

Completed January 14, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	9
Flint	91
Lime and shale	385
Niagara	274
Shale	51
Clinton	25
Red Medina	39
Grey shale	55
White Medina	10
Red shale	2
Total depth	941

Sulphur water at 70 feet.

Kent County

AJAX OIL AND GAS CO., LTD.

Lot 1, con. IV, Dover East tp.

Completed January 4, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	70
Hamilton shale	212
Onondaga lime	123
Sharp sand	95
Brown and grey lime	280
Sharp sand	10
Light-brown lime	30
Sharp sand	125
Brown and grey lime	200
Lime and blue lime	360
Salt	30
Brown, grey, and blue lime	438
Rochester shale	20
Clinton	10
Red Medina	28
Blue shale	60
Manitoulin dolomite	64
Red shale	110
Blue shale	45
Blue and red shale	112
Blue lime, shell, and shale	321
Utica brown shale	156
Trenton lime	282
Total depth	3,181

Small gas yield at 2,910, 3,030, 3,037, 3,106, and 3,114 feet.

AJAX OIL AND GAS CO., LTD.

Lot 3, con. III, Dover East tp.

Completed November 11, 1934.
Producing gas well.
Rock pressure: 1,180 lbs.

Formation	Thickness, ft.
Surface	87
Hamilton shale	165
Onondaga lime	148
Oriskany sandstone	15
Grey and brown lime	185
Sharp lime	130
Brown lime	20
Sharp lime	170
Brown and blue lime	200
Broken lime	100
Brown lime	40
Blue lime and gypsum	10
Brown and blue lime	185
Salt	40
Brown and grey lime	400
Rochester shale	12
Red Medina	50
Blue shale	56
Lime and shale	27
Manitoulin dolomite	55
Queenston red shale	170
Hudson River shale	470
Utica brown shale	115
Trenton lime	128
Total depth	2,978

Gas at 2,966 to 2,970 and 2,977 to 2,978 feet.
Fresh water at 87 feet; sulphur water at 275, 390, 850, and 965 feet.

AJAX OIL AND GAS CO., LTD.
Lot 1, con. III, Dover East tp.

Completed March 26, 1934.
Producing gas well.
Rock pressure: 920 lbs.

Formation	Thickness, ft.
Surface	82
Hamilton	218
Guelph and Niagara	1,662
Clinton	29
Red Medina	25
Blue shale	94
White Medina	46
Hudson River and Utica	743
Trenton	138
Total depth	3,037

Gas at 2,921 to 2,965 feet and 3,010 to 3,018 feet.
Salt water at 395, 422, and 1,935 feet; very salt water at 3,037 feet.

F. H. STOVER AND SON
Lot 3, con. III, Dover East tp.

Completed September 3, 1934.
Producing gas well.
Rock pressure: 1,180 lbs.

Formation	Thickness, ft.
Surface	87
Hamilton shale	165
Onondaga and Detroit River: limestone and sand	748
Salina:	
brown lime and gypsum	55
grey and brown lime	55
blue shale	90
brown, blue, and white lime	242
salt	53
Guelph and Niagara:	
brown and grey dolomite	400
Rochester blue shale	27
Clinton	33
Medina-Cataract:	
Red Medina	35
blue shale	50
White Medina	44
Queenston and Hudson River: red shale	621
Trenton	488
Total depth	3,193

Gas at 2,947, 2,999, 3,036, 3,065, and 3,181 feet.
Sulphur water at 275 and 390 feet.

F. H. STOVER AND SON
Lot 3, con. III, Dover East tp.

Completed November 29, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	79
Hamilton beds	202
Onondaga lime	119
Detroit River and Salina:	
hard lime	290
brown and grey lime	209
grey lime	106
brown lime and gypsum	55
grey and brown lime	55
blue lime	90
brown lime	140
blue and brown lime	92
salt	53
Guelph and Niagara:	
brown and grey lime	125
grey lime	30
Rochester blue shale	27
Clinton	35
Cabot Head	84
Manitoulin dolomite	44
Queenston and Hudson River: red shale	615
Utica blue shale	128
Trenton lime	427
Total depth	3,250

Fresh water at 79 feet; sulphur water at 360 feet; black water at 489 feet; sulphur water at 1,060, 1,680, 1,780 to 1,810 and 1,815 to 1,826 feet.

LADD AND KABANA
Lot 26, con. XIV, Orford tp.

Completed July 19, 1934.
Dry hole.

Formation	Thickness, ft.
Sand	10
Clay and quicksand	55
Hardpan	45
Boulders	40
Hardpan	10
Upper soap	52
Middle lime	10
Lower soap	25
Dark streak	6
Lower lime	157
Sand	9
Sandy lime	18
Fine water sand	7
Total depth	444

Fresh water at 150 feet; salt water at 437 feet.

G. E. AND D. E. WILLITS AND CHAS. MOBEY
Lot 23, con. XV, Orford tp.

Completed July 31, 1934.
Oil yield: 2 bbls. per day.

Formation	Thickness, ft.
Sand	10
Quag	85
Sand and gravel	5
Hardpan	60
Sand and gravel	20
Gravel	14
Hardpan	26
Middle lime	12
Lower soap	28
Lower lime	151
Total depth	411

Oil at 264 feet.
Fresh water at 180 feet.

F. W. KEHLET
Lot 24, con. XV, Orford tp.

Completed September 29, 1934.
Producing oil well.

Formation	Thickness, ft.
Sand	9
Mild hardpan	61
Sand	35
Boulders	10
Hardpan and gravel	104
Grey shale	8
Middle lime	10
Lower soap	28
Lower lime	138
Total depth	403

Oil at 229, 289, 295, 301, 381, and 404 feet.
Fresh water at 160 feet.

F. W. Kehlet
Lot 23, con. XV, Orford tp.

Completed December 13, 1934.
Show of oil.

Formation	Thickness, ft.
Sand	5
Clay	60
Hardpan	20
Sand	14
Hardpan	49
Sand	17
Gravel	8
Hardpan (stiff)	47
Clay	15
Soapstone	25
Lower lime	126
Brown lime	8
Light lime	7
Total depth	401

Gas at 399 feet.
Oil at 294, 328, 364, and 399 feet.
Fresh water at 173 feet; water at 399 feet.

Gas Producers Syndicate
Lot 140, E. ½, N.T.R., Raleigh tp.

Completed December 27, 1934.
Producing gas well.
Rock pressure: 635 lbs.

Formation	Thickness, ft.
Surface	180
Soap	139
Grey lime	66
Brown lime	175
Brown and white lime	135
Grey lime	23
Brown and white lime	42
Grey lime	65
Brown lime	155
Gypsum and brown lime	20
Blue lime	5
Brown lime	25
Blue and brown lime	340
Salt	20
Brown lime	47
Brown and grey lime	105
Total depth	1,542

Gas at 1,145; sweet gas at 1,200, 1,412, 1,420, and 1,437 feet; sour gas at 1,512 and 1,542 feet.
Salt and sulphur water at 522 and 560 feet.

Southern Ontario Gas Co., Ltd.
Lot 4, con. XIII, Raleigh tp.

Completed July 3, 1934.
Producing gas well.
Oil yield: 1 bbl. per day.
Rock pressure: 340 lbs.

Formation	Thickness, ft.
Surface	143
Shale	72
Soap	65
Middle lime	10
Soap	38
Big lime	232
Brown lime	292
Grey lime	428
Brown lime	75
Light-brown sand	6
Brown lime	2
Grey lime	7
Total depth	1,370

Gas at 1,276 and 1,368 feet.
Fresh water at 143 feet; black water at 560 and 730 feet.

Union Gas Co. of Canada, Ltd.
Lot 17, con. XV, Raleigh tp.

Completed November 14, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	175
Soap	165
Grey and brown lime	80
Sharp light-brown lime	65
Grey and brown lime	185
Brown and grey lime	205
Blue lime	85
Blue and brown lime	45
Brown lime	25
Blue and brown lime	50
Brown lime	25
Blue and brown lime	130
Brown lime	70
Grey lime	15
Brown lime	175
Total depth	1,690

Gas at 485 feet; sweet gas at 1,445 feet; sulphur gas at 1,575 feet. Blew down rapidly.
Show of oil at 1,595 feet.
Sulphur water at 535 and 620 feet; salt water at 1,480, 1,595, and 1,680 to 1,690 feet.

Union Gas Co. of Canada, Ltd.
Lot 140, N.T.R., Raleigh tp.

Completed September 25, 1934.
Producing gas well.
Rock pressure: 679 lbs.

Formation	Thickness, ft.
Surface	202
Soap	109
Grey lime	339
Sharp sand	190
Grey and brown lime	155
Grey lime and gypsum	5
Blue and grey lime	60
Blue lime	80
Blue and brown lime	285
Grey lime	45
Brown lime	30
Grey lime	60
Total depth	1,560

Gas at 1,240, 1,405, 1,415, 1,470, 1,500, 1,507, 1,510, 1,520, 1,530, 1,542, 1,547, and 1,560 feet.
Fresh water at 200 feet.

Union Gas Co. of Canada, Ltd.
Lot 17, con. XII, Raleigh tp.

Completed June 5, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	177
Hamilton beds	83
Light-brown lime	260
Light-brown and grey lime	30
Blue lime	55
Light-brown and brown lime	200
Blue and grey lime	35
Blue lime	170
Brown lime	105
Blue lime	25
Blue and brown lime	155
Blue and grey lime	20
Light-brown and blue lime	75
Dark-blue lime	10
Light-brown lime	200
Grey lime	30
Blue shale	30
Clinton	5
Pink shale (Red Medina)	5
Total depth	1,900

Show of gas at 197 and 1,070 feet.
Show of oil at 225 and 287 feet.
Fresh water at 179 feet; salt water at 255 to 287 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 142, N.T.R., Raleigh tp.

Completed December 21, 1934.
Producing gas well.
Rock pressure: 680 lbs.

Formation	Thickness, ft.
Surface	182
Hamilton beds	97
Light-brown lime	188
Grey lime	60
Brown lime	75
Sharp grey lime	220
Brown lime	100
Brown and blue lime	5
Brown lime	15
Brown and blue lime	10
Brown lime	20
Brown and blue lime	15
Brown lime, blue lime, and gypsum	15
Brown lime	30
Brown and blue lime	20
Blue lime	50
Brown and blue lime	185
Blue lime	40
Brown, and blue and brown lime	95
Grey lime	131
Total depth	1,551

Show of gas at 1,215 to 1,220 feet; gas at 1,393 to 1,410, 1,462 to 1,465, 1,475, 1,490 to 1,530, and 1,540 feet.
Show of oil at 550 feet.
Sulphur water at 450, 550, and 800 feet.

C. H. LADD AND JOHN KABANA
Lot 12, S.M.R., Tilbury East tp.

Completed August 30, 1934.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Clay	62
Mild hardpan	84
Grey shale	6
Soapstone	30
Grey lime	559
Sharp lime, 604 to 663 feet.	
Light-brown lime	15
Grey lime	19
Brown lime	10
Grey lime and gypsum	17
Brown lime	6
Mixed lime	87
Brown lime	5
Grey and brown lime	10
Brown lime	31
Mixed lime	150
Grey lime	64
Brown lime	33
Grey lime	44
Brown lime	29
Grey lime	45
Brown lime	31
Grey lime	11
Total depth	1,348

Gas at 1,181, 1,255, 1,267, and 1,322 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 141, N.T.R., Raleigh tp.

Completed July 10, 1934.
Producing gas well.
Rock pressure: 675 feet.

Formation	Thickness, ft.
Surface	190
Hamilton beds	80
Brown lime	220
Grey and brown lime	75
Brown lime	5
Grey sharp sand	225
Light- and dark-brown lime	211
Black and grey lime	4
Brown lime	15
Blue lime	115
Brown lime	60
Brown and grey lime	20
Brown lime	40
Brown and blue lime	120
Brown lime	30
Blue and brown lime	35
Brown lime	55
Grey lime	58
Total depth	1,558

Gas at 1,390 to 1,393, 1,400 to 1,407, 1,432, 1,457 to 1,463, 1,470 to 1,475, 1,490 to 1,518, and 1,530 to 1,540 feet; small show of sweet gas at 1,220 feet.
Fresh water at 185 feet; sulphur water at 275 feet.

PATTINSON, LADD AND ZIEGAN
Lot 9, S.W. cor. S. ½, con. XIV, Tilbury East tp.

Completed October 20, 1934.
Producing gas well.
Rock pressure: 240 lbs.

Formation	Thickness, ft.
Clay	126
Black shale	11
Lime and soapstone	31
Soapstone	56
Dark lime	11
Soapstone	33
Grey lime	609
Grey lime and gypsum	101
Brown lime	12
Grey lime and gypsum	12
Grey lime	20
Brown lime	16
Grey lime	24
Brown lime	33
Dark-grey lime	64
Grey lime and gypsum	24
Grey lime	32
Brown lime	40
Grey lime	24
Grey and brown lime	18
Brown lime	28
Grey lime	18
Brown lime	39
Light-grey lime	12
Total depth	1,394

Gas at 1,220, 1,245, and 1,360 feet.
Fresh water at 120 feet; salt water at 484 and 637 feet.

PATTINSON, LADD AND KABANA

Lot 7, N. ½ of S. ½, con. XIV, Tilbury East tp.

Completed November 25, 1934.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Clay	137
Top rock	6
Soapstone	110
Dark streak	8
Grey lime	394
Sharp lime	75
Grey lime	65
Brown lime	12
Grey lime and gypsum	43
Brown lime	6
Grey lime and gypsum	119
Brown lime	90
Grey lime	15
Brown and grey lime	15
Brown lime	20
Grey lime	87
Brown lime	40
Grey lime	43
Brown lime	48
Grey lime	44
Total depth	1,377

Gas at 1,252, 1,277, 1,302, and 1,365 feet.
Fresh water at 134 feet; salt water at 395 feet; sulphur water at 478 feet.

Lambton County

A. A. HEAL ET AL.

Lot 17, con. XV, Bosanquet tp.

Completed May 21, 1934.
Producing gas well.
Rock pressure: 50 lbs.

Formation	Thickness, ft.
Surface	65
Hardpan	45
Lime	10
Soap	15
Lime	20
Soap	30
Lime	13
Soap	139
Lime	4
Soap	56
Lime	116
Total depth	513

Gas at 157 feet.
Small show of oil at 510 feet

A. A. HEAL ET AL.

Lot 75, L.R.E., Bosanquet tp.

Completed July 19, 1934.
Very small oil well.

Formation	Thickness, ft.
Clay	92
Hardpan	15
Lime	6
Soap	7
Lime	10
Soap	10
Lime	15
Grey shale	13
Soap	28
Lime	9
Hard lime	6
Soap	131
Middle lime	3
Lower soap	60
Lower lime	108
Total depth	513

Gas at 443 feet.
Oil at 422 and 455 feet.
Salt water at 107 to 113 feet.

A. A. HEAL ET AL.

Lot 14, con. XV, Bosanquet tp.

Completed March 11, 1934.
Dry hole.

Formation	Thickness, ft.
Gravel	9
Clay	88
Hardpan	18
Lime	5
Soap	7
Lime	48
Hard soap	10
Soap	10
Grey shale	13
Hard lime	6
Black shale	1
Soap	103
Lime	6
Soap	24
Hard lime	5
Soap	61
Lime	96
Total depth	510

A. A. HEAL ET AL.

Lot 17, con. XIV, Bosanquet tp.

Completed April 30, 1934.
Producing gas well.
Rock pressure: 35 lbs.

Formation	Thickness, ft.
Surface	56
Black shale	2
Lime	4
Soap	56
Lime	9
Brown lime	12
Soap	47
Lime	2
Grey shale	13
Soap	125
Middle lime	3
Soap	61
Lime	132
Total depth	522

Gas at 147 and 203 feet.
Salt water at 56 and 62 feet.

A. A. HEAL ET AL.

Lot 74, L.R.E., Bosanquet tp.

Completed August 30, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	73
Hardpan	23
Soft lime	34
Hard lime	25
Soap	35
Brown lime	12
Soap	111
Lime	3
Soap	21
Lime	6
Soap	8½
Soft lime and grey shale	50
Lime	127½
Total depth	529

Salty water at 523 feet, with trace of oil.

WALKER SALT CORPORATION, LTD.
Lot 41, Port Franks, Bosanquet tp.

Completed September 11, 1934.
Dry hole.

Formation	Thickness, ft.
Sand	23
Quicksand	27
Gravel	2
Grey shale	195
Black sand	3
Fossil	7
Limestone	70
Black sand	1
Limestone	88
Limestone and gyprock	17
Limestone	503
Limestone and gyprock	13
Limestone	128
Limestone and shale	148
Salt	3
Salt and limestone	57
Salt	87
Limestone	10
Total depth	1,382

Fresh water at 50 and 248 feet; sulphur water at 258 and 704 feet; sulphur water at 704 feet; salt water at 278 and 990 feet.

DR. JOHN BLAKE AND FRED CRAFT
Lot 29, con. XII, Brooke tp.

Completed February 16, 1934.
Dry hole.

Formation	Thickness, ft.
Clay and quag	45
Hardpan	5
Gravel	31
Top lime (very streaked, soft and hard)	47
Upper soapstone	162
Middle lime	20
Lower soapstone	25
Dark streak	4
Lower lime	130
Total depth	469

Very small show of oil at 405, 423, and 460 feet.

BROOKEFIELD OIL AND GAS CO.
Lot 22, con. XIV, Brooke tp.

Completed April 6, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	102
Black and grey shale	15
Grey shale and top rock	79
Top soap	134
Middle lime	20
Lower soap	30
Black streak	8
Big lime	122
Total depth	510

BROOKEFIELD OIL AND GAS CO.
Lot 23, con. XII, Brooke tp.

Completed June 21, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	48
Gravel	4
Black shale	23
Top lime	55
Soap and lime	25
Upper soap	130
Middle lime	23
Lower soap	25
Dark shell	4
Lower lime	133
Total depth	470

Small show of oil at 388 feet.
Show of oil and brackish water at 424 to 429 feet.
Fresh water at 48 feet.

BROOKEFIELD OIL AND GAS CO.
Lot 23, con. XIII, Brooke tp.

Completed June 7, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	50
Hardpan	7
Black gravel	8
Black shale	25
Top lime	80
Soapstone	129
Middle lime	23
Lower soap	26
Dark streak	5
Lower lime	121
Grey and blue lime	3
Light-brown sand	9
Total depth	486

Small show of oil at 359 to 364 and 370 to 375 feet.
Fresh water at 57 feet; salt water at 438 to 444 and 462 to 468 feet.

BROOKEFIELD OIL AND GAS CO.
Lot 23, con. XII, Brooke tp.

Completed June 21, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	48
Gravel	4
Black shale	23
Top lime	55
Soap and lime	25
Upper soap	130
Middle lime	23
Lower soap	25
Dark shell	4
Lower lime	133
Total depth	470

Show of oil at 388 feet.
Fresh water at 48 feet; brackish water at 424 to 429 feet.

BROOKEFIELD OIL AND GAS CO.
Lot 22, con. XIV, Brooke tp.

Completed May 23, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	60
Hardpan	3
Hard shale and hard streak	15
Top rock and grey shale	87
Top soap	131
Middle lime	20
Lower soap	33
Big lime	96
Total depth	445

Show of gas at 167 feet.
Show of oil at 410 to 414 feet.
Salt water at 419 to 445 feet.

BROOKEFIELD OIL AND GAS CO.
Lot 27, con. XII, Brooke tp.

Completed March 30, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	30
White sand	28
Gravel	19
Top rock	78
Top soap	135
Middle lime	20
Lower soap	28
Big lime	121
Total depth	459

Small show of oil at 346, 410, and 420 feet.

BERT WILSON
Lot 28, con. XIII, Brooke tp.

Completed May 8, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	28
White sand	38
Gravel	6
Grey shale	7
Top rock	73
Top soap	135
Middle lime	22
Lower soap	34
Big lime	128
Total depth	471

Small show of oil at 456 and 346 feet.

CULLEN AND WALSH
Lot 16, con. XII, Brooke tp.

Completed May 23, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	91
Hardpan	25
Brown shale	29
Streaks of lime and soap	55
Soap	139
Middle lime	31
Lower soap	30
Big lime	140
Total depth	540

Fresh water at 97 feet.; sulphur water at 535 feet.

GUARDIAN PETROLEUM DEVELOPMENT CO.
Lot 7, N.W. ¼, con. II, Brooke tp.

Completed November 21, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	52
Top rock	47
Soap and lime	216
Lower lime	135
Total depth	450

Very small show of oil at 320 and 438 feet.
Fresh water at 58 feet; salt water at 345 feet.

GUARDIAN PETROLEUM DEVELOPMENT CO.
Lot 7, N.E. ¼ of W. ½, con. II, Brooke tp.

Completed December 20, 1934.
A small oil well.

Formation	Thickness, ft.
Surface	56
Top rock	74
Soapstone	140
Middle lime	12
Soapstone	28
Big lime	45
Total depth	355

Oil at 323 and 337 feet.
Fresh water at 57 feet.

GUARDIAN PETROLEUM DEVELOPMENT CO.
Lot 7, N.W. ¼, con. II, Brooke tp.

Completed October 31, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	52
Top rock	47
Soap and lime	216
Big lime	135
Total depth	450

Fresh water at 58 feet.

GUARDIAN PETROLEUM DEVELOPMENT CO.
Lot 7, N.E. ¼ of W. ½, con. II, Brooke tp.

Completed November 24, 1934.
Producing oil well.

Formation	Thickness, ft.
Surface	50
Top rock	37
Soap and lime	38
Soapstone	186
Big lime	45
Total depth	356

Oil at 316 feet.
Fresh water at 57 feet.

F. W. KEHLET
Lot 28, con. VIII, Brooke tp.

Completed August 23, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	70
Hardpan	5
Black shale	10
Blue shale	3
Top lime	37
Upper soap	169
Middle lime	23
Lower soap	28
Lower lime	127
Total depth	472

Fresh water at 75 feet.

F. W. KEHLET
Lot 18, con. XII, Brooke tp.

Completed May 22, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	72
Huron black shale	43
Hamilton lime and shale	270
Onondaga lime	125
Onondaga-Oriskany	5
Detroit River	8
Total depth	523

Fresh water at 72 feet; water at 437 to 443 and 51 5 to 518 feet.

F. W. KEHLET
Lot 29, con. XII, Brooke tp.

Completed May 3, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	93
Hamilton lime and shale	248
Onondaga lime	131
Oriskany sand	3
Total depth	475

Fresh water at 63 feet; water at 466 feet.

R. E. MCARTHUR
Lot 28, E. ½, con. XI, Brooke tp.

Completed June 18, 1934.
Dry hole.

Formation	Thickness, ft.
Brown clay	20
Blue clay	34
Hardpan	16
Brown shale	10
Hard shells	10
Shale and shells	70
Soapstone	81
Shells	4
Soapstone	8
Shells	10
Soapstone	27
Limestone	20
Soapstone	30
Limestone	74
Total depth	414

Black water at 395 to 397 feet; salt water at 410 feet.

H. McLellan

Lot 27, con. XIII, Brooke tp.

Completed February 27, 1934.
Small oil producer.
Plugged September 27, 1934.

Formation	Thickness, ft.
Clay	50
Sand	12
Gravel	11
Hardpan	12
Grey shale and lime	75
Top soap	132
Middle lime	18
Lower soap	26
Dark streak	9
Lower lime	115
Total depth	460

Oil at 371, 410, 420, and 455 feet.
Salt water at 371, 410, 420, and 455 feet.

F. L. Patterson

Lot 22, con. V, Brooke tp.

Completed November 23, 1934.
Dry hole.

Formation	Thickness, ft.
Loam	7
Black shale	15
Blue shale	23
Blue and black shale	10
Brown shale	5
Brown and black shale	40
Top lime (streaked)	65
Upper soapstone	129
Middle lime	26
Lower soapstone	17
Dark streak	6
Lower lime	95
Sharp sand (light)	3
Mixed lime and sand	4
Total depth	445

Stevens King Syndicate

Lot 12, con. IX, Brooke tp.

Completed May 2, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	46
Black shale	90
Lime	70
Soap	10
Lime	5
Soap	90
Lime	5
Soap	9
Middle lime	35
Lower soap	20
Lower lime	121
Total depth	501

Gas at 219 feet.
Show of oil at 387 feet.
Salt water at 500 feet.

Stoddard and Darke

Lot 28, con. XII, Brooke tp.

Completed May 12, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	66
Hardpan and gravel	10
Soapstone	17
Limestone	5
Soapstone	37
Limestone	5
Soapstone	150
Limestone	20
Soapstone	33
Limestone	117
Total depth	460

Fresh water at 66 feet; salt water at 460 feet.

Stoddard and Darke

Lot 28, W. ½ of E. ½, con. XIII, Brooke tp.

Completed March 20, 1934.
Small oil well.

Formation	Thickness, ft.
Clay and quag	55
Hardpan and gravel	19
Blue soft shale	10
Top lime	80
Upper soap	127
Middle lime	21
Lower soap	26
Dark shell	6
Lower lime	117
Total depth	461

Oil at 390 to 396 feet.
Brackish water at 390 to 396 feet.

Stoddard and Darke

Lot 28, con. XIV, Brooke tp.

Completed April 23, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	15
Sand and stone	65
Soapstone	40
Limestone	15
Soapstone	157
Limestone	20
Soapstone	32
Limestone	111
Total depth	455

Show of gas at 260 and 410 feet.
Fresh water at 15 and 80 feet; salt water at 410 and 452 feet.

Dr. Blake and Craft

Lot 27, con. XII, Brooke tp.

Completed March 23, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	75
Shale	5
Top lime	78
Upper soap	132
Middle lime	20
Lower soap	28
Dark streak	6
Lower lime	118
Total depth	462

Show of oil at 345 to 350 feet and 380 to 385 feet.
Fresh water at 75 feet; salt water at 345 to 350 feet and 380 to 385 feet.

Leo Wilson

Lot 25, con. II, Brooke tp.

Completed July 4, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	60
Hardpan	5
Black shale	15
Soap	3
Top rock	5
Grey shale	3
Rock	2
Grey shale	5
Streak rock	35
Grey shale	7
Soap and shale	158
Middle lime	20
Lower soap	32
Lower lime	115
Total depth	465

Fresh water at 65 feet; salt water at 465 feet.

WILSON, BROWN AND SULLIVAN CO.

Lot 29, con. XIII, Brooke tp.

Completed January 15, 1934.
Initial oil yield: about 20 bbls. per day.

Formation	Thickness, ft.
Clay	15
Quag	30
Gravel	28
Grey shale	4
Hardpan	11
Top rock	24
Top soap	177
Middle lime	21
Lower soap	26
Black streak	4
Lower lime	152
Total depth	492

Oil at 395 and 455 feet.
Water at 50 and 484 feet.

BERT WILSON

Lot 26, con. XII, Brooke tp.

Completed February 13, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	31
White sand	21
Gravel	2
Light-brown shale	32
Grey shale	76
Top soap	133
Middle lime	23
Lower soap	24
Lower lime	140
Total depth	482

Fresh water at 50 feet; salt water at 482 feet.

BERT WILSON

Lot 28, W. ½, con. XI, Brooke tp.

Completed July 6, 1934.
Dry hole.

Formation	Thickness ft.
Surface	72
Lime and shale	88
Top soap	130
Middle lime	20
Lower soap	31
Big lime	127
Total depth	468

BERT WILSON ET AL.

Lot 28, con. XIII, Brooke tp.

Completed May 8, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	62
Grey shale	7
Top rock	73
Top soap	135
Middle lime	22
Lower soap	34
Big lime	128
Total depth	471

Show of oil at 346 and 456 feet.
Fresh water at 68 feet; salt water at 346 and 471 feet.

BERT WILSON

Lot 23, E. ½, con. XIII, Brooke tp.

Completed March 8, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	58
Hardpan	26
Top rock	8
Soap	6
Grey shale	67
Top soap	131
Middle lime	21
Lower soap	25
Lower lime	134
Total depth	476

LEO WILSON

Lot 27, W. ½, con. XI, Brooke tp.

Completed February 24, 1934.
Oil yield: about 15 bbls. per day.

Formation	Thickness, ft.
Clay	42
Gravel	29
Black shale	9
Grey shale	8
Top rock	5
Grey shale	5
Grey lime	7
Grey shale	27
Grey hard lime	8
Top soap	156
Middle lime	22
Lower soap	26
Big lime	116
Total depth	460

Oil at 373 and 418 to 426 feet.
Fresh water at 50 feet.

LEO WILSON ET AL.

Lot 27, con. XII, Brooke tp.

Completed March 22, 1935.
Small oil well.

Formation	Thickness, ft.
Surface	52
Black gravel	16
Black shale	10
Grey shale	27
Soap	30
Hard lime	3
Soap	22
Lime	4
Soap	133
Middle lime	21
Soap	21
Dark lime	8
Grey lime	128
Total depth	475

Gas at 95 feet.
Oil at 348 feet.
Sulphur water at 68 to 80 feet; fresh water at 400 to, 405 feet; dark salty water at 450 to 475 feet.

STODDARD AND DARKE

Lot 28, con. XII, Brooke tp.

Completed March 14, 1934.
Oil yield: 23 bbls. per day.

Formation	Thickness, ft.
Clay	66
Black gravel	4
Grey shale	3
Black gravel	3
Limestone	18
Lime and soapstone	4
Limestone	12
Soapstone	14
Limestone	4
Soapstone	19
Limestone	7
Soapstone	100
Grey shale	3
Soapstone	29
Limestone	21
Soapstone	32
Limestone	113
Total depth	452

Oil at 342, 395, and 407 feet.
Fresh water at 66 and 79 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 24, con. I, Dawn tp.

Completed January 4, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	75
Huron shale	175
Hamilton shale and lime	222
Brown lime	218
Grey and brown lime	155
Sharp brown and grey lime	115
Brown lime	70
Blue lime and gypsum	20
Brown lime	25
Blue lime and gypsum	95
Blue and brown lime	230
Salt and lime	40
Salt	185
Brown and blue lime	150
Salt	50
Brown lime	85
Black and grey, and black shale	50
Grey and blue lime	120
Rochester shale	29
Clinton	7
Red shale	4
Total depth	2,120

Fresh water at 72; salt water at 565, 2,037, 2,055 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 25, con. IX, Dawn tp.

Completed December 14, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	50
Huron shale	120
Hamilton shale and lime	255
Brown lime	115
Brown and grey lime	295
Brown and grey lime (sharp sand)	135
Brown lime	100
Brown lime and gypsum	15
Brown and blue lime	210
Brown and grey lime	105
Blue lime	15
Brown and grey lime	50
Salt and shells	85
Brown lime	135
Salt	30
Brown lime	140
Brown and grey lime	125
Rochester blue shale	38
Clinton	9
Shale	1
Total depth	2,028

Blow of gas at 1,730 to 1,740 feet.
Show of oil at 1,740 to 1,745 and 1,880 feet.
Sulphur water at 500 feet; salt water at 1,880 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 25, con. XIII, Dawn tp.

Completed March 14, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	56
Huron black shale	104
Hamilton lime and shale	225
Brown and grey lime	415
Sharp sand	135
Brown and grey lime	95
Blue lime and gypsum	15
Brown lime	15
Blue lime and gypsum	10
Brown and blue lime	315
Salt	145
Brown and blue lime	135
Brown lime, grey lime, and gypsum	10
Brown and blue lime	110
Grey and brown lime	145
Rochester blue shale	45
Clinton	8
Red shale	4
Total depth	1,987

Blow of gas at 1,673 to 1,683 feet.
Show of oil at 1,683 feet.
Black water at 405 feet; salt water at 1,683 to 1,688 and 1,740 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 23, con. XI, Dawn tp.

Completed February 27, 1934.
Producing gas well.
Rock pressure: 550 lbs.

Formation	Thickness, ft.
Surface	103
Huron shale	157
Hamilton shale and lime	226
Brown lime	374
Sharp brown lime (sharp sand)	115
Brown lime	75
Blue lime and gypsum	10
Blue and brown lime	50
Blue lime and gypsum	50
Blue and brown lime	270
Salt and brown lime	20
Salt	140
Salt and brown lime	10
Blue and brown lime	160
Salt	40
Brown and black lime	130
Brown and grey lime	60
Grey lime	65
Rochester blue shale	5
Total depth	2,060

Gas at 1,640 to 1,654 and 1,804 to 1,830 feet.
Oil at 1,812 feet.
Sulphur water at 560 feet; salt water at 1,975 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 24, con. VIII, Dawn tp.

Completed May 8, 1934.
Producing gas well.
Rock pressure: 540 lbs.

Formation	Thickness, ft.
Surface	60
Huron shale	85
Hamilton shale and lime	258
Grey and brown lime	427
Sharp grey lime	275
Brown lime	110
Brown lime, blue lime, and gypsum	10
Brown and blue lime	355
Brown lime	140
Salt	20
Brown, and brown and grey lime	170
Grey lime	67
Rochester shale	38
Clinton	5
Red shale	2
Total depth	2,022

Gas at 1,590 to 1,595 and 1,610 to 1,616 feet.
Show of oil at 1,745 feet.
Sulphur water at 570 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 25, con. XI, Dawn tp.

Completed May 16, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	73
Huron shale	157
Hamilton lime and shale	223
Brown and grey lime	367
Sharp brown and grey lime (sharp sand)	125
Brown and grey lime	130
Blue lime and gypsum	15
Blue lime	90
Grey and brown lime	100
Brown and blue lime	110
Salt and lime shells	175
Salt	15
Salt and lime shells	45
Brown, grey, and blue lime	155
Salt and lime shells	50
Grey, brown, and black lime	180
Grey and light-grey lime	65
Rochester shale	45
Clinton	8
Red shale	3
Total depth	2,131

Show of oil at 1,980 feet.
Fresh water at 73 feet; sulphur water at 510 feet; salt water at 1,990 and 2,070 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 26, con. V, Euphemia tp.

Completed August 28, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	40
Soap and lime	235
Grey and brown lime	80
Sharp grey lime	40
Brown lime	195
Brown lime, grey lime, and gypsum	50
Brown lime	20
Sharp grey lime	135
Brown and grey lime	45
Brown lime, blue lime, and gypsum	105
Blue and brown lime	290
Salt	10
Salt and lime	120
Salt	55
Brown and grey lime	105
Blue lime	5
Brown and grey lime	255
Grey lime	50
Blue shale	33
Clinton	7
Red shale	5
Total depth	1,880

Gas at 1,555 feet.
Fresh water at 60 feet; sulphur water at 440 feet; salt water at 1,695 feet.

W. J. HUSSEY AND SON
Lot 5, con. X, Moore tp.

Completed November 20, 1934.
Oil yield: 1½ bbls. per day.

Formation	Thickness, ft.
Surface	150
Top rock	50
Top soap	122
Middle lime	13
Lower soap	45
Lower lime	96
Total depth	476

Oil at 392 and 460 feet.
Fresh water at 145 feet; salt water at 334 feet.

F. L. PATTERSON AND ASSOCIATES
Lot 4, con. X, Moore tp.

Completed May 11, 1934.
Producing oil well.

Formation	Thickness, ft.
Surface	145
Hardpan	5
Top rock	62
Top soap	120
Middle lime	13
Lower soap	50
Lower lime	69
Total depth	464

Oil at 422 feet.
Fresh water at 476 feet.

F. L. PATTERSON AND ASSOCIATES
Lot 4, con. X, Moore tp.

Completed April 24, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	152
Top rock	63
Top soap	115
Middle lime	12
Lower soap	43
Lower lime	72
Total depth	455

Show of oil at 395 and 419 feet.
Fresh water at 171 feet.

F. L. PATTERSON AND ASSOCIATES
Lot 4, con. IX, Moore tp.

Completed April 17, 1934.
Small oil well.

Formation	Thickness, ft.
Surface	145
Top rock	47
Top soap	133
Middle lime	12
Lower soap	45
Lower lime	392
Total depth	465

Oil at 392, 400, and 420 feet.
Fresh water at 172 feet.

BRITISH PETROLEUM CO., LTD.
Lot 22, con. IX, Plympton tp.

To October 28, 1933 (not completed).

Formation	Thickness, ft.
Surface	92
Brown shale	57
Top rock	6
Soap and rock	130
Top soap	120
Middle lime	9
Lower soap	40
Big lime	226
Total depth	680

Very small show of gas at 465 feet.
Good showing of both oil and gas at 650 feet.
Fresh water at 90 feet; salt water at 650 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 27, con. XIII, Sombra tp.

Completed July 7, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	100
Huron shale	145
Hamilton lime and shale	230
Brown and grey lime	245
Brown lime and gypsum	50
Brown lime	25
Brown lime and gypsum	80
Sharp brown and grey lime	115
Brown lime	90
Blue lime, gypsum, and brown lime	35
Grey lime, blue lime, and gypsum	50
Blue and pink shale	65
Brown and blue lime	170
Brown lime and blue shale	65
Salt	10
Salt and lime shells	135
Salt	90
Brown and blue lime	140
Brown lime and salt	10
Salt	60
Brown and grey lime	258
Rochester shale	7
Total depth	2,175

Sulphur water at 575 and 590 feet; salt water at 2,035 and 2,150 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 30, con. XI, Sombra tp.

Completed September 16, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	85
Huron shale	160
Hamilton shale and lime	223
Grey and brown lime	202
Grey lime and gypsum	10
Brown and grey lime	170
Sharp brown and grey lime	110
Brown, grey, and blue lime	125
Blue lime and gypsum	85
Blue, brown, and grey lime	250
Salt and lime shells	229
Brown, grey, and blue lime	143
Salt	48
Grey, brown, and black lime	175
Light-grey lime	79
Rochester shale	42
Clinton	9
Red shale	5
Total depth	2,150

Show of oil at 2,005 feet.

UNION GAS CO. OF CANADA, LTD.
Lot 29, con. XI, Sombra tp.

Completed October 29, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	91
Huron shale	169
Hamilton shale and lime	224
Brown and grey lime	376
Grey lime (sharp sand)	100
Grey and brown line	90
Blue lime	15
Brown and grey lime	25
Blue and brown lime	55
Blue, grey, and brown lime	275
Salt and lime	10
Salt, salt and lime shells	200
Brown lime	10
Salt, salt and lime shells	15
Brown and grey lime	145
Salt, grey lime and salt	40
Grey and brown lime	85
Black lime	45
Black and grey lime	10
Brown lime	22
Total depth	2,002

Show of gas at 1,990 feet.
Sulphur water at 510 and 515 feet; salt water at 1,990 feet.

BERT WILSON, G. SULLIVAN ET AL.
Lot 19, con. II N., Warwick tp.

Completed October 2, 1934.
Dry hole.

Formation	Thickness, ft.
Clay	35
Sand	10
Hardpan	33
Black gravel	6
Hamilton lime	58
Lime and soap	13
Lime	50
Grey shale	20
Lime	8
Soap	75
Lime	5
Soap	27
Lime	2
Soap	22
Middle lime	23
Lower soap	26
Onondaga lime	122
Total depth	535

Sulphur water at 70 to 80 feet.

Lincoln County

GRIMSBY NATURAL GAS CO., LTD.
Lot 1, con. II, Caistor tp.

Completed August 18, 1934.
Producing gas well.
Rock pressure: 128 lbs.

Formation	Thickness, ft.
Surface	85
Shale	21
Niagara	205
Shale	50
Clinton	30
Red Medina	33
Grey shale	60
White Medina	11
Red shale	50
Total depth	545

Gas at 484 feet.

LINCOLN GAS CO., LTD.
Lot 1, con. III, Caistor tp.

Completed December 28, 1934.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	75
Lime and shale	35
Niagara	223
Shale	55
Clinton	30
Red Medina	35
Shale	60
White Medina	15
Red shale	55
Total depth	583

Gas at 399 and at 520 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 1, con. III, Caistor tp.

Completed December 28, 1934.
Producing gas well.
Rock pressure: 142 lbs.

Formation	Thickness, ft.
Surface	98
Lime and shale	20
Niagara	212
Shale	40
Clinton	34
Red Medina	30
Shale	51
White Medina	12
Red shale	40
Total depth	537

Gas at 376 and 495 feet.
Fresh water at 101 feet; salt water at 135 feet.

GRIMSBY GAS CO.
Lot 1, N.W. ¼, con. II, Gainsborough tp.

Completed September 15, 1934.
Producing gas well.
Rock pressure: 130 lbs.

Formation	Thickness, ft.
Surface	67
Lime and shale	24
Niagara	200
Shale	45
Clinton	35
Red Medina	32
Grey shale	60
White Medina	13
Red shale	50
Total depth	526

Gas at 476 feet.
Fresh water at 65 feet; sulphur water at 79 feet.

GRIMSBY GAS CO.
Lot 1, N. ¼, con. II, Gainsborough tp.
Completed September 1, 1934.
Producing gas well.
Rock pressure: 128 lbs.

Formation	Thickness, ft.
Surface	82
Lime and shale	18
Niagara	205
Shale	50
Clinton	31
Red Medina	37
Grey shale	60
White Medina	11
Red shale	50
Total depth	544

Gas at 486 and 495 feet.
Fresh water at 85 feet; sulphur water at 100 feet.

LINCOLN GAS CO., LTD.
Lot 2, con. I, Gainsborough tp.
Completed July 22, 1934.
Producing gas well.
Rock pressure: 180 lbs.

Formation	Thickness, ft.
Surface	75
Lime and shale	33
Niagara	230
Shale	52
Clinton	30
Red Medina	35
Shale	57
White Medina	18
Red shale	65
Total depth	595

Gas at 390 feet.

LINCOLN GAS CO., LTD.
Lot 3, B.F., Gainsborough tp.
Completed June 28, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	74
Lime and shale	38
Niagara	238
Shale	44
Clinton	35
Red Medina	37
Shale	53
White Medina	14
Red shale	2
Total depth	535

LINCOLN GAS CO., LTD.
Lot 3, con. I, Gainsborough tp.
Completed August, 1934.
Producing gas well.
Rock pressure: 165 lbs.

Formation	Thickness, ft.
Surface	73
Lime and shale	35
Niagara	240
Shale	44
Clinton	35
Red Medina	29
Shale	60
White Medina	15
Total depth	531

Gas at 396 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 3, con. I, Gainsborough tp.
Completed June 25, 1934.
Producing gas well.
Rock pressure: 185 lbs.

Formation	Thickness, ft.
Surface	74
Lime and shale	38
Niagara	238
Shale	44
Clinton	35
Red Medina	37
Shale	53
White Medina	14
Red shale	2
Total depth	535

Gas at 394 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 2, con. I, Gainsborough tp.
Completed July 22, 1934.
Producing gas well.
Rock pressure: 180 lbs.

Formation	Thickness, ft.
Surface	75
Lime and shale	33
Niagara	230
Shale	52
Clinton	30
Red Medina	35
Shale	57
White Medina	18
Red shale	65
Total depth	595

Gas at 390 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 3, con. I, Gainsborough tp.
Completed August, 1934.
Producing gas well.
Rock pressure: 165 lbs.

Formation	Thickness, ft.
Surface	73
Lime and shale	35
Niagara	240
Shale	44
Clinton	35
Red Medina	29
Shale	50
White Medina	15
Red shale	10
Total depth	531

Gas at 392 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 2, con. I, Gainsborough tp.
Completed September, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	80
Lime and shale	30
Niagara	240
Shale	34
Clinton	32
Red Medina	38
Shale	57
White Medina	18
Red shale	30
Total depth	559

Fresh water at 74 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 4, con. I, Gainsborough tp.

Completed June, 1934.
Producing gas well.
Rock pressure: 215 lbs.

Formation	Thickness, ft.
Surface	89
Lime and shale	21
Niagara	227
Shale	52
Clinton	31
Red Medina	37
Shale	58
White Medina	18
Red shale	29
Total depth	560

Gas at 513 feet.
Fresh water at 84 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 1, con. I, Gainsborough tp.

Completed 1934.
Producing gas well.
Rock pressure: 155 lbs.

Formation	Thickness, ft.
Surface	80
Lime and shale	25
Niagara	230
Shale	42
Clinton	34
Red Medina	35
Shale	59
White Medina	14
Red shale	1
Total depth	520

Gas at 377 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 3, B.F., Gainsborough tp.

Completed 1934.
Producing gas well.
Rock pressure: 156 lbs.

Formation	Thickness, ft.
Surface	91
Lime and shale	19
Niagara	229
Shale	48
Clinton	40
Red Medina	30
Shale	56
White Medina	18
Red shale	29
Total depth	560

Gas at 395 and 528 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 3, B.F., Gainsborough tp.

Completed 1934.
Producing gas well.
Rock pressure: 185 lbs.

Formation	Thickness, ft.
Surface	80
Lime and shale	35
Niagara	232
Shale	40
Clinton	40
Red Medina	35
Shale	55
White Medina	15
Red shale	25
Total depth	557

WAINFLEET OIL AND GAS CO., LTD.
Lot 1, B.F., Gainsborough tp.

Completed December 22, 1934.
Producing gas well.
Rock pressure: 155 lbs.

Formation	Thickness, ft.
Surface	81
Lime and shale	31
Niagara	234
Shale	37
Clinton	30
Red Medina	32
Shale	58
White Medina	10
Red shale	22
Total depth	535

Gas at 394 feet.
Salt at 144 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 4, B.F., Gainsborough tp.

Completed October 1, 1934.
Producing gas well.
Rock pressure: 215 lbs.

Formation	Thickness, ft.
Surface	91
Lime and shale	23
Niagara	229
Shale	46
Clinton	36
Red Medina	34
Shale	57
White Medina	14
Red shale	40
Total depth	570

Gas at 527 feet.
Fresh water at 96 feet; salt water at 134 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 1, B.F., Gainsborough tp.

Completed November 5, 1934.
Producing gas well.
Rock pressure: 185 lbs.

Formation	Thickness, ft.
Surface	89
Lime and shale	23
Niagara	216
Shale	38
Clinton	31
Red Medina	34
Shale	54
White Medina	13
Red shale	32
Total depth	530

Gas at 340 feet.
Fresh water at 94 feet; salt water at 129 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 1, B.F., Gainsborough tp.

Completed December, 1934.
Producing gas well.
Rock pressure: 183 lbs.

Formation	Thickness, ft.
Surface	86
Lime and shale	28
Niagara	237
Shale	39
Clinton	34
Red Medina	35
Grey shale	56
White Medina	12
Red shale	30
Total depth	557

Gas at 397 and 515 to 527 feet.
Fresh water at 91 feet; salt water at 143 feet.

Middlesex County

F. W. Kehlet
Lot 1, con. IV, Ekfrid tp.

Completed September 15, 1934.
Dry hole.

Formation	Thickness, ft.
Sand	15
Quicksand	155
Sand	3
Hardpan	20
Upper soap	105
Dark streak	7
Lower lime	65
Lime and sand	23
Total depth	393

Fresh water at 170 feet.

F. W. Kehlet
Lot 7, E. ½, con. VII, Metcalfe tp.

Completed September 4, 1934.
Dry hole.

Formation	Thickness, ft.
Sand	5
Clay	81
Hardpan	34
Upper soap	165
Middle lime	20
Lower soap	27
Lower lime	88
Lime and sand	22
Coarse brown lime	26
Total depth	468

Fresh water at 102 feet.

Dominion Petroleum Co., Ltd.
Lot 8, S. ½, con. VII, Mosa tp.

Completed July 3, 1933.
Oil yield: 24 bbls. per day.

Formation	Thickness, ft.
Clay	32
Quag	33
Boulders	10
Hardpan	6
Grey shale	54
Upper soap	142
Middle lime	20
Lower soap	19
Dark shell	9
Lower lime	84
Total depth	409

Oil at 391 to 397 feet.
Fresh water at 75 feet; salt water at 397 feet.

F. J. Merchant
Lot 13, con. II, Mosa tp.

Completed January, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	130
Top soap	135
Middle lime	20
Lower soap	20
Big lime	115
Oriskany	3
Total depth	423

Show of oil at 150, 315 to 330, and 355 to 360 feet.

Norfolk County

E. P. Rowe
Lot 1, con. II, N.T.R., Middleton tp.

Completed August 3, 1934.
Producing gas well.
Rock pressure: 600 lbs.

Formation	Thickness, ft.
Clay	80
Quicksand	70
Clay	25
Gravel	10
Brown lime	165
Flint	110
Brown lime	65
Black shale and lime	75
Gypsum and shale	85
Shale and lime	200
Niagara lime	305
Blue shale	50
Clinton sand	28
Red shale	15
Blue shale	34
Total depth	1,317

Gas at 1,247 and 1,260 to 1,268 feet.
Sulphur water at 200 and 885 feet.

E. P. Rowe
Pt. lot 2, con. II, N.T.R., Middleton tp.

Completed June 9, 1934.
Dry hole.

Formation	Thickness, ft.
Quicksand	140
Clay	67
Grey lime	138
Brown lime	45
Flint	95
Shale and lime	485
Niagara lime	233
Shale	49
Clinton	28
Red Medina	20
Blue shale	60
White Medina	10
Red shale	3
Total depth	1,373

Fresh water at 205 feet; sulphur water at 383 feet.

E. P. Rowe
Lot 1, con. II, Middleton tp.

Completed November 22, 1934.
Producing gas well.
Rock pressure: 550 lbs.

Formation	Thickness, ft.
Quicksand	70
Clay and sand	100
Gravel	20
Brown lime	150
Flint	130
Brown lime	40
Shale and gypsum	380
Niagara lime	305
Blue shale	46
Clinton sand	28
Red Medina	20
Total depth	1,289

Gas at 900, 1,265, and 1,269 feet.
Fresh water at 170 feet; sulphur water at 260 and 900 feet.

E. P. Rowe
Pt. lot 1, con. II, N.T.R., Middleton tp.
Completed September 15, 1934.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Quicksand	100
Clay	5
Gravel	18
Grey lime	17
Brown lime	50
Grey lime	110
Flint	105
Grey lime	50
Lime, shale, and gypsum	75
Brown lime	20
Lime and shale	10
Lime and gypsum	250
Niagara lime	322
Blue shale	50
Clinton	29
Red Medina	15
Blue shale	44
White Medina	42
Red shale	6
Total depth	1,318

Gas at 127, 1,204, and 1,211 feet; sulphur gas at 818 feet.
Show of oil at 140 feet.
Fresh water at 122 feet; sulphur water at 127 feet.

Midwal Oil and Gas Co., Ltd.
Lot 18, E. ½ of N. ½, con. III, S.T.R., Middleton tp.
Completed July 18, 1934.
Producing gas well.

Formation	Thickness, ft.
Surface	245
Lime	177
Flint	135
Lime and shale	388
Niagara	245
Shale	45
Clinton	20
Red Medina	25
Total depth	1,280

Gas at 1,253 feet.
Fresh water at 255 feet; black water at 1,100 feet.

Midwal Oil and Gas Co., Ltd.
Lot 33, con. III, Middleton tp.
Completed September 6, 1934.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Thickness, ft.
Sandy loam	6
Sand, carrying some water	6
Clay	13
Sand and water	80
Clay	115
Gravel	8
Flint	122
Shale	200
Brown lime	150
Niagara lime	400
Streaked shale	25
Shale	40
Clinton lime	25
Red Medina	30
Grey shale	15
Total depth	1,235

Gas at 1,185 feet.
Water at 6 to 12 and 25 feet.

E. P. Rowe
Pt. lot 2, con. II, N.T.R., Middleton tp.
Completed April 3, 1934.
Producing gas well.
Rock pressure: 375 lbs.

Formation	Thickness, ft.
Quicksand	130
Clay	88
Gravel	2
Grey lime	75
Brown lime	20
Grey lime	30
Light-brown lime	50
Flint	105
Shale and lime	475
Niagara	240
Shale	51
Clinton	27
Blue shale	10
Red shale	35
Total depth	1,338

Gas at 1,285 and 1,293 feet.
Fresh water at 218 feet; black water at 385 feet.

Midwal Oil and Gas Co., Ltd.
Lot 18, W. ½ of N. ½, con. III, Middleton tp.
Completed June 2, 1934.
Producing gas well.
Rock pressure: 275 lbs.

Formation	Thickness, ft.
Surface	243
Lime and shale	183
Flint	135
Lime and shale	384
Niagara	240
Shale	61
Clinton	20
Red Medina	25
Grey shale	15
Total depth	1,306

Gas at 1,269 feet.
Black water at 255 feet.

Walter Gas Syndicate, Limited
Lot 15, con. XIV, Townsend tp.
Completed April 13, 1934.
Producing gas well.
Rock pressure: 390 lbs.

Formation	Thickness, ft.
Surface	40
Flint	102
Lime shale	353
Niagara lime	327
Blue shale	32
Clinton sand	33
Red Medina sand	30
Grey shale	58
White Medina sand	5
Red shale	3
Total depth	983

Gas at 884 and 915 feet.

Delhi Gas Syndicate
Lot 1, S. ½, con. XII, Windham tp.
Completed June 30, 1934.
Producing gas well.
Rock pressure: 270 lbs.

Formation	Thickness, ft.
Surface	201
Lime	254
Lime and shale	395
Niagara	220
Casing shale	53
Clinton	27
Red Medina shale	22
Grey shale	68
White Medina	7
Red shale	5
Total depth	1,252

Gas at 1,141 feet.
Fresh water at 240 feet.

DELHI GAS SYNDICATE
Lot 1, S. ½, con. XIII, Windham tp.

Completed October 10, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	193
Lime	300
Lime and shale	337
Niagara	230
Casing shale	65
Clinton	25
Red Medina shale	20
Grey shale	65
White Medina	8
Red shale	4
Total depth	1,247

Show of gas at 1,145 feet.
Fresh water at 240 feet.

DELHI GAS SYNDICATE
Lot 1, S. ½, con. XIII, Windham tp.

Completed August 16, 1934.
Producing gas well.
Rock pressure: 270 lbs.

Formation	Thickness, ft.
Surface	187
Limestone	363
Lime and shale	335
Niagara	180
Casing shale	53
Clinton	27
Red Medina shale	22
Grey shale	74
White Medina	5
Red shale	5
Total depth	1,251

Gas at 1,133 feet.
Fresh water at 240 feet.

WALTER GAS SYNDICATE, LIMITED
Lot 13, con. VI, Woodhouse tp.

Completed September 15, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	85
Lime and flint	86
Lime and shale	354
Niagara lime	340
Grey shale	39
Clinton band	23
Red Medina sand	24
Blue shale	73
White Medina sand	7
Red shale	5
Total depth	1,036

Water at 94 feet.

WALTER GAS SYNDICATE, LIMITED
Lot 13, con. VI, Woodhouse tp.

Completed November 14, 1934.
Producing gas well.
Rock pressure: 570 lbs.

Formation	Thickness, ft.
Surface	52
Lime	108
Lime and shale	370
Niagara lime	340
Grey shale	41
Clinton	27
Red Medina	25
Blue shale	64
White Medina	11
Red shale	50
Total depth	1,088

Gas at 1,032 feet.
Sulphur water at 72 feet.

WALTER GAS SYNDICATE, LIMITED
Lot 13, con. VI, Woodhouse tp.

Completed June 23, 1934.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	90
Lime and shale	354
Shale and flint	106
Niagara lime	305
Shale	30
Clinton sand	37
Red Medina sand	25
Blue shale	60
White Medina sand	11
Red shale	8
Total depth	1,026

Gas at 896 and 898 feet.
Water at 121 feet.

WALTER GAS SYNDICATE, LIMITED
Lot 13, con. VI, Woodhouse tp.

Completed July 30, 1934.
Producing gas well.
Rock pressure: 390 lbs.

Formation	Thickness, ft.
Surface	75
Lime and shale	445
Niagara lime	310
Shale	30
Clinton sand	28
Red Medina sand	25
Blue shale	73
White Medina sand	11
Red shale	35
Total depth	1,032

Gas at 880 and 1,000 feet.
Water at 87 feet.

Peel County

CAMPBELL'S CROSS OIL SYNDICATE
Lot 25, con. I E., Chinguacousy tp.

Completed September 27, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	100
Red shale	50
Hudson shale	720
Utica shale	75
Trenton	595
Potsdam	10
Granite	182
Total depth	1,732

Show of gas at 555 feet.
Fresh water at 103 feet; mineral water at 1,732 feet.

Welland County

CHARLES C. HOUSE
Lot 12, con. XIII, N.R., Bertie tp.

Completed February 6, 1934.
Producing gas well.
Rock pressure: 60 lbs.

Formation	Thickness, ft.
Surface	45
Salina	212
Guelph and Niagara	213
Rochester	95
Clinton	32
Red Medina	65
Manitoulin	45
White Medina	10
Queenston	5
Total depth	722

Gas at 597 and 642 feet.
Fresh water at 48 feet.

CHARLES C. HOUSE
Lot 12, con. XIII, N.R., Bertie tp.

Completed July 10, 1934.
Producing gas well.
Rock pressure: 60 lbs.

Formation	Thickness, ft.
Surface	48
Salina	214
Guelph and Niagara	215
Rochester	90
Clinton	32
Red Medina	65
Manitoulin	15
White Medina	32
Queenston	79
Total depth	790

Gas at 572, 663, and 707 feet.
Fresh water at 50 feet.

WELLAND COUNTY GAS SYNDICATE
Lot 15, con. II, N.R., Bertie tp.

Completed August 17, 1934.
Producing gas well.
Rock pressure: 165 lbs.

Formation	Thickness, ft.
Surface	22
Salina	212
Guelph and Niagara	206
Rochester	97
Clinton	32
Red Medina	80
Manitoulin	24
White Medina	21
Queenston	71
Total depth	765

Gas at 545, 639, 683, and 689 feet.
Fresh water at 50 feet.

WELLAND COUNTY GAS SYNDICATE
Lot 15, con. II, N.R., Bertie tp.

Completed November 7, 1934.
Producing gas well.
Rock pressure: 80 lbs.

Formation	Thickness, ft.
Surface	22
Salina	215
Guelph and Niagara	210
Rochester	102
Clinton	32
Red Medina	70
Manitoulin	26
White Medina	20
Queenston	61
Total depth	758

Gas at 563, 646, and 687 feet.
Fresh water at 60 feet.

WAINFLEET OIL AND GAS CO., LTD.
Lot 58, con. VII, W.R., Wainfleet tp.

Completed 1934.
Producing gas well.
Rock pressure: 155 lbs.

Formation	Thickness, ft.
Surface	69
Lime and shale	30
Niagara	240
Shale	41
Clinton	30
Red Medina	37
Shale	57
White Medina	15
Red shale	2
Total depth	521

Gas at 400 and 418 feet.

W. C. PATTERSON
Lot 3, con. VII, Willoughby tp.

Completed January 26, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	80
Shale and lime	122
Niagara	204
Shale	56
Clinton	38
Red Medina	61
Shale	30
White Medina	18
Red shale	2
Total depth	611

Small show of gas at 609 feet.

W. C. PATTERSON
Lot 14, Cross con., Willoughby tp.

Completed April 9, 1934.
Dry hole.

Formation	Thickness, ft.
Surface	52
Shale and lime	197
Niagara	208
Shale	55
Clinton	37
Red Medina	60
Grey shale	30
White Medina	19
Red shale	2
Total depth	660

W. C. PATTERSON
Lot 1, con. VII, Willoughby tp.

Completed March 10, 1934.
Producing gas well.
Rock pressure: 290 lbs.

Formation	Thickness, ft.
Surface	80
Shale and lime	147
Niagara	208
Shale	57
Clinton	38
Red Medina	56
Grey shale	29
White Medina	20
Red shale	66
Total depth	701

Gas at 530 to 586 feet and 628 feet.
Fresh water at 120 feet; sulphur water at 300 feet.

W. C. PATTERSON
Lot 13, Cross con., Willoughby tp.

Completed May 24, 1934.
Producing gas well.
Rock pressure: 285 lbs.

Formation	Thickness, ft.
Surface	50
Shale and lime	204
Niagara	208
Shale	58
Clinton	38
Red Medina	60
Grey shale	27
White Medina	20
Red shale	50
Total depth	715

Gas at 573 and 655 feet.
Fresh water at 72 feet; sulphur water at 708 feet.

Wentworth County

ALOKA OIL CO., LTD.

Lot 19, con. IV, Ancaster tp.

Completed March 1, 1934.
Producing gas well.
Rock pressure: 40 lbs.

Formation	Thickness, ft.
Surface	98
Guelph and Niagara lime	209
Rochester shale	31
Clinton	17
Red Medina	24
Blue shale	36
Manitoulin	26
White Medina	10
Big red shale	134
Total depth	585

Gas at 340 and 352 feet.
Fresh water at 105 and 125 feet; fresh water, some sulphur, at 215 feet; very salty water at 352 feet.

G. ECKER

Lot 1, S. pt., con. III, Binbrook tp.

Completed November 14, 1934.
Producing gas well.
Rock pressure: 50 lbs.

Formation	Thickness, ft.
Surface	92
Brown lime	50
Formation—Continued	
Niagara	143
Shale	33
Clinton	24
Red Medina	30
Blue shale	28
White Medina	10
Red shale	20
Total depth	430

Gas at 410 feet.

SECURITY OIL AND GAS CO.

Lots 17 and 18, W. ½, con. IX, Binbrook tp.

Completed July 27, 1934.
Producing gas well.
Rock pressure: 60 lbs.

Formation	Thickness, ft.
Surface	66
Lime and shale	25
Niagara	256
Shale and lime	48
Clinton	18
Blue shale	24
Red Medina	10
Shale	30
White Medina	12
Red shale	20
Total depth	509

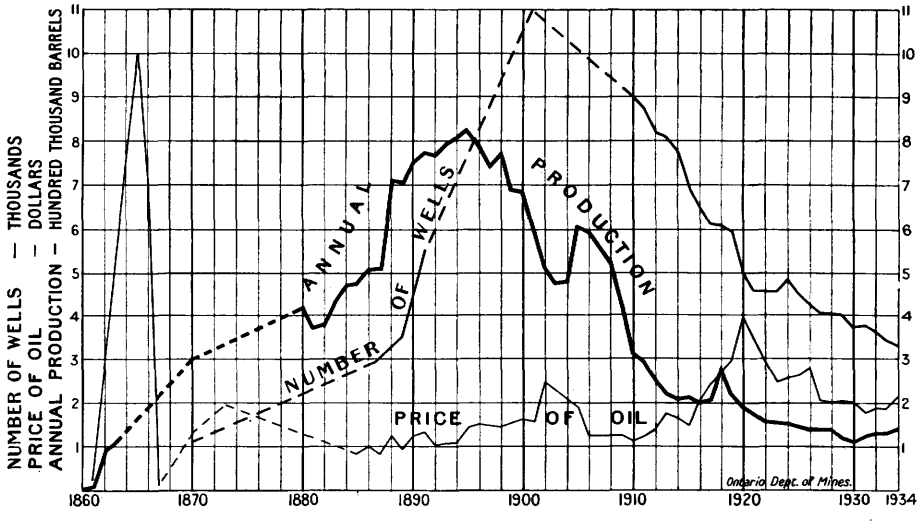
Gas at 489 feet.

PETROLEUM IN 1934

By R. B. Harkness

General

The production of crude petroleum in Ontario has for four consecutive years shown an increase, and is now approaching that of nine years ago. The prices paid have shown a decided improvement for the past four years. The total number of wells, however, continues to decline. The gain in production in the past year is 5,327 barrels, as will be seen in Table II. This gain is mostly in the old part of the Bothwell field where wells drilled 70 years ago and idle for 30 years have been cleared out and rejuvenated. These wells are north and south



Graph of the crude oil industry in Ontario for the past seventy-four years.

of the Thames river in Zone, Aldborough, Orford, and Mosa townships, where the four townships find a common corner. In addition to these old wells, some new wells have been drilled with favourable results. Although this new production can scarcely be considered as a new field, the results have been better than in many of the recent new producing areas, most of which gave a high initial production but became exhausted in 30 to 90 days. For instance, Brooke township, with 14 new producing wells, gave a total of 1,941 barrels; and approximately the same number of old and new wells in Bothwell show a gain in production of 9,198 barrels.

TABLE I—OIL PRODUCED IN ONTARIO BY FIELDS, 1926–1934

Field	1927	1928	1929	1930	1931	1932	1933	1934
	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.
Petrolia and Enniskillen	59,424	60,547	56,284	55,130	57,515	58,871	57,298	57,938
Oil Springs	37,281	35,653	30,737	29,160	30,792	31,438	31,343	29,863
Moore tp	2,112	2,148	1,230	1,576	3,739	3,272	2,192	2,963
Sarnia tp	1,590	1,221	749	1,149	1,466	1,227	2,181	825
Plympton tp	1,241	371	315	296	296	274	211	202
Bothwell	25,224	24,255	23,236	21,176	18,024	19,460	22,935	32,133
Tilbury East tp	60	736	138	149	.....	.....	.....	.....
Dover tp	602	773	715	457	891	453	763	558
Raleigh tp	276	.....	.....	.....	.....	.....	239	264
Onondaga tp	210	186	243	231	34	543	946	601
Mosa tp	7,447	7,268	6,851	7,166	8,517	8,429	8,168	9,031
Thamesville	4,139	1,006	427	447	462	534	847	614
Euphemia tp	.....	.....	.....	.....	121	496	510	189
Dunwich tp	.....	.....	148	365	507	285	346	283
Brooke tp	.....	.....	52	.....	.....	.....	.....	1,941
Dawn tp	.....	.....	.....	.....	.....	5,061	8,079	3,980
Total	139,606	134,164	121,125	117,302	122,364	130,343	136,058	141,385
Value	$289,391	$249,981	$253,678	$235,746	$219,993	$247,468	$253,486	$299,874
Average price	$2.11	$1.86	$2.09	$2.00	$1.80	$1.89	$1.86	$2.12

The capital employed in producing crude petroleum is $1,377,877; the number of employees, 204; and the wages paid, $110,008. This information is furnished by the Dominion Bureau of Statistics, Ottawa.

TABLE II—OIL WELLS AND THEIR PRODUCTION, 1934

Field	Wells			Wells drilled		Production[1]		Gain or loss in 1934	
	Operating	Not operating	Abandoned	Producing	Dry			Gain	Loss
						bbls.	gals.	bbls.	bbls.
Petrolia and Enniskillen	864	534	92	1	.....	57,937	29	639	.....
Oil Springs	877	141	.....	.....	.....	29,862	18	.....	1,480
Moore tp	44	43	1	1	.....	2,962	19	770	.....
Sarnia tp	72	31	1	.....	.....	825	3	.....	1,355
Plympton tp	21	9	1	.....	1	201	21	.....	9
Bothwell	203	74	5	4	4	32,132	23	9,198	.....
Dover tp	2	.....	.....	.....	.....	558	11	.....	205
Raleigh tp	.....	6	.....	.....	.....	264	5	25	.....
Onondaga	16	21	.....	.....	.....	600	31	.....	345
Mosa	90	24	2	.....	3	9,030	31	863	.....
Thamesville	2	22	.....	.....	.....	614	10	.....	232
Euphemia and Dawn tps	7	118	.....	1	1	4,169	4	.....	4,420
Dunwich tp	1	98	.....	.....	.....	283	17	.....	63
Brooke tp	2	17	.....	14	19	1,941	14	1,941	.....
Tilbury East tp	.....	1	.....	.....	.....	.....	.....	.....	.....
Other fields	.....	1[2]	.....	.....	2[3]	.....	.....	.....	.....
Total	2,201	1,140	102	21	30	141,384	26	13,436	8,109
								Net gain	5,327

[1]Production figures from Imperial Oil Company.
[2]Nottawasaga.
[3]Warwick.

Exploratory Drilling

As there is a large percentage of exploratory or "wildcat" wells, it is difficult to distinguish them as oil or gas wells. In order to draw some line, exploratory wells that result in dry holes are classified as gas wells, if they are drilled as deep or deeper than the shallowest gas horizon, i.e. the Guelph. All shallower wells are called oil wells. The "wells drilled" shown in Table II, are nearly all less than 500 feet deep.

The revival of production in the Bothwell field has led to a considerable drilling activity, which has extended well into Orford and Aldborough townships. Mosa township had some attention on the west flank of the Glencoe oil field, where a producing well was drilled a few years ago.

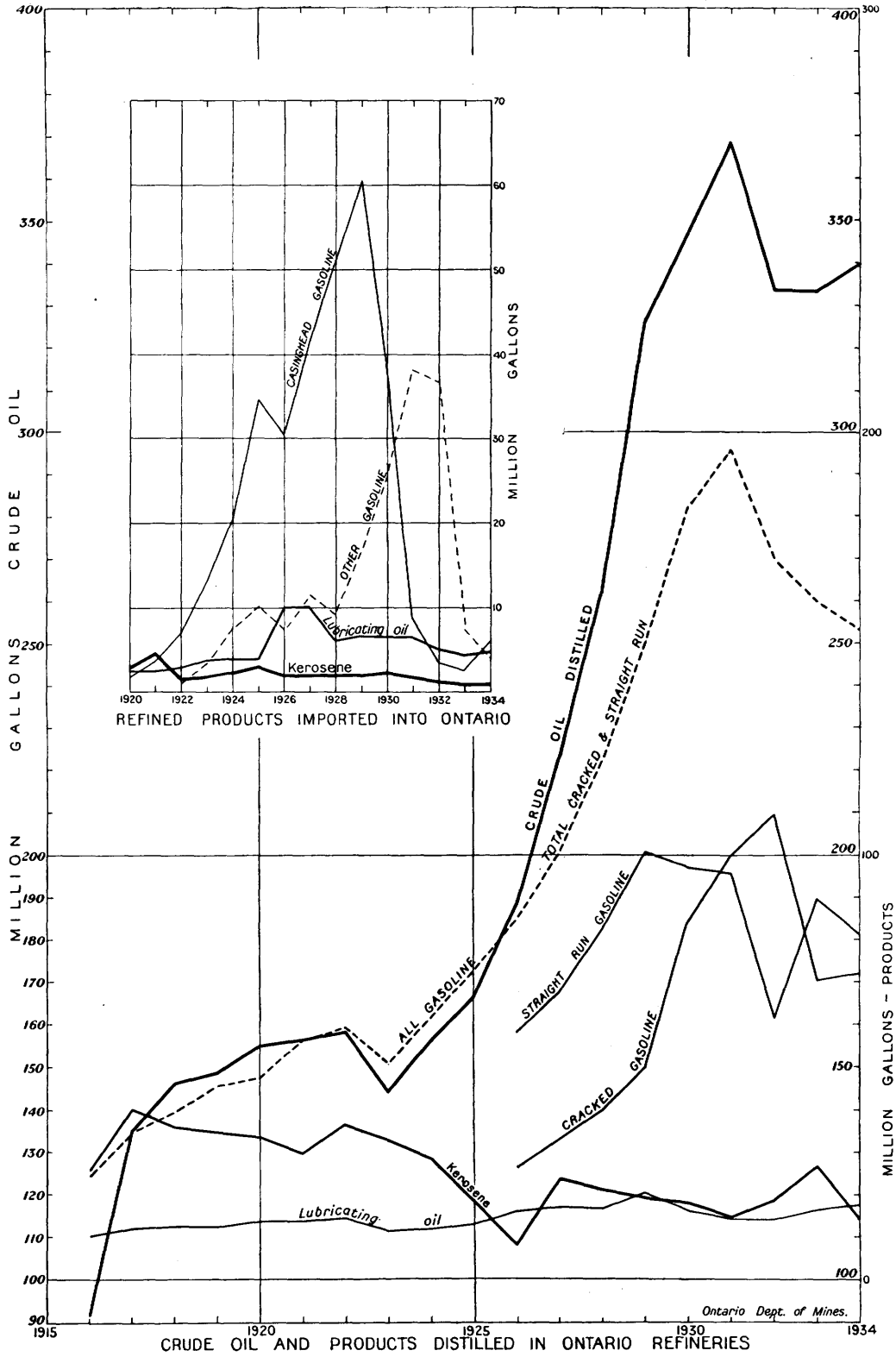
The major activity is in Brooke township, where a producing well was drilled late in 1933 on the Atcheson farm, lot 23, concession XIII. Development spread eastward through concessions XI, XII, XIII, and XIV to the township of Metcalfe, where two dry holes were drilled years ago.

It is difficult to segregate drilling rigs engaged in oil-drilling from those engaged in drilling gas wells, as they are used for both purposes. The investment of six drilling rigs which are engaged in both operations are reported under "Natural Gas." Four drilling rigs engaged in drilling oil wells only have an investment of $7,300. Eight men were engaged and received wages amounting to $2,652. Total footage drilled for oil wells is 10,982 feet.

Oil in Brooke Township

In December, 1933, a large-volume oil well was reported on the Atcheson farm in lot 23, concession XIII of Brooke township, producing from a shallow depth, and at the same horizon as the oil at Petrolia and Oil Springs. During 1934, there was considerable interest in this area, and 33 wells were drilled, 14 of which were reported by the owners as producers and 19 as dry. Only 9 wells, however, including the drilling for the first six months of 1935, have pumped any oil, 4 of these less than 100 barrels. The total production to the end of June, 1935, when only one well in the field was producing, was 2,065 barrels. In the fall of 1935, all activities in the field, including those at this well, had practically stopped.

As will be seen from the accompanying map, the results have been very erratic. Unfortunately, very few samples reached the office of the Natural Gas Commissioner and little first-hand information is available. Inspector Scott reports that there is no oil sand (porous or crystalline limestone) in the Brooke township wells and that the oil comes mainly from the "mud vein." The "mud vein" is at the top of the Delaware limestone, where the joints in the limestone are open and filled with a soft clay, which, when oil is present, yields in great quantity for a short time, after which the flow of oil ceases or is replaced by water. This is borne out by the erratic results obtained from drilling. In the Petrolia, Oil Springs, and Bothwell fields, where there is a continuous porosity in the rock, there are no dry holes in the main portion of the field. The old operators in the Oil Springs field knew that, by locating the water level on the flank of the dome and choosing a well located slightly below the oil and water level, they could, by operating high-capacity pumps continuously, lower this water level and cause the oil to flow downward with the water toward the well so pumped. This method applied in Brooke has proved a failure because the area has a gentle southwest dip, uninterrupted, so far as is known, by any major feature


MILLION GALLONS CRUDE OIL
MILLION GALLONS - PRODUCTS
CRUDE OIL DISTILLED
TOTAL CRACKED & STRAIGHT RUN
ALL GASOLINE
STRAIGHT RUN GASOLINE
CRACKED GASOLINE
Kerosene
Lubricating oil
Ontario Dept. of Mines.
1915
1920
1925
1930
1934
CRUDE OIL AND PRODUCTS DISTILLED IN ONTARIO REFINERIES
MILLION GALLONS
CASINGHEAD GASOLINE
OTHER GASOLINE
Lubricating oil
Kerosene
1920
1922
1924
1926
1928
1930
1932
1934
REFINED PRODUCTS IMPORTED INTO ONTARIO

that would form a trap for oil moving on top of fluids. The water that accompanies this oil is brackish, that is, a mixture of fresh and saline water. It is possible that where these waters intermingle (fresh water moving down dip interrupting saline waters moving up dip) some accumulation might be found where the waters came to rest, the oil having been flushed from oil-bearing rocks in the vicinity. From the results obtained, however, it is apparent that there is not a large enough reservoir to form a commercial oil field.

It is unfortunate that where the drill-cuttings do not give any information as to the type of porosity in an oil well the prospector can only speculate on this point in continuing his exploratory work. Oil may be found under various conditions that will not be apparent from an examination of drill-cuttings, viz., faulted areas, open joints and bedding planes, certain shale beds, limestone or shale beds containing large fossil casts, and coral reefs. In this last class, the corals, most of the reefs are very limited in area and the porosity is not continuous. Isolated corals are very common, and in the well-known oil-bearing rocks corals containing oil are often exposed in quarries. A few years ago the Union Gas Company, using a small core-drill to confirm some geological determination, found "shows of oil" where their drill holes entered the Onondaga limestone, and in the core found such corals filled with oil.

It is the writer's belief that were the core drill more generally used exploratory work could be done with a better knowledge, and with underground conditions such as those discussed in the preceding paragraph no further drilling would be done.

The history of oil-drilling in southeastern Ontario shows that where oil is accompanied by brackish water, a field of commercial importance has never been developed. Most of such fields are found where the limestone is covered only by Pleistocene deposits. The Brooke township field is an exception to this. Other non-commercial fields are at Puce Creek, Maidstone township, and Belle River, Rochester township, Essex county; four miles northwest of the village of Iona in Dunwich township, Elgin county; and a few miles south of Tillsonburg in Dereham township, Oxford county. None of these proved to be profitable ventures.

Petroleum Refining

Seven petroleum refineries were in operation in Ontario in 1934, as listed below:—

PETROLEUM REFINERIES, 1934

Company	Location of refinery	Head office address
British American Oil Co., Ltd.	Foot of Cherry St., Toronto	Royal Bank Bldg., Toronto.
Burlington Refineries, Ltd.	.....	1209 Pigott Bldg., Hamilton.
Canadian Oil Companies, Ltd.	Petrolia	12 Strachan Ave., Toronto.
Goodrich Refining Co., Ltd.	Scarborough	3509 Danforth Ave., Toronto.
Imperial Oil Refineries, Ltd.	Sarnia	Sarnia.
Lloyds Refinery	Port Credit	Port Credit.
McColl-Frontenac Oil Co., Ltd.	Foot of Cherry St., Toronto	Royal Bank Bldg., Montreal, Que.

The total capacity of these refineries is 39,850 barrels.

A comparison of refining operations over a 6-year period is given in Table III. The figures in this table, together with those in Table IV, represent the consumption of petroleum products in Ontario, as nearly as it can be arrived at. Along the eastern and western boundaries of Ontario, there is some interprovincial

trade, viz. imports from Montreal and exports to Manitoba. It is not known where the balance of trade lies, but it will not be sufficient to seriously affect the total.

A comparison of the past two years shows little fluctuation in any product produced, except kerosene. It is probable that there was a heavy carry-over from last year.

TABLE III—PETROLEUM REFINING OPERATIONS, 1929–1934[1]

Schedule	Unit of measure	1929	1930	1931	1932	1933	1934
Imported crude distilled	Gallons[2]	321,687,678	343,372,124	364,871,253	327,524,704	314,058,338	307,717,332
	Value	$23,341,514	$23,273,547	$17,035,028	$19,197,691	$14,904,715	$16,110,251
Imported crude oil distilled not in its natural state	Gallons				1,669,675	14,815,049	27,871,946
	Value				$51,092	$966,409	$1,723,943
Canadian crude distilled	Gallons	4,426,863	3,944,969	4,382,806	4,704,609	4,823,639	4,289,702
	Value	$292,949	$264,008	$261,334	$290,752	$299,793	$274,888
Percentage of total		1.35	1.13	1.19	1.43	1.45	1.26
Total value of crude		$23,634,463	$23,537,555	$17,296,362	$19,539,535	$16,170,917	$18,109,082
PRODUCTS							
Gasoline: Straight run	Gallons	101,276,701	97,806,121	95,934,920	61,297,731	89,429,293	81,307,756
	Selling value	$14,521,648	$12,334,586	$9,886,611	$6,378,577	$7,793,607	$6,231,050
By cracking process	Gallons	49,884,248	84,496,056	100,120,768	109,519,770	70,519,864	71,949,582
	Selling value	$7,176,654	$11,066,369	$10,544,926	$10,673,010	$5,736,708	$4,754,529
Kerosene	Gallons	19,138,614	17,973,730	14,656,833	18,666,252	26,499,830	14,208,236
	Selling value	$2,516,618	$1,980,546	$1,397,607	$1,736,164	$2,022,408	$1,109,504
Lubricating oil	Gallons	20,452,106	16,451,717	13,963,545	14,187,555	16,299,872	17,638,490
	Selling value	$3,707,592	$2,756,579	$2,445,410	$3,476,341	$2,854,787	$3,695,083
Engine distillate and naphtha	Gallons	5,845,447	4,272,751	3,652,973	6,098,784	8,384,517	6,636,041
	Selling value	$811,240	$504,206	$327,717	$573,585	$490,728	$340,237
Gas oil	Gallons	99,035,616	80,742,218	101,370,904	85,233,170	37,860,532	50,461,106
	Selling value	$5,016,370	$3,792,757	$3,627,041	$3,550,598	$1,874,878	$2,795,217
Fuel oils	Gallons					55,394,540	58,918,615
	Selling value					$2,112,522	$2,716,951
Tar	Gallons	103,250	101,750	902,000			130,641
	Selling value	$8,260	$8,140	$9,020			$49,977
Grease	Pounds	17,045,846	13,468,964	8,814,022	8,751,758	8,342,446	8,571,927
	Selling value	$316,946	$268,509	$171,036	$492,339	$357,316	$509,271
Paraffin wax and candles	Pounds	10,784,609	10,153,924	10,097,478	9,196,156	8,978,068	10,656,115
	Selling value	$538,233	$453,601	$368,686	$417,336	$355,323	$476,928
Petroleum coke	Short tons	67,599	56,946	54,223	62,836	62,601	49,011
	Value	$396,565	$316,180	$285,051	$328,067	$344,686	$268,821
Still gas	M cu. ft.	1,103,142	1,551,334	2,128,739	1,942,741	1,574,451	1,498,379
	Value	$270,479	$421,500	$505,156	$410,222	$306,984	$281,524
Asphalt	Gallons	2,664,199	6,029,624	8,778,452	6,885,142	6,494,707	7,946,775
	Selling value	$137,714	$285,460	$318,005	$555,654	$524,532	$712,468
Miscellaneous	Value	$258,113	$291,404	$219,900	$222,545	$50,498	$56,971
Total value of refined products		$35,676,432	$34,479,837	$30,106,166	$28,814,438	$24,824,977	$23,998,621
Employees	Average No.	2,313	2,449	1,984	1,937	2,036	2,047
	Wages paid	$3,657,619	$3,760,870	$2,840,794	$2,764,208	$2,752,718	$2,637,213
Capital invested		$26,784,547	$26,761,273	$25,282,459	$25,732,687	$22,947,812	$23,579,481

[1]Information furnished by the Dominion Bureau of Statistics, Ottawa.
[2]Gallons refer to Imperial gallons.

Petroleum Imported into Ontario

Table IV gives a comparative statement of imports of crude and refined petroleum for the past two years. There is a 5 per cent. gain in the crude petroleum imported and a 5 per cent. loss in refined petroleum imported. "Casing

head" gasoline and commercial gasoline show considerable fluctuation from year to year, but taken together the totals for the past two years show no change. The outstanding difference in the comparison is a 66 per cent. rise in the price of crude petroleum.

TABLE IV—PETROLEUM AND REFINED PRODUCTS IMPORTED IN 1933 AND 1934

Import	1933		1934	
	Imperial gallons	Value	Imperial gallons	Value
CRUDE PETROLEUM:				
Petroleum, 0.790 specific gravity or heavier, for refining	233,694,540	$4,938,131	244,801,477	$7,498,528
REFINED PETROLEUM:				
For use in concentrating ores	41,048	$23,594	12,580	$7,108
Gasoline lighter than 0.669 specific gravity (casing head)	2,600,405	111,433	5,973,610	259,232
Gasoline lighter than 0.8235 specific gravity	7,572,627	586,077	4,400,803	358,682
Gas oils, other than naphtha and gasoline, between 0.8235 and 0.775 specific gravity	55	2	114,807	6,680
Kerosene and illuminating oils	959,855	57,231	1,027,834	58,162
Fuel oil, 0.8235 specific gravity and heavier	2,808,543	137,678	1,294,661	64,805
Engine distillate lighter than 0.8235 specific gravity	41,261	3,919	17,014	1,531
Lubricating oils, consisting wholly or in part of petroleum, costing less than 25 cents a gallon	2,943,286	506,210	3,244,580	446,492
Lubricating oils, all other	1,652,113	646,032	1,539,299	545,508
All other oils	164,303	54,966	237,401	67,412
Total	18,783,496	$2,127,142	17,862,598	$1,815,612
PETROLEUM PRODUCTS:				
Axle grease.....lbs.	1,467,456	$65,427	2,020,461	$85,122
Vaseline, toilet and medicinal petroleum	.....	112,797	.....	128,501
Paraffin wax.....lbs.	462,652	28,121	682,259	37,779
Paraffin wax candles.....lbs.	120,019	22,573	104,939	21,525
Other petroleum products lighter than 0.8235 specific gravity.....gals.	950,561	84,225	1,631,722	120,936
Total	.....	$313,143	.....	$393,863
Total value	.....	$7,378,416	.....	$9,708,003
Total net value of petroleum and refined products imported[1]	$7,378,416		$9,708,003	
Duty paid on the above, calculated on the existing tariff schedule	525,813		474,213	
Sales tax at 6 per cent	474,254		610,933	
Freight,[2] approximately	6,000,000		805,000	
Exchange, approximately	80,764		.....	
Total value delivered in Ontario	$14,459,247		$11,598,149	

[1]These statistics are furnished through the courtesy of the Department of Customs and Excise.

[2]The difference in the freight on petroleum and refined products imported in 1933 and 1934 is explained by the manner of reporting. In 1933 the crude oil was valued at the placed of purchase and freight was added separately; in 1934, it was valued at the refinery with freight included.

INDEX, PART V

A

PAGE

Abandoned wells.
Gas 8, 9
Oil 68
Abbreviations for gas-well localities 22
Acknowledgments 68, 72, 73
Acme Gas and Oil Co., Ltd.
Licenses 17, 20
Acreage of gas land under lease 8, 9
Adams, L. W.
License 17
Ajax Oil and Gas Co., Ltd.
Licenses 17, 18, 20
Logs, dry-hole 48
gas wells 48, 49
Aldborough tp.
See also Rodney; West Lorne.
Dry holes, logs 23, 24
Gas statistics 6, 8
Oil 67, 69
Allen, A. J., license 18
Aloka Oil Co.
Gas well, log 66
Alvinston, gas statistics 4
Amabel gas field, production 3
Amabel tp.
See also Amabel gas field; Hepworth.
Gas production 9
Analysis of gas consumption 3-7
Analysis, sulphur gas 12
Ancaster tp.
See also West Hamilton.
Gas statistics 7
well, production 9
log 66
Aragain Gas Co.
Gas wells, logs 24
Aragain Gold and Natural Gas Synd.
License 20
Ardross block, Oneida tp.
Dry hole, log 33
Asphalt, production 72
Atcheson farm, Brooke tp.
Oil drilling 69
Average consumption of natural gas 3
Avery, Ealey and Blackheath Gas Co.
Gas well, log 35
Avery, Esmond, and Associates.
Gas wells, logs 29
Axle grease, imports 73
Aylmer, gas statistics 4

B

Barnum, R. G., license 17
Barr, D., license 17
Barton tp.
See also Bartonville; Hamilton; Mount Hamilton.
Gas statistics 7
Bartonville, gas statistics 4
Bayham gas field, production 3

PAGE

Bayham tp.
See also Bayham, Eden gas fields; Eden; Port Burwell, Straffordville; Vienna.
Dry hole, log 24
Gas statistics 6
wells, production 8
Oil, show of, in dry hole 24
Sulphur gas, photo 12
Beattie, James A., license 17
Bell, George E., license 17
Belle River.
Gas statistics 4
leakage 14
Oil 71
Belmont.
Gas statistics 4
leakage 14
Bertie tp.
See also Crystal Beach; Fort Erie; Ridgeway; Stevensville.
Gas statistics 7
wells, production 9
logs 65
Bertie Township Gas and Oil Syndicate.
License 20
Binbrook, gas statistics 4
Binbrook tp.
See also Binbrook.
Gas statistics 7
wells, production 9
logs 66
Blackheath Gas Co.
Gas wells, logs 35
Blacklock, S. C., license 17
Blain, Dr. E. B., license 17
Blake, Dr. John, and Craft, Fred.
Dry holes, logs 53, 55
Blake system, gas leakage 16
Blenheim.
Gas statistics 4
leakage 14
Borden Milk Co.
Sulphur gas used by 13
Border Cities.
Gas statistics 5
leakage 15
Bore-hole records 21-66
Boring licenses.
Listed 18, 19
Price 17
Bosanquet tp.
See also Lake Shore.
Oil and gas wells, logs 52, 53
Bothwell.
See also Bothwell oil field.
Gas statistics 4
leakage 15
Bothwell oil field.
Exploratory drilling 69
Production 68
increase in, source of 67

PAGE
Brant Co.
Gas, statistics ... 6
wells, production ... 3, 9
logs ... 22, 23
Oil. *See* Onondaga tp.
Brantford.
Gas statistics ... 4
leakage ... 14
Brantford tp.
See also Brantford; Cainsville; Echo Place.
Gas statistics ... 6
Brantford Gas Co.
Gas leakage ... 14
License ... 21
Brigden.
Gas statistics ... 4
leakage ... 14
British American Oil Co.
Refinery ... 71
British Petroleum Co., Ltd.
Log of well ... 58
Broadway Gas Syndicate.
License ... 20
Logs, dry holes ... 37, 38
gas wells ... 37, 38
Brooke tp.
See also Alvinston; Inwood.
Gas statistics ... 6
Oil occurrences, map ... *facing* 68
notes on ... 69, 71
wells ... 67, 68
logs ... 53 56
production ... 67, 68
Brookefield Oil and Gas Co.
Logs, dry holes ... 53
Bruce co.
Gas wells, production ... 3, 9
Burford tp., gas statistics ... 6
Burlington, gas statistics ... 4
Burlington Refineries, Ltd. ... 71

C

Cabot Head formation ... 23, 33, 49
Cainsville.
Gas statistics ... 4
leakage ... 14
Caistor tp.
Gas statistics ... 7
wells, production ... 9
logs ... 59
Caledon tp.
Gas wells, production ... 9
Caledonia, gas statistics ... 4
Camden tp.
See also Dresden; Thamesville.
Gas statistics ... 6
Cameron, R. B., license ... 17
Campbell's Cross Oil Syndicate.
License ... 17
Log, dry hole ... 64
Canadian Natural Gas Syndicate.
Gas wells, logs ... 27, 28
License ... 20
Canadian Oil Companies, Ltd.
Refinery; address ... 71
Canborough tp.
Gas statistics ... 7
wells, production ... 9
logs ... 24-26
Candles, statistics ... 72, 73
Canfield, gas statistics ... 4
Canfield Gas Syndicate.
Gas wells, logs ... 29
Canfield Natural Gas Co., Ltd.
Licenses ... 20, 21
Capital.
Invested in gas industry and equipment ... 2, 3
in oil wells and drilling ... 11, 68
in refineries ... 72
Cascaden, C. H., license ... 17
Cayuga, gas statistics ... 4
Cayuga tps. *See* North Cayuga tp.; South Cayuga tp.
Central Pipe Line Co., Ltd.
Licenses ... 18, 20, 21
Central Seneca Gas Syndicate.
License ... 20
Logs, dry hole ... 35
gas wells ... 35, 36
Charlotteville tp.
See also Lynedoch; Vittoria
Gas statistics ... 6
wells, production ... 8
Chatham.
Gas statistics ... 4
leakage ... 14
Chatham tp.
See also Tupperville; Wallaceburg.
Gas statistics ... 6
leakage ... 16
Chinguacousy tp.
Dry hole, log ... 64
Gas wells ... 9
Cities.
Gas statistics ... 4, 5
leakage in distribution plants ... 14, 15
Climate, effect of on gas consumption ... 4
Clinton formation ... 22-49, 56-66
Coatsworth, gas statistics ... 4
Coke, petroleum, production ... 72
Colchester South tp. *See* Essex.
Colonial Natural Gas and Oil Co., Ltd.
License ... 20
Columbia Natural Gas and Oil Co.
Gas wells, logs ... 26
Comber.
Gas statistics ... 4
leakage ... 14
Comfort, B. F., and Son, license ... 17
Companies, private.
Total gas distributed to ... 7
Consolidated Natural Gas Co., Ltd.
Gas well, log ... 28
Consumers of natural gas, statistics ... 3-7
Continental Gas Corporation, Ltd.
License ... 20
Corals, oil-bearing ... 71
Corunna, gas leakage ... 14
Cottam, gas statistics ... 4
Counties.
Gas statistics ... 6, 7
wells and production ... 8, 9
Courtland, gas statistics ... 4
Courtright.
Gas statistics ... 4
leakage ... 14
Craft, Fred W.
Dry holes, logs ... 53, 55
License ... 17

PAGE

Crowland tp.
See also Welland.
Gas statistics 7
wells, production 9
Crude oil.
Imported 73
Industry, graphs 67, 70
Output 72
Crumlin gas field, production 3
Crystal Beach, gas statistics 4
Cullen and Walsh.
Dry hole, log 54
Culver, W. H., Jr., licenses 18
Customs duty on petroleum imports 73
Cyclops Gas Syndicate, licenses 20

D

Darke. *See* Stoddard and Darke.
Dashwood, D., and Son.
Gas well, log 27
Dawn gas field, production 3
Dawn tp.
See also Dawn gas field; Florence.
Gas statistics 6
leakage 16
wells, production 8
logs 57
Oil wells 68
production statistics 68
show of in gas wells and dry holes. 57
Dawson, Ralph.
See also Kerwin and Dawson.
License 20
Declute gas field 2
Drilling results 10
Pipe line from, photo 13
Delaware formation.
"Mud vein," oil in 69
Delhi, gas statistics 4
Delhi Gas Syndicate.
Logs, dry hole 64
gas wells 63, 64
Department of Customs and Excise 73
Department of Mines, Canadian 12
Dereham tp.
See also Tillsonburg.
Oil 71
Detroit River formation 49, 54
Dicker, Reginald, license 17
Distillate, engine, statistics 72, 73
Distribution license, price 17
Distribution lines.
Leakage on 7
Miles of 13
Distribution plants, leakage in 7, 14, 15
Domestic consumption of gas 3
Domestic Gas Syndicate.
Licenses 17, 20
Logs, dry hole 36
gas wells 36
Dominion Bureau of Statistics 68, 72
Dominion Natural Gas Co., Ltd.
Leakage 14, 15
Licenses 17, 20, 21
Dominion Petroleum Co., Ltd.
License 17
Oil well, log 62
Dorchester.
Gas statistics 4
leakage 13, 14

PAGE

Dorchester North tp.
See North Dorchester tp.
Dover gas field.
Drilling; fault 10, 11
Map (No. 44h) ..... *in pocket*
Pipe line to Hamilton 11
Production 3
Dover tp.
See also Dover gas field.
Gas statistics 6
leakage 16
well, free flowing, photo 2
wells, production 8
logs 48, 49
Oil production 68
Photo of scene in 11
Dresden.
Gas statistics 4
leakage 14
Drift, surface, wells in 3
Drilling.
See also Logs of wells.
Exploratory, oil 69
core-drill advocated 71
Gas wells 10, 11
Dumfries South tp.
See South Dumfries tp.
Dundas.
Gas statistics 4
leakage 13-15
Dunn tp.
Gas statistics 7
wells, production 9
logs 26, 27
Dunnville.
Gas statistics 4
leakage 13-15
wells, logs 27
Dunwich tp.
See also Dutton; Iona; Wallacetown.
Gas statistics 6
Oil production 68
Dutton, gas statistics 4
Duty, customs, on petroleum imports 73

E

Earl tract, Dunn tp., gas wells, logs 26, 27
East Flamborough tp.
See also Waterdown.
Gas statistics 7
East Oxford tp.
See also Woodstock.
Gas statistics 6
East Windsor. *See* Border Cities.
Echo Place, gas statistics 4
Ecker, G., gas well, log 66
Eden, gas statistics 4
Eden gas field.
See also Bayham, Middleton tps.
Drilling 11
Sulphur gas, notes and photo 11-13
Ekfrid tp., dry hole, log 62
Elgin co.
See also Aldborough, Bayham Dunwich tps.
Dry holes, logs 23, 24
Gas statistics 6
wells, production 3, 8
Oil 71
Emerald Gas Syndicate, license 20

PAGE
Emerson, Harry L., license 20
Empire Natural Gas, Ltd.
Gas wells, logs 39
License 20
Employees. *See* Labour statistics.
Engine distillate, statistics 72, 73
Enniskillen oil field, production 68
Enniskillen tp.
See also Oil Springs; Petrolia.
Gas statistics 6
leakage 16
wells, production 8
Oil wells, production 68
Erie Gas, Ltd., licenses 17, 20
Esmond Avery and Associates.
Gas wells, logs 29
Essex.
Gas statistics 4
leakage 14
Essex co.
See also Rochester, Sandwich E. and S. tps.
Gas statistics 6
wells, production 3, 8
Oil 71
Euphemia tp.
Dry hole, log 58
Gas wells, production 8
Oil, production 68
Exchange paid on petroleum imports .. 73
Exploratory drilling for oil 69

F

Fairground, gas statistics 4
Faults, gas and oil at 10, 11, 71
Fenwick.
Gas statistics 4
leakage 14
Ferris, T. Gordon, Sr., license 17
Fingal.
Gas statistics 4
leakage 14
Firelite Gas and Oil Co., Ltd.
Logs, dry hole 40
gas well 39
Fisherville, gas statistics 4
Fisherville Gas Co., licenses 20, 21
Flint. *See* Logs of wells.
Florence, gas statistics 4
Fonthill.
Gas statistics 4
leakage 14
Fonthill Gas Co., leakage in plant 14
Forshee, C. S., license 17
Fort Erie, gas statistics 4
Francis, J. L., gas well, log 24
Free gas, statistics 4-7
Freight paid on petroleum imports 73
Fuel oil.
Imported 72, 73
Output 72
Fuel Testing Laboratories 12

G

Gainsborough tp.
See also St. Anns.
Gas statistics 7
wells, logs of 59-61
production 9

PAGE
Galt.
Gas statistics 4
leakage 14
Gas, natural. *See* Natural gas.
Gas oil.
Imported 73
Output 72
Gas Finders Co.
Logs, dry hole 30
gas wells 29, 30
Gas Finders Gas Co.
Log, dry hole 33
Gas Producers Syndicate.
Gas well, log 50
Gasoline.
Imported 73
Output 72
Gaul, Henry J., license 17
Geddes, E. W., license 17
Gifford, Arthur and Son.
License 20
Glanford tp.
Gas statistics 7
wells, production 9
Glencoe oil field.
Exploratory drilling 69
Goit, Lorne R., license 18
Goodrich Refining Co. 71
Gosfield North tp.
See also Cottam.
Gas statistics 6
Gosfield South tp.
See also Kingsville.
Gas statistics 6
well in Lake Erie, photo 10
wells, production 8
Grand River Gas and Oil Synd.
License 20
Logs, dry holes 30
gas wells 30
Grand River Natural Gas Co., Ltd.
License 20
Grantham tp.
See also Merritton; St. Catharines.
Gas statistics 7
Graphs.
Natural gas industry 1
Petroleum industry 67, 70
Gray, Ira.
License 17
Grease, statistics 72
Gregory, George F., and Son.
Licenses 18
Grimsby, gas statistics 4
Grimsby sandstone, gas in 11
Grimsby tps. *See* North Grimsby tp.; South Grimsby tp.
Grimsby Beach.
Gas statistics 4
Grimsby Gas Co.
Gas wells, logs 59, 60
Grimsby Natural Gas Co., Ltd.
Gas well, log 59
Licenses 20, 21
Guardian Petroleum Development Co.
Logs, dry holes 54
oil wells 54
Guelph formation ... 23, 24, 27, 36, 49, 64-66
Gas horizon 69
sulphur 11
Gypsum. *See* Logs of wells.

H PAGE

Hagersville.
Gas statistics ... 4
leakage ... 13, 14
Haldimand co.
Gas statistics ... 7
exploratory drilling ... 11
wells, production ... 3, 9
logs ... 24-48
Haldimand gas field, production ... 3
Haldimand Gas Syndicate, license ... 20
Haldimand Natural Gas Syndicate.
Licenses ... 17, 20
Halton co. *See* Burlington.
Hamilton.
Gas statistics ... 4
leakage ... 15
pipe line from Dover field ... 11
Hamilton formation ... 24, 48-51, 54, 56-59
Harkness, R. B.
Report by, on Natural Gas (1934) ... 1-66
on Petroleum (1934) ... 67-73
Harris, Joseph E. *See* House and Harris.
Harwich tp.
See also Blenheim.
Gas statistics ... 6
leakage ... 16
wells, production ... 9
Heal, A. A.
Licenses ... 17-19
Logs, dry holes ... 52
gas wells ... 52
oil well ... 52
Henry, A. H., license ... 17
Hepworth, gas statistics ... 4
Hespeler, gas statistics ... 5
High Grade Natural Gas Co.
License ... 17
Highbank Oil, Ltd., licenses ... 17, 20
Highgate, gas statistics ... 5
Holmes, A. B., licenses ... 17, 19
Hoover, May, Ltd., licenses ... 17, 19
Hope Gas Syndicate, license ... 20
Horn, W. C., license ... 17
Houghton tp.
See also Fairground.
Gas wells, production ... 8
House, Charles C.
See also House and Harris.
Gas wells, logs ... 64, 65
Licenses ... 17, 19
House and Harris, license ... 20
Howard, W. C., license ... 17
Howard gas field, production ... 3
Howard tp.
See also Howard gas field; Ridgetown.
Gas statistics ... 6
leakage ... 16
wells, production ... 9
Hudson River formation ... 48, 49, 64
Huff tract, N. Cayuga tp.
Gas wells, logs ... 31
Humberstone, gas statistics ... 5
Humberstone tp.
See also Humberstone; Port Colborne.
Gas statistics ... 7
wells, production ... 9
Huron formation ... 54, 56-59
Hussey, W. J.
Licenses ... 17, 19
Oil well, log ... 58
Hussey, W. J., and Son, oil well, log ... 58

I PAGE

Ideal Gas Syndicate.
License ... 20
Illuminating oils.
Imported ... 73
Output ... 72
Imperial Oil Co. ... 68
Imperial Oil Refineries, Ltd. ... 71
Imports of mixed gas ... 3
Petroleum products ... 72, 73
graph ... 70
Industrial gas, statistics ... 4-7
Industrial Natural Gas Co., Ltd.
Licenses ... 17, 20
Ingersoll.
Gas statistics ... 5
leakage ... 14
Inwood, gas statistics ... 5
Iona, oil near ... 71

J

Jackson, Percy L.
Gas well, log ... 27
Licenses ... 19
James, F. L., license ... 17
Jarvis, gas statistics ... 5
Jasperson, Bon.
Gas well in Lake Erie, photo ... 10
Licenses ... 17, 19, 20

K

Kabana, John.
Logs, dry hole ... 49
gas wells ... 51, 52
Kehlet, F. W.
License ... 17
Logs, dry holes ... 54, 62
oil wells ... 49, 50
Kells, E., license ... 19
Kelly Gas Syndicate.
Logs, dry hole ... 40
gas wells ... 40
Kent co.
See also Chatham, Dover, Harwich, Howard, Orford, Raleigh, Tilbury E., Zone tps.
Gas statistics ... 6
wells, logs ... 48-52
production ... 3, 8
Oil.
see Bothwell, Thamesville oil fields; Tilbury E., Zone tps.
wells, logs ... 49, 50
Kerosene, statistics ... 72, 73
Kervin and Dawson, license ... 19
King, Stevens, Syndicate.
Dry hole, log ... 55
Kingsville.
See also Kingsville gas field.
Gas statistics ... 5
leakage ... 13
Kingsville gas field, production ... 3
Kiser Bros., licenses ... 19

L

Labour statistics.
Drilling ... 11, 69
Gas industry ... 3, 13
Petroleum industry ... 68, 72

PAGE
Ladd, C. H.
Logs, dry hole ... 49
gas wells ... 51, 52
Ladd and Kabana.
Logs, dry hole ... 49
gas well ... 51
Lake Erie.
Drilling for gas, notes and photo ... 10
Lake Shore, gas statistics ... 5
Lambeth, gas statistics ... 5
Lambton co.
See also Brooke, Dawn, Enniskillen, Euphemia, Moore, Plympton, Sarnia, Sombra, Warwick tps.
Gas statistics ... 6
wells, logs ... 52, 53, 55-59
production ... 3, 8
Oil wells, logs ... 52-59
Lauer, D. G., licenses ... 19
Leakage of gas.
Increase, notes on ... 13
Statistics ... 14-16
Leamington.
See also next ref.
Gas statistics ... 5
leakage ... 13, 14
Leamington, Town of.
Gas plant, leakage ... 13
License ... 21
Leasing gas or oil area, price of license ... 17
Lewis, James R., licenses ... 17, 19
Licenses, gas and oil ... 17-21
Limestone.
Gas and oil in. *See* Logs of wells.
Lincoln co.
Gas statistics ... 7
wells, production ... 3, 9
Logs, dry hole ... 60
gas wells ... 59, 60
Lincoln gas field, production ... 3
Lincoln Gas Co., Ltd.
Gas wells, logs ... 59, 60
Licenses ... 20, 21
Lloyds Refinery ... 71
Lochron, Virgil L., license ... 17
Logs of wells ... 21-66
Louth tp.
Gas statistics ... 7
Lowbanks Drillers Syndicate.
Gas wells, logs ... 28
Lubricating oils.
Imported ... 73
Output ... 72
Lymburner, M. G., license ... 17
Lymburner Bros. and Webber.
Licenses ... 19, 20
Logs, dry hole ... 28
gas wells ... 40
Lynedoch, gas statistics ... 5
Lynn Valley Natural Gas Syndicate.
License ... 20
Logs, dry holes ... 32
gas wells ... 32

M

McArthur, R. E.
Dry hole, log ... 54
McColl-Frontenac Oil Co., Ltd. ... 71
McCutcheon, Thomas J., licenses ... 19
McDougall, A. S., license ... 17
PAGE
McGaffey, Roy, license ... 19
McGill, Joseph, license ... 17
McKechnie, S., licenses ... 19
McKillop, William, license ... 19
McKinney, John F., license ... 20
McLellan, H.
Oil well, log ... 55
McLister, J. J., license ... 19
McMaster, W. R., license ... 19
McNinch, S. E., licenses ... 18, 19
Maidstone tp.
See also Belle River.
Gas statistics ... 6
Oil ... 71
Malahide tp.
See also Aylmer.
Gas statistics ... 6
wells, production ... 8
Manitoulin formation ... 48, 49, 64-66
Manufacturers Natural Gas Co., Ltd.
License ... 21
Maps.
Brooke tp., oil occurrences ... *facing* 68
Dover oil and gas field ... *in pocket*
May Gold and Natural Gas Syndicate.
Logs, dry hole ... 25
gas wells ... 24, 25
Medicinal petroleum, statistics ... 73
Medina formation.
See Red Medina, White Medina formations.
Medina-Cataract formation ... 49
Medina Natural Gas Co., license ... 18
Merchant, Frank.
Dry hole, log ... 62
License ... 19
Merlin.
Gas statistics ... 5
leakage ... 14
Merritt, Fred H., licenses ... 18, 19
Merritton, gas statistics ... 5
Mersea tp.
See also Leamington; Wheatley.
Gas statistics ... 6
well, production ... 8
Metcalfe tp.
Dry hole, log ... 62
Exploratory drilling ... 69
Middlesex co.
Gas statistics ... 6
wells, production ... 3, 8
Oil.
see also Metcalfe, Mosa tps.
wells, logs ... 62
Middleton tp.
See also Courtland; Delhi; Eden gas field.
Gas statistics ... 6
wells, logs of ... 62, 63
production ... 8
Midwal Oil and Gas Co., Ltd.
Gas wells, logs ... 63
Licenses ... 18, 20
Millar, James, license ... 19
Mixed gas, imported ... 3
Mobey, Chas.
Oil well, log ... 49
Mohawk Gas and Oil Syndicate, Ltd.
License ... 20
Logs, dry hole ... 41
gas wells ... 40, 41

PAGE
Monarch Gas and Oil Syndicate.
Logs, dry hole 41
gas wells 41
Moore tp.
See also Brigden; Corunna; Courtright.
Gas statistics 6
leakage 16
wells, production 8
Oil production 68
wells, logs of 58
Mosa tp.
Gas wells 8
Oil 67, 69
wells, logs of 62
production 68
Mossop, H. T., license 18
Moulton tp.
See also Dunnville.
Gas statistics 7
wells, logs of 27-29
production 9
Mount Hamilton.
Gas plant, leakage in 14
"Mud vein," oil from 69
Mytinger, Lawrence P.
Logs, dry holes 23

N

Naphtha statistics 72
National Gas Syndicate.
Gas wells, logs 37
Natural gas.
Consumption 3-7
Exploratory work 10, 11
Graph of industry 1
Leakage 13-16
Licenses 17-21
Production by fields 3
Rates 3-7
Report (1934) by R. B. Harkness ... 1-66
Reserves 2
Well, free flowing, photo 2
Wells, logs of 21-66
production 7-9
statistics 3
Natural Gas Conservation Act 17
Neath, Charles, license 18
Nelles Corners, gas statistics 5
Nelson tp. *See* Burlington.
Newton, Roy, license 18
Niagara formation 22-49, 59-66
Niagara Falls, gas statistics 5
Niagara Natural Gas Co., Ltd.
License 20
Nisbit, James F., license 19
Norfolk co.
See also Eden gas field.
Gas statistics 6
wells, logs of 62-64
production 3, 8, 9
Norhal Gas and Oil Syndicate.
License 20
Logs, dry holes 41
gas wells 33, 41, 42
North Cayuga tp.
See also Canfield; Cayuga; Nelles Corners.
Gas statistics 7
wells, logs of 29-31
production 9

PAGE
North Cayuga Gas Syndicate.
License 20
Logs, dry hole 31
gas wells 31
North Dorchester tp.
See also Crumlin gas field; Dorchester.
Gas statistics 6
wells 8
North Dumfries tp. *See* Galt.
North Grimsby tp.
See Grimsby; Grimsby Beach.
North Oxford tp. *See* Ingersoll.
North Walsingham tp.
Gas statistics 6
well, production 8
Nottawasaga tp., oil well 68

O

Ogletree, F. A., license 19
Oil.
See also Petroleum.
Crude, statistics 72, 73
graphs 67, 70
Exploratory work 69
Fuel, statistics 72, 73
Gas, statistics 72, 73
Illuminating, statistics 72, 73
Lubricating, statistics 72, 73
Price 68
Production by fields 68
increase, notes 67
Wells, logs of 24, 49-59, 62, 63
statistics 68
Oil Springs.
See also next two refs.
Gas statistics 5
Oil Springs gas field.
Production 3
Oil Springs oil field.
Wells, production and statistics 68
Oil Springs Oil and Gas Co., Ltd.
License 21
Oneida tp.
See also Hagersville.
Gas statistics 7
wells, logs of 32, 33
production 9
Onondaga formation 48, 49, 54, 59
Onondaga gas field, production 3
Onondaga tp.
See also Onondaga gas field.
Gas statistics 6
wells, logs of 22, 23
production 9
Oil production 68
Ontario Salt Co.
Gas plant, leakage 14
Open flow, gas wells, statistics 8, 9
Ordovician formations. *See* Logs of wells.
Orford tp.
See also Bothwell oil field; Highgate.
Gas statistics 6
Oil 67, 69
wells, logs 49, 50
Oriskany formation 48, 54, 62
Otterville Natural Gas Synd.
License 20
Logs, dry holes 37, 42-44
gas wells 37, 42-44

PAGE
Oxford co.
Gas statistics ... 6
Oil ... 71
Oxford tps. *See* East, West Oxford tps.

P

Paraffin wax, statistics ... 72, 73
Paris.
Gas statistics ... 5
leakage ... 14
Parmenter, M. D., license ... 18
Patterson, F. L.
Logs, dry holes ... 55, 58
oil wells ... 58
Patterson, W. C.
Licenses ... 18, 20
Logs, dry holes ... 26, 34, 44-46, 65
gas wells ... 26, 33, 34, 44, 46, 65
Pattinson, Ladd and Kabana.
Gas well, log ... 52
Pattinson, Ladd and Ziegan.
Gas well, log ... 51
Peel co.
Dry hole, log ... 64
Gas wells, production ... 9
Pelham tp.
See also Fenwick.
Gas statistics ... 7
Perkins, J. E., license ... 19
Petrol Oil and Gas Co., Ltd.
Gas wells, logs ... 23, 33
License ... 20
Petroleum.
See also Oil.
Imports ... 72, 73
graphs ... 70
Price ... 68, 73
Production ... 72
Refining operations ... 71, 72
Rept. on, 1934, by R. B. Harkness ... 67-73
Petroleum coke, statistics ... 72
Petrolia.
See also next ref.
Gas statistics ... 5
leakage ... 13-15
Oil refinery ... 71
Petrolia oil field, production ... 68
Picard, E. M., license ... 18
Pipe lines.
Licenses to operate ... 17, 21
Total length in use ... 13
Welded, winter laying of, photo ... 13
Plympton tp.
See also Wyoming.
Gas statistics ... 6
Log of well showing gas and oil ... 58
Oil production ... 68
Point Edward, gas statistics ... 5
Pope and Ryan.
Dry hole, log ... 48
Population, towns, cities, townships ... 4-7
Port Burwell.
Gas statistics ... 5
leakage ... 14
Port Colborne, gas statistics ... 5
Port Colborne–Welland Natural Gas and Oil Co., Ltd.
Licenses ... 18-21
Logs, dry holes ... 22
gas wells ... 22, 23

PAGE
Port Credit, oil refinery ... 71
Port Dover, gas statistics ... 5
Port Lambton.
Gas statistics ... 5
leakage ... 14
Port Rowan, gas statistics ... 5
Potsdam formation ... 64
Prairie Gas and Oil Co., Ltd., license ... 20
Premier Oils, Ltd., license ... 20
Preston, gas statistics ... 5
Price.
Licenses ... 17
Natural gas ... 3-7
Oil, crude ... 68
Private wells, gas statistics ... 3, 7, 9
Prospecting for natural gas, licenses ... 17, 18
Provincial Natural Gas and Fuel Co. of Ont., Ltd., licenses ... 20, 21
Puce Creek, oil field ... 71

Q

Queenston formation ... 23, 48, 49, 64, 65

R

Raeburn, James, license ... 19
Rainham tp.
See also Fisherville.
Gas statistics ... 7
wells, logs of ... 33, 34
production ... 9
Rainham Gas Syndicate, license ... 20
Raleigh tp.
See also Chatham; Declute gas field; Merlin.
Gas statistics ... 6
leakage ... 16
wells, logs of ... 50, 51
production ... 8
Oil production ... 68
wells, logs of ... 50, 51
Randolph Syndicate.
Gas well, log ... 23
License ... 20
Rawlings, George H., license ... 18
Reaume, Earl, license ... 18
Red Medina formation ... 22-50, 59-66
Refined products imported ... 73
Graph ... 70
Refineries, petroleum ... 71
Operations, statistics ... 72
graph ... 70
Regal Gas Syndicate.
License ... 20
Reicheld, Fred W.
Logs, dry hole ... 46
gas wells ... 46
Reichheld, O. E., license ... 18
Rentals paid for gas leases ... 8, 9
Rich Gas Co., license ... 20
Ricker, Arthur, license ... 19
Ridgetown.
Gas statistics ... 5
leakage ... 13-15
Ridgeway, gas statistics ... 5
Rigs, drilling, total operated ... 11
Oil only ... 69
Roberts, J. R., license ... 18
Rochester formation.
In bore-holes ... 23, 33, 48, 49, 57-59, 64-66

PAGE

Rochester tp.
See also Belle River.
Gas statistics 6
leakage 16
Oil 71
Rock pressure in gas wells 8, 9
See also Logs of wells.
Rodgers, Alexander, license 18
Rodney, gas statistics 5
Romney tp.
See also Coatsworth.
Gas statistics 6
wells, production 8
Rons, Murray D., license 18
Rose Valley Natural Gas Syndicate.
License 18
Rowe, E. P.
License 18
Logs, dry hole 62
gas wells 62, 63
Rural lines, leakage 16
Ryan, John J., license 18
Ryan, W. T. *See* Pope and Ryan.

S

St. Anns, gas statistics 5
St. Catharines.
Gas statistics 5
leakage 13-15
St. George.
Gas statistics 5
leakage 14
St. Williams, gas statistics 5
Sales tax, petroleum products 73
Salina formation 23, 33, 49, 64, 65
Sulphur gas in 11
Salina Gas Co., Ltd., license 20
Salt. *See* Logs of wells.
Saltfleet tp.
Gas statistics 7
Sandusk Gas and Oil Syndicate.
Gas well, log 47
Sandwich. *See* Border Cities.
Sandwich East tp.
Gas statistics 6
leakage 16
Sandwich South tp.
Gas statistics 6
leakage 16
Sandwich West tp.
See Border Cities; Windsor.
Sarnia.
Gas statistics 5
leakage 13-15
Oil refinery 71
Sarnia gas field, production 3
Sarnia tp.
See also Point Edward; Sarnia; Sarnia gas field.
Gas statistics 6
wells, production 8
Oil production 68
Savage, Louis, license 18
Scarborough, oil refinery 71
Schafer, Le Roy K., license 18
Schollenberger, Christian, license 18
Scott, Inspector 69
Scullard, Fred B., license 18
Security Oil and Gas Co.
Gas wells, logs 37, 66

PAGE

Selected Natural Gas and Oil Synd.
License 20
Logs, dry hole 33
gas wells 33
Selkirk, gas statistics 5
Seneca tp.
See also Caledonia.
Gas statistics 7
wells, logs of 35-37
production 9
Seneca Gas Co., gas wells, logs 25, 26
Shedden.
Gas statistics 5
leakage 14
Sheehan tract, Dunn tp.
Dry hole, log 26
Sherbrooke tp.
Gas statistics 7
wells, production 9
Sherbrooke Gas Syndicate, license 20
Simcoe.
Gas statistics 5
leakage 13, 14
Simcoe co. *See* Nottawasaga tp.
Simpson, Chas. A.
License 18
Log, dry hole 24
Smith, E. W., license 18
Smith, H. W., license 18
Smith, Dr. Luke, license 18
Smith, Robt. H.
Gas wells, logs 28
Licenses 18-20
Smithville, gas statistics 5
Snyder, A. D., license 18
Soapstone. *See* Logs of wells.
Sombra.
Gas statistics 5
leakage 15
Sombra tp.
See also Port Lambton; Sombra.
Dry holes, logs 58, 59
Gas statistics 6
leakage 16
wells, acreage 8
South Cayuga tp.
Gas statistics 7
well, log of 37
production 9
South Colchester tp.
See Colchester South tp.
South Dumfries tp.
See also Paris; St. George.
Gas statistics 6
South Grimsby tp. *See* Smithville.
South London, gas leakage 15
South Walsingham tp.
See also Port Rowan; St. Williams.
Gas statistics 6
wells 8
Southern Ontario Gas Co., Ltd.
Gas leakage 14, 15
Licenses 18, 20, 21
Log, gas and oil well 50
Pipe line, Declute field, photo 13
Dover field to Hamilton 11
Southwold tp.
See also Fingal; Shedden.
Gas statistics 6
Sovereign Gas Syndicate.
Gas well, log 47

PAGE

Springvale Gas and Oil Co., Ltd.
License 20
Stamford tp.
See also Niagara Falls.
Gas statistics 7
Standard Gas and Oil Syndicate.
Gas wells, logs 47
License 20
Statistics.
Natural gas 3-16
Petroleum 68, 71, 72
Sterling Gas Co., Ltd., license 20
Stevens King Syndicate.
Dry hole, log 55
Stevensville, gas statistics 5
Stevensville Natural Gas and Fuel Co.
License 20
Stewart, Elgin Russell, licenses 18, 19
Still gas, statistics 72
Stoddard and Darke.
Logs, dry holes 55
oil wells 55, 56
Stover, F. H., and Son.
Licenses 19
Logs, dry hole 48
gas well 48
Straffordville.
Gas statistics 5
leakage 15
Stromwell Gas Syndicate.
Gas wells, logs 29
Stubble, H. H., license 19
Sullivan, George F.
Dry hole, log 59
License 18
Sulphur. *See* Logs of wells.
Sulphur gas.
Eden gas field, notes and analysis ... 11-13
well, photo 12
Sundy, Basil K., license 19
Superior Gas Syndicate.
Gas wells, logs 34
Licenses 20
Surface gas wells, production 9
Sweets Corners Gas and Oil Syndicate.
License 20

T

Tar statistics 72
Temperatures, effect of, on gas consumption 4
Thamesville, gas statistics 5
Thamesville oil field, production 68
Thorold.
Gas statistics 5
leakage 15
Thorold tp. *See* Fonthill; Thorold.
Tilbury.
Gas statistics 5
leakage 15
Tilbury gas field.
Depletion 2
Production 3
Tilbury East tp.
See also Tilbury; Tilbury gas field.
Gas statistics 6
leakage 16
wells, logs of 51, 52
production 8
Oil production 68

PAGE

Tilbury North tp.
Gas statistics 6
Tilbury West tp.
See also Comber.
Gas statistics 6
Tillsonburg.
Gas statistics 5
leakage 15
Oil near 71
Sulphur gas used at 11, 13
Tillsonburg Oil and Gas Co., Ltd.
License 20
Toilet petroleum, statistics 73
Topp, Nathan, license 18
Toronto, oil refineries 71
Towns.
Gas statistics 4, 5
leakage in distribution plants 14, 15
Townsend tp.
See also Waterford.
Gas statistics 6
wells, production 8
log of 63
Townships.
Gas leakage on rural lines 16
statistics 6, 7
wells, logs of 21-66
production 8, 9
Oil wells, production 68
Transmission lines.
Leakage in 13, 15
Length of 13
Trenton formation 48, 49, 64
Tupperville, gas statistics 4
Tuscarora tp.
Gas statistics 6
wells, logs of 23
production 9

U

Union Gas Co. of Canada, Ltd.
Gas leakage 14, 15
Licenses 19, 21
Logs, dry holes 24, 50, 57-59
gas wells 50, 51, 57
United Gas and Fuel Co of Hamilton, Ltd., license 21
Utica formation 48, 49, 64

V

Vaseline, statistics 73
Vienna.
Gas statistics 5
leakage 15
Vittoria, gas statistics 5

W

Wages. *See* Labour statistics.
Wainfleet tp.
Gas statistics 7
wells, production 9
log 65
Wainfleet Oil and Gas Co , Ltd.
Licenses 18, 19
Logs, dry hole 60
gas wells 59-61, 65
Walker, Geoffrey, license 19

PAGE
Walker Salt Corporation, Ltd.
Dry hole, log ... 53
Walkerville. *See* Border Cities.
Wallaceburg.
Gas statistics ... 5
leakage ... 15
Wallacetown, gas statistics ... 5
Walpole tp.
See also Jarvis; Selkirk.
Gas statistics ... 7
exploratory drilling for ... 11
wells, logs of ... 37-48
production ... 9
Walpole Gas Syndicate.
License ... 20
Logs, dry hole ... 48
gas wells ... 48
Walsingham tps. *See* North, South Walsingham tps.
Walter Gas Syndicate.
License ... 19
Logs, dry hole ... 64
gas wells ... 63, 64
Walwark, Geo., and Simpson, C.A.
Log, dry hole ... 24
Warwick tp.
Dry hole, log ... 59
Oil wells, dry ... 68
Water, brackish.
See also Logs of wells.
In oil fields, notes on ... 71
Waterdown, gas statistics ... 5
Waterford, gas statistics ... 5
Waterloo co.
Gas statistics ... 7
Waterloo tp.
See also Hespeler.
Gas statistics ... 7
Wax, paraffin, statistics ... 72, 73
Webber. *See* Lymburner Bros. and Webber.
Welch, James A., license ... 18
Well Drillers' Act ... 17
Welland, gas statistics ... 5
Welland co.
Gas statistics ... 7
wells, logs of ... 64, 65
production ... 3, 9
Welland gas field, production ... 3
Welland County Gas Syndicate.
Gas wells, logs ... 65
Licenses ... 18, 21
Wells, gas.
Classification ... 69
In surface drift ... 3
Logs ... 21-66
Number drilled in 1934 ... 11
Production ... 7-9
Wells, oil.
Classification ... 69
Logs ... 24, 49-59, 62, 63
Statistics ... 68
Wentworth co.
Gas statistics ... 7
wells, logs of ... 66
production ... 3, 9
Wentworth gas field, production ... 3
West Flamborough tp. *See* Dundas.

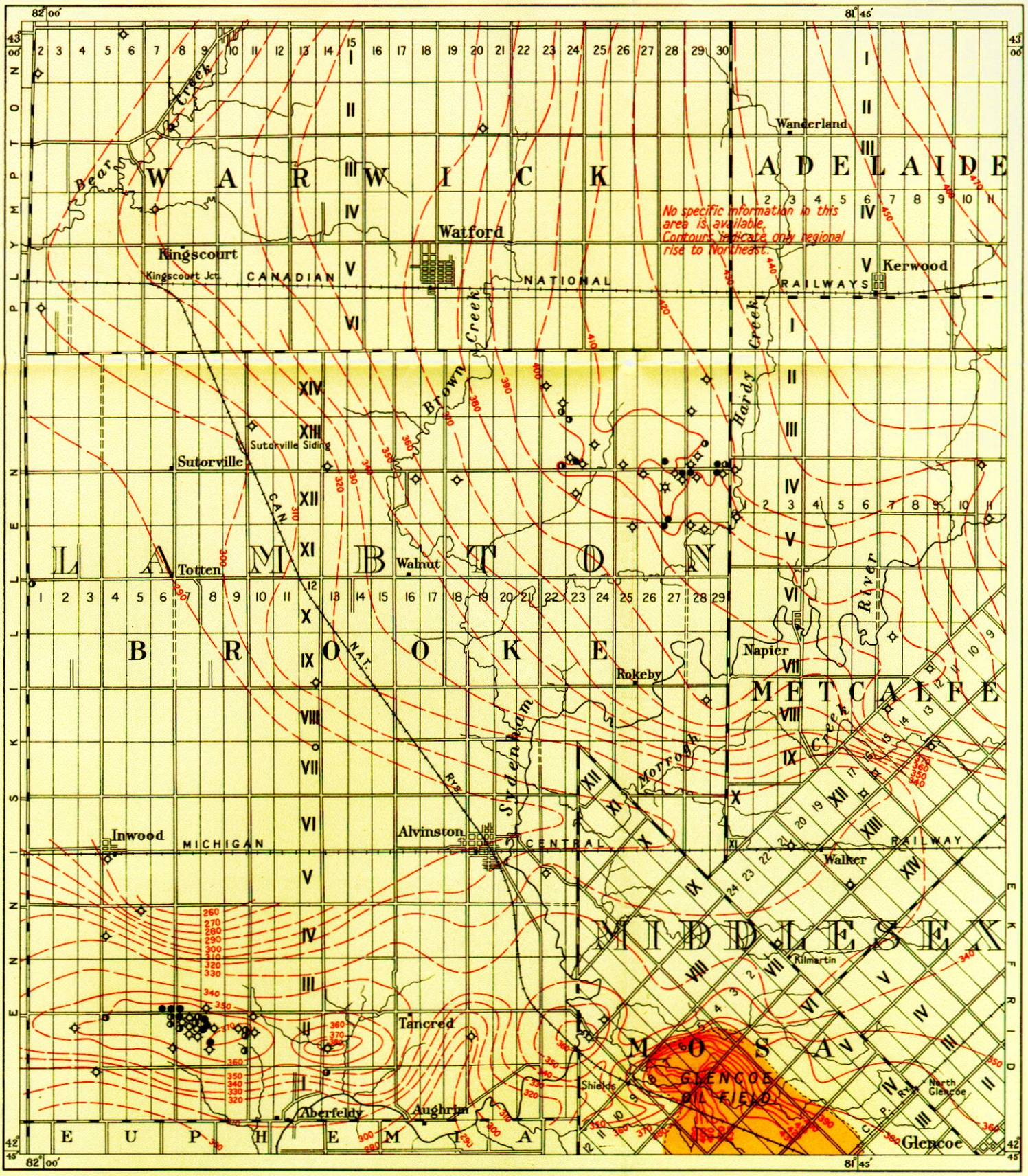
PAGE
West Hamilton, gas leakage ... 15
West Lorne, gas statistics ... 5
West Oxford tp.
Gas statistics ... 6
Western Ontario Natural Gas Co., Ltd.
Gas wells, logs ... 27, 31
License ... 21
Westminster tp.
See also Belmont; Lambeth.
Gas statistics ... 6
Wheatley.
Gas statistics ... 5
leakage ... 13, 15
White, Roy, license ... 18
White Medina formation ... 22-49, 59-66
White Oil and Gas Co., Ltd.
License ... 21
Willits, G. E. and D. E.
Licenses ... 19
Oil well, log ... 49
Willoughby tp.
Gas statistics ... 7
wells, logs of ... 65
production ... 9
Wilson, Abel A., license ... 18
Wilson, Bert.
Dry holes, logs ... 54, 56, 59
Licenses ... 18, 19
Wilson, Leo.
Logs, dry hole ... 55
oil wells ... 56
Wilson, Brown and Sullivan Co.
oil well, log ... 56
Windham tp.
Gas statistics ... 6
wells, logs of ... 63, 64
production ... 8
Windsor.
Gas statistics ... 5
leakage ... 15
Windsor, East. *See* Border Cities.
Windsor Gas Co., Ltd., license ... 21
Woodhouse tp.
See also Port Dover; Simcoe.
Gas statistics ... 6
wells, logs of ... 64
production ... 8
Woodstock.
Gas statistics ... 5
leakage ... 15
Wooster, Joseph T., license ... 18
Wright, David, license ... 19
Wyoming.
Gas statistics ... 5
leakage ... 15

Y

Yager, J. J., license ... 21

Z

Ziegan, Pattinson and Ladd.
Gas well, log ... 51
Zone tp.
See also Bothwell.
Gas statistics ... 6
Oil wells ... 67



Producing oil well

Producing gas well

Show of oil

Dry hole

Structure Contours, defined and assumed, in feet below sea level, on the top of the Delaware (Onondaga) limestone, known locally as the "Big Lime."

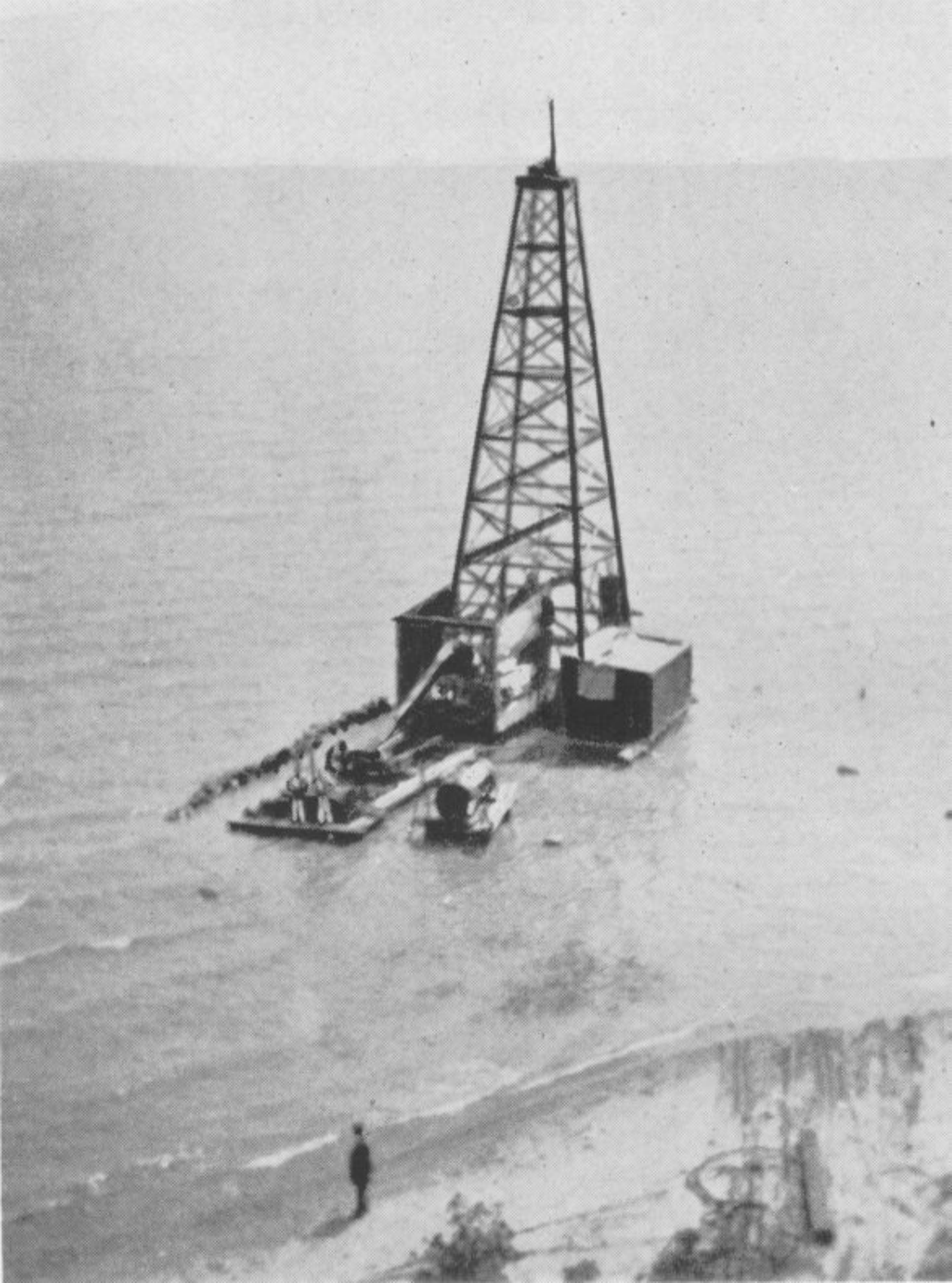
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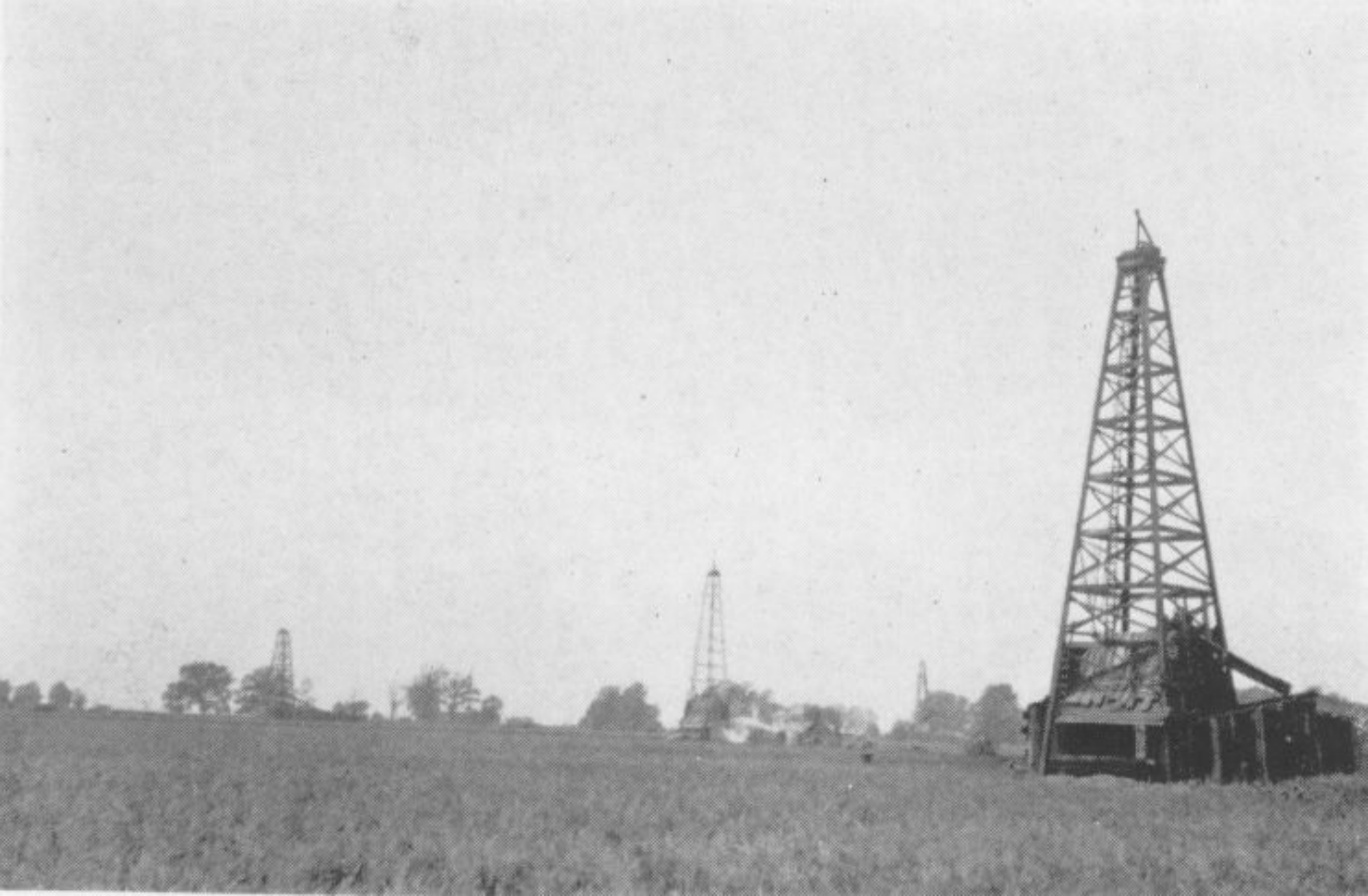
Chains 80 40 0 1 2 3 4 Miles

Structure Contour Map of Brooke Township and Vicinity, showing Oil occurrences.

Prepared in cooperation with the Geological Survey, Department of Mines, Ottawa.

To accompany report by R. B. HARKNESS in Vol. XLIV, Part 5, Ontario Department of Mines Annual Report, 1935.













PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FOURTH ANNUAL REPORT

OF THE

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BEING

VOL. XLIV, PART VI, 1935

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TABLE OF CONTENTS

Vol. XLIV, Part VI

GOLD DEPOSITS IN THE VICINITY OF RED LAKE

PAGE

Introduction 1
Acknowledgments 1
Position and Means of Access 1
Power 2
Previous Work 3
General Geology 3
Carbonate Zones 4
Economic Geology 5
Description of Properties 6
Goldside Mining Company, Limited 6
Wilson Red Lake Gold Mines, Limited 7
Harvey 7
Paul Martin Syndicate 7
Cochenour–Rose Quartz 8
Dorion Island 9
Kert 11
McCuaig Red Lake Gold Mines, Limited 11
McKenzie Red Lake Gold Mines, Limited 11
Gold Eagle Gold Mines, Limited 17
South McKenzie Island Mines, Limited 18
Macandrew Red Lake Gold Mines, Limited 19
Boyle-Rutherford 19
Nortricia Mining Company, Limited 19
Cochenour-Willans Syndicate 23
Martin-McNeely Mines, Limited 24
Rahill Red Lake Mining Company, Limited 25
McManus Red Lake Gold Mines, Limited 25
Red Lake Centre Mines, Limited 26
Howey Gold Mines, Limited 26
General Description of the Deposit 26
The Quartz Porphyry Dike 27
Composition and Age Relationships of Veins 28
Development 29
Milling 30
Production, Operating, and Cost Data 31
McIntyre-Porcupine Mines, Limited 32
Red Lake Gold Shore Mines, Limited 33
Skookum Gold Mines, Limited 35
Madsen Red Lake Gold Mines, Limited 35
Soumi (Finland) 36
Paulore Gold Mines, Limited 37
Red Crest Gold Mines, Limited 37
Rowan Lake Gold Mines, Limited 39
Frontier Red Lake Gold Mines, Limited 40
Graham 40

PAGE

Description of Properties—*Continued*
A.R.L. Gold Mines, Limited 40
Madsen–Sadler Bay 43
West Red Lake Gold Mines, Limited 43
Big-Lode Gold Mines, Limited 46
May-Spiers Gold Mines, Limited 46
Middle Bay Mines, Limited 47
Cardinal Gold Mines, Limited 48
Scott Gold Mining Syndicate 49
Cole Gold Mines, Limited 49
Biron 51
Brown 51
Pendleton 51
Other Properties 52

GEOLOGY OF THE CAT RIVER–KAWINOGANS LAKE AREA

Introduction 53
General Description of the Map Area 53
Acknowledgments 55
History of Exploration 55
Bibliography 56
Means of Access 56
Improvements to Navigation on the Root River 57
Topography 58
Glaciation 58
Natural Resources 59
Forests and Trees 59
Animals, Birds, Fish 60
Water Power 60
Agriculture 60
Inhabitants 61
General Summary of Geological Survey 61
General Geology 62
Keewatin 62
Lava Flows 62
Intrusives 63
Hornblendite, Gabbro, and Diorite 63
Quartz Porphyry Dikes 63
Sediments 64
Greywacké and Quartzite 64
Conglomerate 65
Banded Iron Formation 66
Slate 66
Algoman 66
Granite Gneiss 66
Granite 66
Pegmatite 67
Quartz Porphyry and Feldspar Porphyry 67
Mineralization 68
Structure 69
Faulting 72
Properties 73
Connell-Stirrett-Williams Group 73

ILLUSTRATIONS

PAGE

Aerial photograph of the Howey mine and vicinity ..... *frontispiece*
Rail-power haulage, Sam's portage, Chukuni river 2
Plant of McKenzie Red Lake Gold Mines 13
Plant of Howey Gold Mines 26
Vein structure, Howey mine 27
Specimen of vein matter from the Howey mine 30
Plant of Red Lake Gold Shore Mines 32
Plant of West Red Lake Gold Mines 43
Drill rig of May-Spiers Gold Mines 47
Plant of Cole Gold Mines 50
Oblique aerial photograph looking southwest on Bamaji lake 54
Glacial striae striking southwest, northwest arm of Fry lake 58
Indian cemetery at Slate Falls 61
Keewatin banded sediments intruded by *lit par lit* injections of quartz and granite, north shore of Matapesatakun bay, Lake St. Joseph 64
Contorted iron formation, north shore of Jacknife lake 65
Quartz vein cutting greenstone, northwest of the long west bay of Fry lake 68
Large eastward-plunging pillow-like lava structures, north shore of Rockmere lake 70
View looking east along the strike of the gold-quartz vein on the Connell-Stirrett-Williams claims 71

SKETCH MAPS, PLANS, AND SECTIONS

PAGE

Key map of the Red Lake area showing the location of properties ..... *facing* 6
Geological plan of the surface workings, Paul Martin Syndicate 8
Sketch map showing the general geology in the vicinity of Mackenzie island 9
Geological plan of the surface workings, McKenzie Red Lake Gold Mines 10
Plan of underground workings, McKenzie Red Lake mine 14
Transverse vertical projection through the shaft of the McKenzie Red Lake mine 15
Plan of underground workings, Gold Eagle mine 18
Geological plan of surface workings, Nortricia Mining Company 20
Geological plan of the 175-foot level, Nortricia mine 21
Geological plan of the surface workings, Cochenour-Willans Syndicate 22
Transverse vertical projection through the shaft, Nortricia mine 23
Vertical section showing removal and preservation of zone of pre-glacial weathering, Cochenour-Willans Syndicate 24
Transverse vertical projections at 200-foot intervals along the ore zone, Howey mine ..... *facing* 26
Longitudinal vertical projection through the shaft of the Howey mine ..... *facing* 30
Surface plan of vein on claim No. 820, Red Lake Gold Shore Mines 33
Official plan of underground workings, Red Lake Gold Shore mine 34
Geological plan of surface workings, claim No. 10,235, Red Crest Gold Mines 38
Geological plan of workings, southeast corner of claim No. 6,181, Rowan Lake Gold Mines 39
Geological sketch map of the Madsen–Sadler Bay claims 41
Geological plan of surface workings, West Red Lake Gold Mines 42
Transverse vertical projection through the shaft of the West Red Lake mine 44
Geological plan of the surface workings, Big-Lode Gold Mines 45
Plan of surface workings, Cardinal Gold Mines 48
Key map showing the location of the Cat River–Kawinogans Lake area 53
Sketch map of the Cat River–Kawinogans Lake area show the section burned during the fire of July, 1932 59
Sketch map illustrating the folding of the Cat River–Kawinogans Lake belt of Keewatin greenstones and sediments 70
Geological sketch map of the Connell-Stirrett-Williams group of claims 72

COLOURED GEOLOGICAL MAP

(In pocket at back of report)

Map No. 44f—Cat River–Kawinogans Lake Area, District of Kenora (Patricia Portion), Ontario. Scale, 2 miles to the inch



AERIAL PHOTOGRAPH OF THE HOWEY MINE AND VICINITY, MARCH, 1936.

Gold Deposits in the Vicinity of Red Lake

By M. E. Hurst

INTRODUCTION

Interest in the mineral possibilities of the Red Lake area was greatly stimulated by the discovery of the Howey mine in 1925. During the next year or so a large number of claims were staked and considerable surface exploration was done in various parts of the area. While this activity led to the discovery of several gold-bearing deposits, development of the showings was handicapped to such an extent by the high costs of transportation and by the economic conditions then prevailing that operations were largely discontinued and many of the holdings were either abandoned or allowed to lie dormant. During the next few years development work was confined chiefly to the Howey mine. A marked revival of interest in the area took place early in 1933 and has continued to the present time (1936). This renewed activity, while due primarily to the increased price of gold, has been further stimulated by the greatly reduced cost of freight transportation, by the availability of cheap hydro-electric power, and by the low operating costs attained at the Howey mine.

In this report the writer presents descriptions of the principal gold occurences and a summary of development work accomplished during recent years. The field work in this connection was done during the summer of 1933 and during part of August and September, 1934. This report also includes such official information as was available to the writer concerning development work done during 1935.

Acknowledgments

The field work was greatly facilitated by the co-operation of those engaged in prospecting, developing, or operating properties in the area, and the writer wishes to acknowledge his indebtedness to the many individuals who contributed information which has been embodied in this report. He desires particularly to express his appreciation of the assistance and hospitality accorded him by E. Futterer, resident manager, and other members of the staff of Howey Gold Mines; by W. P. Mackle and J. W. Shaw, of McKenzie Red Lake Gold Mines; by N. S. Beaton, E. G. Bishop, M. Bouzan, W. M. Cochenour, J. Y. Cole, Jr., T. W. Dean, A. Gillies, G. Glendinning, W. S. Hall, R. Halpenny, Sr., A. H. Honsberger, W. S. Livingston, M. Madsen, O. May, J. L. Ramsell, W. M. Rice, G. H. Scott, and C. E. St. Paul; and by officials of the transportation companies.

The plans and vertical projections of the underground workings of Howey Gold Mines, McKenzie Red Lake Gold Mines, Gold Eagle Gold Mines, Nortricia Mining Company, and Red Lake Gold Shore Mines, included in this report, were obtained through the courtesy of the managements of these companies.

During the field season of 1933, V. B. Meen rendered able and efficient service as assistant to the writer.

Position and Means of Access

Red lake lies in the district of Kenora, Patricia portion, about 100 miles northwest of Hudson on the Canadian National railway. Express, mail, and passenger service is maintained throughout the year by commercial airlines

operating from Sioux Lookout, Hudson, and Kenora. During the season of open waterways, a regular boat service provides passenger and freight transportation between Hudson and Red Lake. The trip requires two days. A considerable lowering in the costs of transportation by water has been achieved by the construction of rail and power haulage over the four portages that occur along the route. During the summer of 1934 the freight rate from Hudson to Red Lake was $22.50 per ton. A radio station, operated by the Ontario Forestry Branch, provides communication with Sioux Lookout.



Rail-power haulage, Sam's portage, Chukuni river, June, 1933.

Power

The area is served with electric power from the plant of the Hydro-Electric Power Commission at Ear falls on the English river, 40.6 miles southeast of the Howey mine. This plant was constructed in 1929 and has an estimated capacity of 5,000 horse-power. The transmission line is owned by the Howey mine and was erected at a cost of approximately $190,000. The power costs $25 per horsepower year at the generating station and, after allowance for depreciation, line loss, etc., about $40 per horsepower year delivered at the mine. During 1934, the connected load at the Howey mine was about 3,225 horse-power.

During 1935 transmission lines were extended from the Howey mine to McKenzie Red Lake and Red Lake Gold Shore mines.

Most of the other operations in the area are being supplied with power for underground development work from individual steam plants using cordwood as fuel.

Previous Work

The earliest reference to the geology in the vicinity of Red Lake is contained in a report[1] by D. B. Dowling, who visited the area in 1893. In 1922 and 1923, E. L. Bruce made a preliminary examination of the area. His report, accompanied by a geologically coloured map, is contained in part 4, Volume XXXIII, of the Ontario Department of Mines. In 1926, E. L. Bruce and J. E. Hawley re-examined the geology of the area and visited the properties on which development work was being done. Their observations, together with a revised geological map, are contained in part 3, Volume XXXVI, of the Ontario Department of Mines.

GENERAL GEOLOGY

For a detailed description of the distribution and character of the various formations and rock types occurring in the area the reader is referred to the report by E. L. Bruce and J. E. Hawley. The general geology of the area is briefly summarized below.

Table of Geological Formations

QUATERNARY	
PLEISTOCENE:	Glacial deposits, stratified lake clays.
PRE-CAMBRIAN	
ALGOMAN:	Lamprophyre and diabase dikes. Granite, granodiorite, diorite, and allied porphyries. Quartz porphyry.
TIMISKAMING:	Slate, greywacké, arkose, conglomerate.
POST-KEEWATIN (?):	Diorite.
KEEWATIN:	Greenstones, volcanic fragmental rocks, rhyolite, iron formation, schists.

The consolidated rocks in the vicinity of Red lake are all pre-Cambrian in age. Only remnants of the oldest formations remain. These consist of a group of dominantly volcanic rocks, regarded as Keewatin in age, overlain by a considerable thickness of sediments, tentatively classified as Timiskaming. These formations occur in a belt, 3 to 12 miles wide, which extends from east to west for more than 30 miles. They rest upon and are bounded on the north and south by batholithic intrusions of granite. Prior to or during the granitic invasions, the greenstones and sediments were compressed into steeply dipping folds. This deformation gave rise to planes or zones of structural weakness, along which dikes and irregularly shaped masses of quartz porphyry were introduced. The emanations given off by these intrusions are believed to have been responsible for the carbonatization of the greenstones and the formation of bodies of ferro-dolomite.

Prior to the introduction of the quartz veins, the peripheral portions of the granitic intrusions as well as the adjoining greenstones and sediments were penetrated by narrow dikes of lamprophyre, diorite, and rocks of similar types.

[1] D. B. Dowling, Geol. Surv. Can., Vol. VII, pt. F, 1894.

A widespread structural disturbance followed the solidification of the granite and quartz porphyry intrusions and of the dikes associated with them. To some extent, this readjustment followed earlier lines of weakness and in addition gave rise to the fractures that traverse the granite and porphyry bodies as well as the older rocks. Into these open spaces were introduced the residual emanations of the granitic magma, including the auriferous quartz veins. Igneous activity ended with the intrusion of certain lamprophyre and feldspar porphyry dikes that cut the quartz veins. Since the close of the pre-Cambrian the area has been subjected to almost continuous erosion. The residual products of weathering have been largely removed by glaciation, and the relatively fresh bedrock surface is extensively covered by a mantle of glacial drift and lacustrine deposits.

Carbonate Zones

Bodies of carbonate rock occur in many parts of the area. They consist of (1) ferrodolomite or (2) crystalline limestone.

1. Zones composed of rusty-weathering carbonate are widely distributed throughout the belt of greenstones. Representative samples from typical occurrences of this type were submitted to the Provincial Assay Office for analysis. The results given below indicate that the material may be classified mineralogically as ferruginous dolomite or, more concisely, ferrodolomite.

	No. 1	No. 2
	per cent.	per cent.
SiO_2	4.27	5.60
Al_2O_3	.69	nil
Fe_2O_3	.56	.80
FeO	3.86	3.55
CaO	29.12	29.49
MgO	18.25	17.89
K_2O	trace	nil
Na_2O	trace	nil
TiO_2	trace	nil
P_2O_5	.08	trace
MnO	nil	.19
CO_2	43.06	42.63
H_2O	.25	.15
S	trace	trace
Total	100.14	100.30
Specific gravity	2.894	2.883

Sample No. 1—Cochenour-Willans property.
Sample No. 2—Nortricia Mining Company.

The ferrodolomite bodies occupy zones of fracturing in greenstones and iron formation or along porphyry-greenstone contacts. They occur almost invariably in close proximity to intrusions of quartz porphyry. Where exposures of porphyry are lacking, the carbonatization is believed to be structurally and genetically related to intrusions that solidified a short distance below the present surface.

The ferrodolomite occurs in the form of veins, stockwork breccias, and masses of lenticular or irregular outline. These bodies range from a few feet to 100 feet in width and may extend for several hundred feet along the strike. Many of the deposits contain angular inclusions of country rock and occasionally nests or radiating aggregates of pale-green actinolite. As a rule the boundaries between ferrodolomite and greenstone are sharply defined, although, in some instances, the carbonatization appears to diminish gradually from the plane of greatest

disturbance outward into the adjoining rock. In the writer's opinion most of the ferrodolomite was deposited in open spaces created during the introduction of the quartz porphyry intrusions. Evidence can be found indicating that the deposits may be due in part to replacement of the host rocks, but the extent to which this process has been operative cannot be clearly established.

Some of the ferrodolomite zones have been affected by later structural readjustments. These movements gave rise to intersecting sets of fractures, in which gash veinlets of gold-bearing quartz were subsequently deposited. The quartz stringers are very erratically distributed and, as a rule, form only a very small part of the total volume of a carbonate zone. Where such zones have been deeply weathered, it is usual to find that, owing to the disintegration of the auriferous quartz veinlets, the decomposed outcrops contain a residual concentration of gold.

2. Several bodies of crystalline limestone have been found in the western part of the area in association with bands of siliceous iron formation and greenstone. The largest exposure occurs along the west shore of Hahn lake. The limestone is white, grey, or buff in colour and in places contains streaks and bands of chert and some pyrite and pyrrhotite. A sample of the best-looking material was submitted to the Provincial Assay Office for partial analysis. It yielded:—

	Per cent.
SiO_2	0.37
Al_2O_3	2.14
Fe_2O_3	1.38
CaO	53.27
MgO	.82

An exposure of limestone, about 20 feet in width, occurs on claim No. 10,205, midway along the west shore of Golden arm. In addition to stringers and bands of cherty silica, it contains streaks of chloritic material and patches of pyrite and pyrrhotite.

ECONOMIC GEOLOGY

Gold is the chief mineral of economic value in the area. Until recently all the production was derived from the Howey mine. From the commencement of milling operations in April, 1930, to the end of 1935, this property produced bullion valued at $6,715,955. In March, 1935, McKenzie Red Lake Gold Mines came into production. There is reasonable hope that, if the present price of gold is maintained and operating costs are not increased, some of the other deposits undergoing development will be of economic importance.

The gold-bearing deposits consist chiefly of auriferous quartz veins. They are widely distributed throughout the area and occur not only in the greenstones, sediments, and quartz porphyry bodies but also in the granitic rocks. The veins are of the fissure type and represent the filling of open spaces created by shearing and fracturing. The mineralizing solutions are believed to have been derived from the granite intrusions during the final stage of consolidation.

Examination of the vein structures reveals the fact that during the main period of mineralization, the deposition of vein matter took place in several stages or generations, separated from one another by minor structural readjustments, which served to create new fractures or to widen those already existing. In most instances, gold deposition appears to have accompanied the early generations of vein matter rather than those introduced toward the close of the period of mineralization. In many veins two or more generations of vein matter can be recognized.

In the Howey deposit the earliest generation of vein matter consists of quartz containing coarsely crystalline pyrite. These veins have been reopened and the pyrite shattered, the fractures being occupied by a later generation of quartz containing zinc blende, galena, and native gold. This type of vein matter appears to be much smaller in volume and more erratically distributed than the original vein-filling. Assays of selected samples indicate that the quartz originally deposited with the pyrite is barren, that the unfractured pyrite contains a comparatively low gold content, and that the major portion of the gold was introduced with the second generation of vein matter. In mining, the presence of zinc blende and galena invariably indicates ore sections of higher than average grade. In this instance, the original vein-filling has been enriched by the introduction of later vein matter.

At the McKenzie Red Lake mine the original vein-filling consisted of quartz containing native gold, together with small percentages of zinc blende, galena, arsenopyrite, pyrite, and jamesonite. This has been diluted in places by the introduction of a later generation of quartz containing negligible gold values.

Only a small proportion of the area has been carefully and systematically prospected. Such exploration has been handicapped in some sections by heavy overburden, dense vegetation, slash, or windfalls. Although many of the gold-bearing veins are narrow and discontinuous, their wide distribution, together with the generally favourable geological conditions, lends hope that a more intensive search will uncover additional deposits of economic importance. Structural conditions favourable for the occurrence of such deposits are most likely to be found about the margins of bosses of granite and quartz porphyry, at bends in the contacts between the granite and greenstones or sediments, along contacts between rocks of widely different texture and composition, and in places where the greenstones or sediments have been traversed by numerous dikes.

DESCRIPTION OF PROPERTIES

This section contains descriptions of most of the properties in the vicinity of Red lake on which development work has been done since 1925. The reader is referred to the report by E. L. Bruce and J. E. Hawley[1] for descriptions of the following properties or company holdings, which have been idle during recent years: Red Lake Prospectors Syndicate; Coniagas, claims K.1,525–1,529; Victoria Syndicate; Lang; Noranda Mines, Limited; Huronian Belt; Chukuni Red Lake Syndicate; Dunlop Red Lake Syndicate; Toronto Red Lake Syndicate; Patricia group; Beaumont; claims K.R.L. 1,516 and 1,517; Dome Mines; Tyrrell Red Lake; and Northern Mineral Areas.

The information concerning the operating properties covers, in most cases, the development work accomplished to the end of 1935.

Goldside Mining Company, Limited

In 1933, the Goldside Mining Company, Limited, acquired from McChesney Gold Mines, Limited, a group of 20 claims located near the north end of East bay and a group of 5 claims lying to the east of the Howey mine.

Development work has been largely concentrated on the East Bay group. The workings are located near the east side of the bay, about three-quarters of a mile from the north end. A series of cross-trenches have been excavated at intervals for a distance of 12 chains along a belt composed of parallel bands of

[1]Ont. Dept. Mines, Vol. XXXVI, pt. 3, 1927.

greenstone separated by tongues and sill-like bodies of quartz porphyry ranging in width from less than a foot to 30 feet. The trend of these formations is N.35°–50°E. Considerable shearing and fracturing have occurred, especially along the greenstone-porphyry contacts. Stringers and bulges of quartz, which for the most part lie parallel to the direction of shearing, have been exposed at widely separated points. These veins range from a fraction of an inch to 12 inches in width and are sparsely mineralized with pyrite, chalcopyrite, and pyrrhotite. Visible gold is said to have been found in some of the showings.

Wilson Red Lake Gold Mines, Limited

Wilson Red Lake Gold Mines, Limited, controls a group of 38 surveyed claims in the East Bay section of Red lake. During the summer of 1933 considerable surface work was done under the direction of C. D. Chisholm and M. Bouzan on claims Nos. 10,322, 10,323, 10,286, and 10,287. The principal workings are located on a peninsula composed of granite that projects from the east side of East bay, opposite East narrows. On the east side of the peninsula just south of the camp, trenching has exposed a 3-foot width of quartz. The vein appears to strike N.75°E. and to dip northwest. Toward the west it is deeply covered by sand and varved clay and toward the east it passes beneath the lake. According to the management, sampling of the showing yielded encouraging values in gold.

Farther south, near the boundary between claims Nos. 10,286 and 10,287, a shear zone has been exposed at intervals for a distance of about 200 feet. This zone strikes in a north-south direction and intersects grey biotite granite. It contains stringers and bulges of quartz that are erratic in strike, dip, and continuity. They range in width from a fraction of an inch to 7 feet. Some of the veinlets contain visible gold in addition to small percentages of pyrite, pyrrhotite, chalcopyrite, zinc blende, and tourmaline.

At the south end of the peninsula, the granite is cut by gash veinlets of quartz, 1 to 4 inches in width. These veinlets are widely separated and quite variable in strike and dip. Visible gold was observed in some of the exposures.

Some trenching has been done near the north end of a peninsula that projects from the west side of East bay, about a mile south of East narrows. The showings are located close to the lakeshore and near the north boundary of claim No. 1,499. The workings have exposed a rusty zone in greenstone, which, over a width of 15 to 20 feet, contains streaks and patches mineralized with galena, zinc blende, pyrite, pyrrhotite, and chalcopyrite.

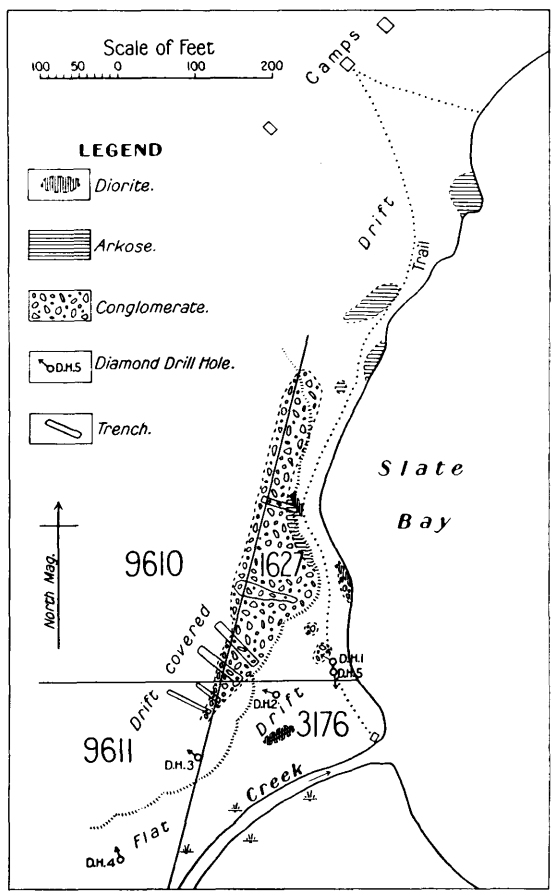
Harvey

The Harvey property, consisting of 9 unsurveyed claims, is located on the west side of the northeast arm of Red lake. The showing occurs on a prominent point about a mile west of Post narrows. Stripping near the lakeshore has exposed an auriferous quartz vein, 1 to 4 inches wide, for a distance of 20 feet. The vein occurs in dark-grey tuff or greywacké cut by tongues of granite. It strikes N.80°E. and passes under the lake toward the west. In addition to visible gold, the quartz contains a little zinc blende, pyrite, and chalcopyrite.

Paul Martin Syndicate

The property of the Paul Martin Syndicate is located at the head of Slate bay. The principal workings occur near the southwest corner of claim No. 1,627, where a series of trenches have been excavated along the east slope of a ridge of

conglomerate and arkose. The sediments have been cut by dikes of diorite. In places the conglomerate contains stringers of black tourmaline and disseminated pyrite and chalcopyrite. Although vein quartz is sparingly present, the mineralized sections are said to carry values in gold. Early in 1931, about 1,000 feet of diamond-drilling, in 5 holes, was done in the vicinity of the showings, but no mineralization of importance was encountered.



Geological plan of the surface workings on the claims of the Paul Martin Syndicate.

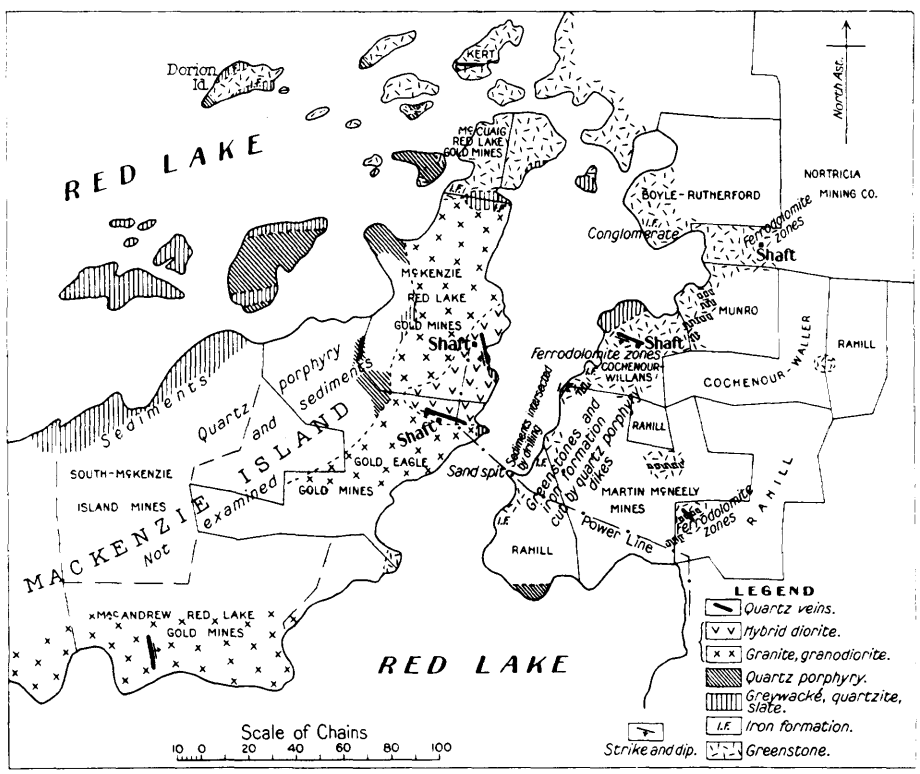
Cochenour-Rose Quartz

The Cochenour–Rose Quartz property is in the northeast corner of Fairlie township. It consists of a group of 7 claims located on the west side, near the entrance, of Slate bay. The principal showings are close to the lakeshore on claim No. 10,047. When the property was visited in 1933, surface workings had exposed two quartz veins in coarse-grained greenstone or diorite. One of these veins is 4 to 10 inches wide and contains streaks and nests of coarsely crystalline pyrite. It strikes N.58°W. and has been traced inland from the water's edge for about 40 feet. The other vein has been uncovered at intervals for about 175 feet. It strikes N.20°W., ranges from a fraction of an inch to 30 inches in width, and is

sparsely mineralized with pyrite. In places, the quartz has a reddish colour, due to the weathering of the pyrite.

Dorion Island

Dorion island is situated about a mile east of the mouth of Slate bay. A geological sketch map of the island and a description of the deposits are contained in a report by G. D. Furse.[1] During 1932, some diamond-drilling was done on the principal showings by Coniagas Mines, Limited.

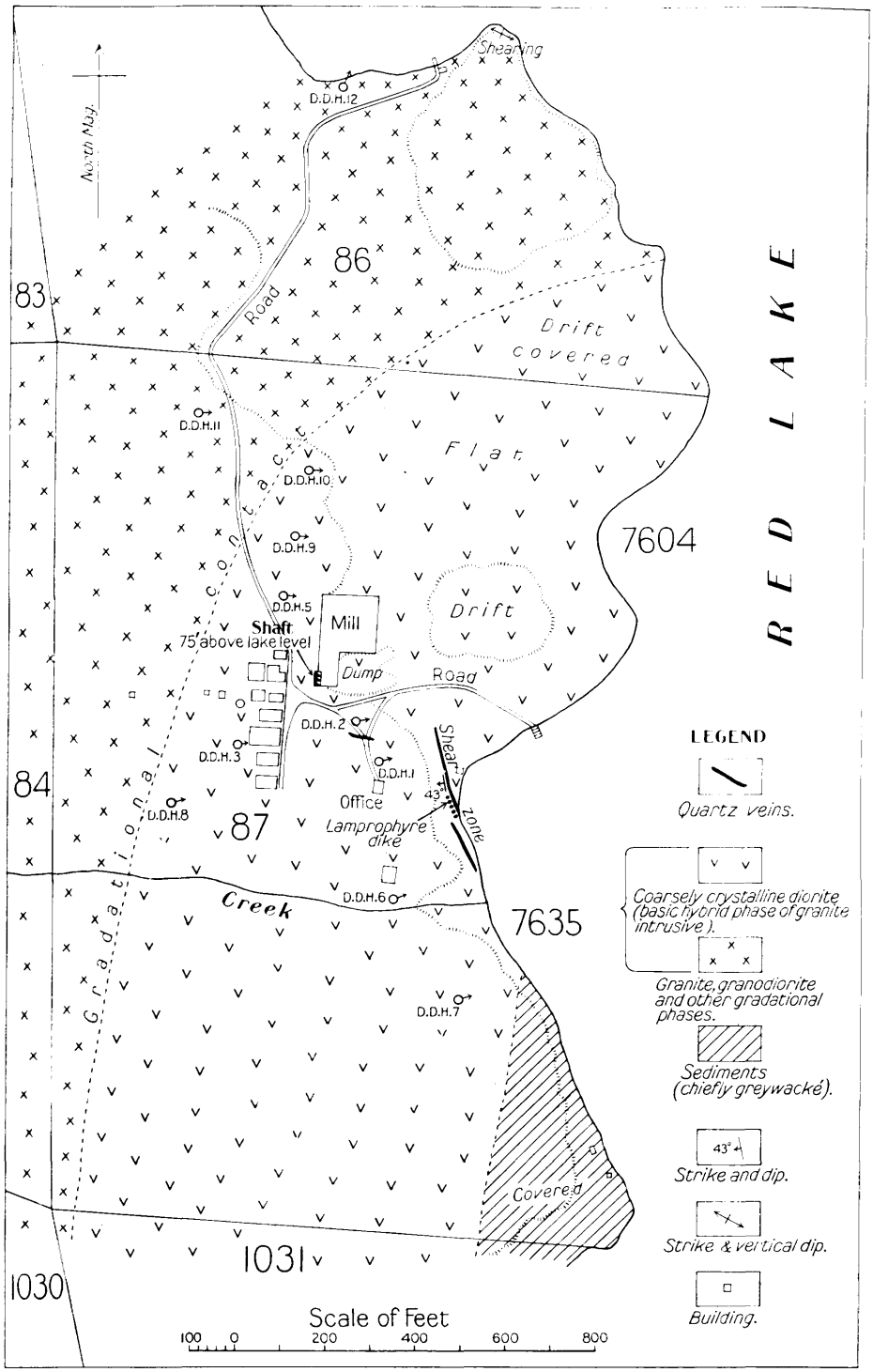


Sketch map showing the general geology in the vicinity of Mackenzie island.

On the northwest side of the island, trenches have been excavated at intervals along a rusty band of cherty iron formation, 30 to 100 feet wide. Gash veinlets of quartz occur here and there in the iron formation, in the adjoining greenstone, and in the tongue of quartz porphyry that cuts these formations. In places the greenstone is heavily mineralized with pyrite.

On the southwest side of the island there is another band of siliceous iron formation, 20 to 40 feet wide, that has been exposed at intervals over a length of 500 feet. Vein quartz is sparingly present. Rusty-weathering patches of sulphides, consisting chiefly of pyrite, pyrrhotite, and chalcopyrite, occur in the iron formation and adjoining greenstones.

[1]Ont. Dept. Mines, Vol. XLII, pt. 6, 1933, pp. 48-51.



Geological plan of the surface workings on the claims of McKenzie Red Lake Gold Mines.

Kert

The Kert property adjoins that of McCuaig Red Lake Gold Mines and consists of part of an island lying to the north of Mackenzie island. The principal showing occurs near the south boundary of claim No. 11,048. Surface workings have exposed a quartz vein, 1 to 17 inches wide, lying along a sheared contact of greenstone, diorite, and a narrow quartz porphyry dike. The vein strikes N.85°W. and has been traced for about 400 feet. The vein matter consists of quartz well-mineralized with zinc blende and galena; the veins contain in addition some pyrite, chalcopyrite, arsenopyrite, ankerite, and tourmaline. Sampling is said to have indicated the presence of low values in gold.

McCuaig Red Lake Gold Mines, Limited

McCuaig Red Lake Gold Mines, Limited, controls a group of 8 claims located on the north end of Mackenzie island and on the adjacent islands. These holdings adjoin those of McKenzie Red Lake Gold Mines on the north. Near the south boundary of the group there is a narrow belt of interbedded greywacké and slate. These rocks strike N.60°E. and lie along the north contact of the Mackenzie Island granite mass. On the east side of the island near the southeast corner of claim No. 10,225, a number of pits have been excavated in the sediments. These workings have exposed several narrow gash veins of quartz, which are sparsely mineralized with chalcopyrite and pyrite and contain, according to the management, some gold. Some shallow drilling was done in the vicinity of the showings, but no commercial widths of ore were encountered. No deposits of value had been reported up to the end of 1934 as a result of surface exploration done on other parts of the property.

McKenzie Red Lake Gold Mines, Limited

The property of McKenzie Red Lake Gold Mines, Limited, consists of a group of 11 surveyed claims and includes the former McNeely holdings on the north end of Mackenzie island. The principal showings are located along the east shore of the island on claim No. 87. In the fall of 1931, Coniagas Mines, Limited, explored the deposit by diamond-drilling. Underground development of the showings was begun by the present company in June, 1933.

The general geology of the northern part of Mackenzie island is shown on the accompanying plan. The tongue of granitic rock that occupies the central part of the island varies in composition from granite to diorite. Along its easterly contact with the greenstone-sediments complex it is quite coarsely crystalline and relatively basic in composition. This basic phase appears to grade without perceptible boundaries into typical medium-grained granite. Although predominantly dark-coloured, it contains nests or patches of coarsely crystalline quartz and pink microcline, which suggests a genetic relationship to the main granite mass. Its hybrid character is believed to be due to assimilation of the adjoining greenstones or sediments.

For the most part, the granitic rocks are pink or grey in colour and medium-grained. They consist of variable proportions of microcline, albite, oligoclase, hornblende, biotite, and quartz and correspond in composition to granite, quartz monzonite, and granodiorite. The coarsely crystalline, dark-coloured phase, in which the quartz veins occur, lies between diorite and gabbro in chemical composition. Under the microscope it is seen to be composed chiefly of broad

laths of andesine, a quarter of an inch to an inch in length, together with minor quantities of hornblende, biotite, apatite, sericite, carbonate, and a little interstitial quartz. Immediately adjoining the veins the diorite usually shows evidence of hydrothermal alteration. It is greenish-yellow in colour and bleached and waxy in appearance. Examination under the microscope shows this change to be due to the alteration of the ferromagnesian constituents to carbonate and chlorite and of the feldspars to carbonate and sericite. Typical specimens of the fresh and altered diorite taken in the vicinity of the veins, were submitted to the Provincial Assay Office for analysis. These yielded the analyses given below:—

	No. 1	No. 2	No. 3
	per cent.	per cent.	per cent.
SiO_2	52.80	44.33	50.95
Al_2O_3	19.58	21.06	17.97
Fe_2O_3	1.94	.90	2.79
FeO	6.01	4.22	4.82
CaO	8.42	7.48	6.51
MgO	4.75	2.63	3.81
K_2O	3.12	4.48	2.26
Na_2O	.79	3.25	3.30
TiO_2	.37	.93	.99
P_2O_5	.28	.33	.35
CO_2	.45	8.75	3.89
H_2O	1.38	1.85	2.24
FeS_2	trace	.....	.51
Total	99.89	100.21	100.39
Specific gravity	2.696	2.817	2.813

Sample No. 1—Fresh diorite.
Sample No. 2—Altered diorite immediately adjoining a quartz vein.
Sample No. 3—Syenitic lamprophyre dike, 350-foot level, 50 feet south of winze.

From analyses Nos. 1 and 2, it is evident that the hydrothermal alteration of the diorite involved a marked loss of silica and considerable gains in soda and carbon dioxide.

Within the zone of shearing and mineralization, the diorite is cut by several dark-coloured lamprophyre dikes ranging from a few inches to 7 feet in width. The age relationships of these dikes to one another have not been definitely determined. The most persistent dike is uniformly fine-grained, massive, and dark-grey in colour. A representative specimen from this dike was submitted to the Provincial Assay Office and yielded the analysis (No. 3) given above. Examination under the microscope shows the rock to be somewhat altered. Of the original constituents, biotite, orthoclase, and quartz can be recognized. The secondary minerals consist of chlorite, carbonate, sericite, and pyrite. The analysis and mineral composition indicate that the rock is more basic than typical quartz porphyry and would be better described as a syenitic lamprophyre. The other lamprophyre dikes appear to be still more basic in composition and as a rule are more highly altered. In places they are dark-green in colour and contain conspicuous flakes of biotite. Elsewhere they have been extensively carbonatized and have a "flecked" appearance due to the presence of scales of chlorite along the planes of shearing.

The principal deposit lies within a shear zone that intersects the coarsely crystalline diorite described above. This zone strikes N.10°W. (mag.), dips

35°–45°W., and ranges from 10 to 30 feet in width. It has been exposed in surface workings for a distance of 300 feet. To the north it is covered by drift and to the south it passes beneath the lake. The shearing and mineralization have been traced by diamond-drilling for a distance of 1,350 feet along the strike.

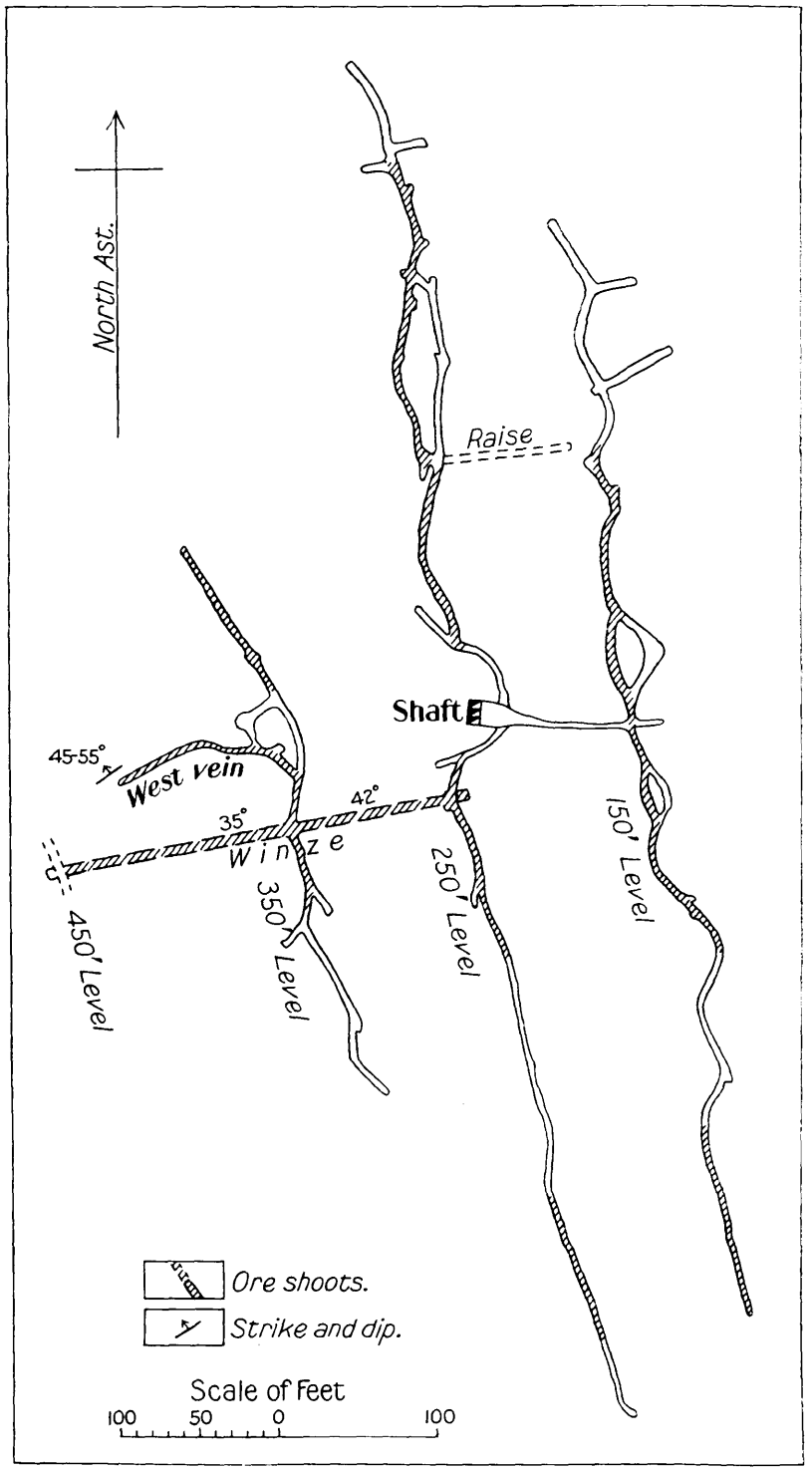
There appears to be a close structural relationship between the lamprophyre dikes and the loci of mineralization within the shear zone. These dikes were intruded along the original plane of weakness in the diorite. Subsequent movement caused local shearing, brecciation, or faulting of the dikes and gave rise to open spaces, chiefly in the adjoining more highly sheared diorite, into which



Plant of McKenzie Red Lake Gold Mines, September, 1933.

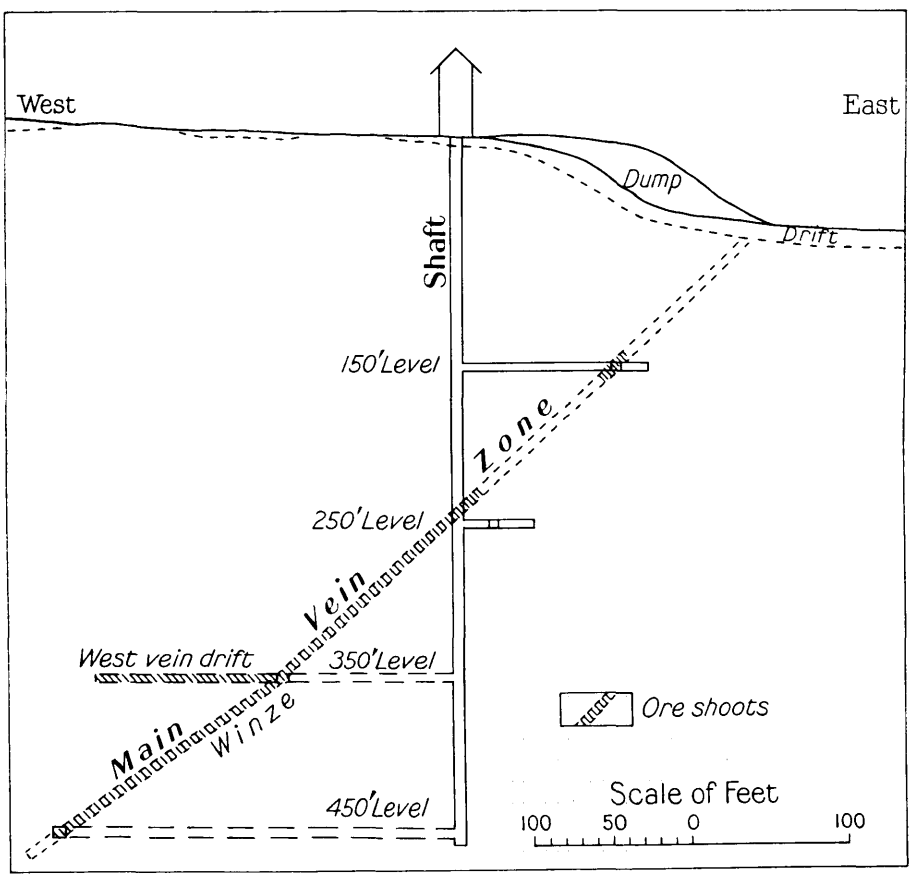
vein matter was later introduced. The distribution of these fractures was influenced if not controlled by variations in the strike, dip, thickness, and physical character of the dikes.

The mineralization occurs in the form of stringers and lenses of quartz, which pinch and swell along the strike and range from a fraction of an inch to 6 feet in width. Two generations of vein matter can be recognized. The earlier generation consists of greyish quartz containing small percentages of pyrite, zinc blende, galena, arsenopyrite, chalcopyrite, and jamesonite, as well as native gold. The later generation of vein matter is composed chiefly of white quartz and ankerite and contains little or no gold. Both generations vary greatly in relative volume from place to place. In some sections of the deposit it is evident that the auriferous veins have been reopened and their gold content considerably



Plan of underground workings, McKenzie Red Lake mine, September, 1934.

diluted by the introduction of later quartz and ankerite. Sampling of the veins indicates that the erratic distribution of the gold is to a large extent due to variations in the relative proportions of the two generations of vein matter. The sheared diorite adjoining the veins is sparsely mineralized with pyrite or arsenopyrite. Although the dike rocks were intruded prior to the mineralization they appear to have been much less favourable for the development of fractures than the adjoining diorite, and hence they contain only a small proportion of the vein matter.



Transverse vertical projection through the shaft of the McKenzie Red Lake mine.

The deposit has been opened up by a 3-compartment vertical shaft, which was begun in the hanging wall and which intersected the main zone of shearing between 190 and 220 feet below the surface. Exploration below the 250-foot level has been carried to a vertical depth of 450 feet by means of an inclined winze sunk in the shear zone at a point about 50 feet south of the shaft. Levels have been established at depths of 150, 250, 350, and 450 feet, and the deposit is being explored by drifts running north and south. In sinking the winze from the 350-foot level to the 450-foot level, the dip of the shear zone was found to decrease from 43 to about 35 degrees. Early in 1935, the shaft was extended to the 450-foot level.

The ore shoots in the main shear zone occur chiefly in soft sheared diorite and in close proximity to the hanging wall or footwall of a persistent lamprophyre dike. It is believed that there is a definite structural relationship between the location of the gold-bearing veins and the variations in width, strike, and dip of the dike. Owing to the width of the shear zone, which is as much as 30 feet in places, the presence of unmineralized dikes within it, and the erratic distribution of the auriferous lenses and stringers of quartz, considerable exploration and sampling are necessary in order to delimit the ore shoots. Stoping operations have shown the ore shoots on the two upper levels to be wider than preliminary exploration indicated, the average stope width being about 10 feet.

During the summer of 1934, a well-defined vein was encountered on the 350-foot level at a point about 40 feet north of the winze. This vein, which is known as the West vein, branches to the west from the main shear zone and follows a narrow lamprophyre dike. It ranges from 1 to 7 feet in width and appears to dip about 50° N. Up to December, 1935, it had been drifted on for about 450 feet. A raise put up at a point about 100 feet west of the main drift encountered another vein roughly parallel to the main shear zone. This vein has been followed for 120 feet and is believed to join the main "break" toward the south. During 1935, the West vein was also opened up at the 150-, 250-, and 450-foot levels. At the 250-foot level it has been followed for 400 feet west from the main shear zone. Another vein has been encountered in the hanging wall about 12 feet north of the West vein.

At the 250-foot level, a crosscut has been run eastward into the footwall of the main shear zone at a point 360 feet north of the shaft. At a distance of 98 feet the crosscut intersected a parallel shear zone containing gold values.

According to the management, the following ore sections had been indicated by development work up to November, 1934:—

	Length	Average width	Gold content
	feet	feet	oz. per ton
MAIN ZONE:			
Surface	240	5.4	0.53
150-foot level	400	5.3	.39
150-foot level	150	5.2	± .42
250-foot level	580	5	.42
250-foot level	100	5.2	.29
350-foot level	375	5.3	.435
WEST VEIN:			
350-foot level	165	5.5	.416
WINZE:			
250- to 450-foot level	319	4.7	.835

In November, 1934, ore reserves indicated by development work down to the 350-foot level were reported by the management to be approximately 97,000 tons, containing 0.437 ounces of gold per ton over an average width of 5.25 feet. This estimate does not include ore in the dump or ore indicated by drifting on the 450-foot level. Development during 1935 is said to have added considerably to the estimate of ore reserves given above. New ore has been found in the main shear zone, particularly to the north on the 350-foot level, where a shoot of better than average grade and up to 15 feet in width is said to have been followed for a length of 125 feet. Stoping on the 150-foot level is said to have extended the ore length 100 feet farther south. On the 450-foot level, drifting north on

the hanging-wall side of the dike is said to have exposed ore of good grade and width for a length of 140 feet. Exploration of the West vein and of the parallel vein structures has indicated several ore shoots of mineable width.

Delivery of hydro-electric power was begun in January, 1935, over a transmission line, 5½ miles in length, that connects the property with the Howey mine. Erection of a steel-frame mill having an initial capacity of 125 tons a day was completed in February, 1935. The flow-sheet provides for sorting of waste and recovery of the gold by cyanidation. During December, 1935, the mill treated an average of 133 tons per day.

Production from the commencement of milling operations on March 1, 1935, to the end of 1935 was as follows:—

Tonnage hoisted		42,113
Tonnage sorted		5,996
Tonnage milled		36,117
Gold recovered	ounces	15,113.45
Silver recovered	ounces	2,771.31
Average gold content per ton milled	ounces	0.418
Per cent extraction		98.1
Value of bullion produced, in Canadian funds		$532,987.23

Gold Eagle Gold Mines, Limited

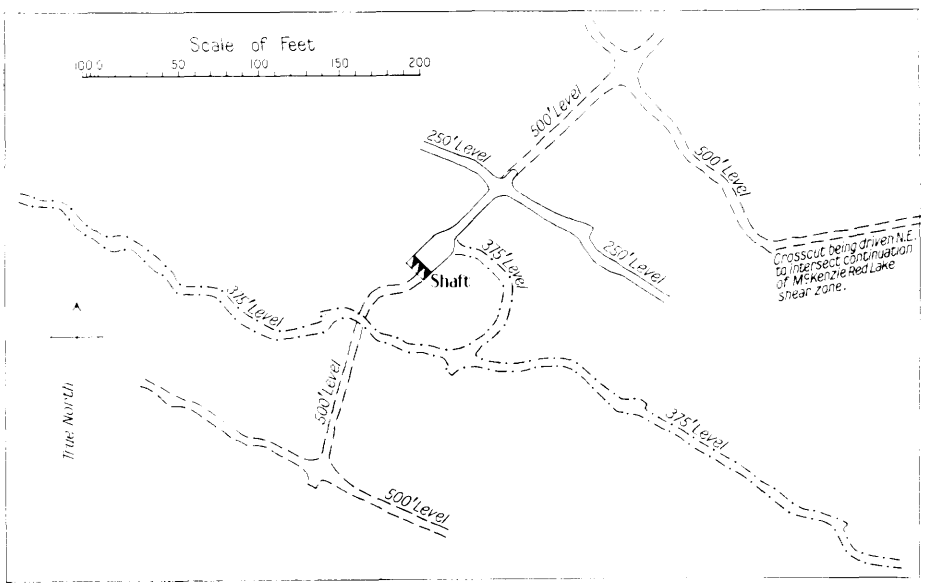
Gold Eagle Gold Mines, Limited, controls a group of 25 claims adjoining McKenzie Red Lake Gold Mines on the south and west. During the winter of 1933–34, an attempt was made to trace by diamond-drilling the southward continuation of the vein zone being developed by McKenzie Red Lake Gold Mines. A series of holes was drilled eastward beneath the lake immediately south of the McKenzie Red Lake boundary. Most of the holes began in massive granodiorite or diorite and passed toward the east into quartz porphyry. In several holes, vein matter containing values in gold was intersected, but from the data available these occurrences cannot be correlated.

The coarse-grained diorite in which the McKenzie Red Lake deposit occurs extends southward into the northeastern part of the Gold Eagle property. During the summer of 1934 considerable surface exploration was done in this section under the direction of A. Gillies. This work led to the discovery on claim No. 10,631 of a persistent fracture zone containing stringers, veins, and lenses of auriferous quartz. This zone strikes N.63–70°W. (mag.) and dips 60°–70°S.W. It ranges from 1 to 8 feet in width and has been traced by pits and trenches for a distance of 900 feet. In the most easterly workings the fracture zone passes from diorite into quartz porphyry. The quartz occurs in parallel or branching veins, a fraction of an inch to 3 feet in width, contained in or separated by massive, sparsely mineralized diorite. In addition to quartz, small percentages of pyrite, arsenopyrite, zinc blende, galena, jamesonite, ankerite, and native gold are present in the vein matter. Two generations of vein quartz can be recognized. The gold appears to be confined to the earlier generation, and this is believed to account for its erratic distribution in the surface showings.

In November, 1934, a 3-compartment shaft was begun in the hanging wall about 170 feet southwest of the central part of the vein zone exposed in the surface workings. By April, 1935, the shaft had been completed to a depth of 525 feet. The lateral exploration accomplished at the 250-, 375-, and 500-foot levels up to the end of 1935 is shown on the accompanying plan. The main vein zone was intersected at a point 69 feet northeast of the shaft at the 250-foot level, at a depth of 315 feet in the shaft, at a point 45 feet south of the shaft at the 375-foot level, and at a point 145 feet south of the shaft at the 500-foot level.

This exploration shows the dip of the vein between the 250- and 500-foot levels to be about 50 degrees, which is slightly less than the dip between the surface and the 250-foot level.

A crosscut driven northeast at the 500-foot level intersected a minor vein structure at a distance of 181 feet from the shaft. This was followed to the southeast for 150 feet, at which point a crosscut was started to the northeast. It is expected by the management that this crosscut will intersect a vein, indicated by drilling from the surface, at a distance of 500 feet and the projected continuation of the main shear zone of McKenzie Red Lake Gold Mines at a distance of 800 feet.



Plan of underground workings, Gold Eagle mine, October, 1935.

In a progress report issued by the company on December 3, 1935, the following information is given regarding the ore shoots indicated by development work up to that time:—

On the 250-foot level, there is a body of ore 40 feet long, having an average width of 31 inches and an average grade of $5.51. Twenty-seven feet farther on we have a 20-foot length, averaging $13.00 over 33 inches. As this drift is 125 feet long, about one-half of it is ore. On the 375-foot level, in the west drift, there is a length of 50 feet with an average width of 26 inches, having an average value of $16.00. On the 375-foot level, southeast drift, there is an ore shoot 35 feet in length, 50 inches wide, having an average value of $12.00. On the 500-foot level, the ore in the vein to the northwest is improving and runs $8.00 in the present face across 24 inches. The southeast drift is still in a large dike. Please note that all values given are at $20.00 per ounce.

South McKenzie Island Mines, Limited

The property of South McKenzie Island Mines, Limited, consists of a group of 16 claims situated in the central part of Mackenzie island and adjoining the property of Gold Eagle Gold Mines on the west. During the summer of 1934, some surface exploration and shallow diamond-drilling was done on various parts of the property under the direction of W. M. Rice. This work indicated the presence of a much wider band of sediments than had previously been known to exist, along the western flank of the granite mass that underlies most of

Mackenzie island. Although a few narrow quartz veins were encountered, no discoveries of commercial importance have as yet been reported on this property.

Macandrew Red Lake Gold Mines, Limited

The property of Macandrew Red Lake Gold Mines, Limited, consists of 18 claims adjoining those south of South McKenzie Island Mines and Gold Eagle Gold Mines on the south. Exploration of the ground was begun in the summer of 1934 under the direction of C. D. Chisholm. The camp and principal showings are located on claim No. 11,418 near the south shore of Mackenzie island.

When the property was visited in September, 1934, surface workings had exposed several sections of vein quartz within a distance of 350 feet along a fracture zone in granodiorite. The most continuous exposure is about 65 feet in length. It strikes N.16°W., dips 75°E., and ranges from 12 to 30 inches in width. In other exposures the vein matter ranges from a fraction of an inch to 3 feet in width. For the most part the wall rock consists of massive, unmineralized granodiorite. In the most northerly workings some shearing is evident, and the granodiorite is cut by a tongue of quartz porphyry. The vein matter has a banded appearance due to the presence of film-like inclusions of wall rock parallel to the margins of the vein. It consists of quartz containing a little pyrite, chalcopyrite, ankerite, and, in places, visible gold. Some shallow diamond-drilling has been done in the central part of the zone.

Boyle-Rutherford

The Boyle-Rutherford property, which consists of 12 surveyed claims, is situated on the mainland east of Mackenzie island and adjoins the holdings of Nortricia Mining Company on the west. The principal workings are on claims Nos. 432 and 433.

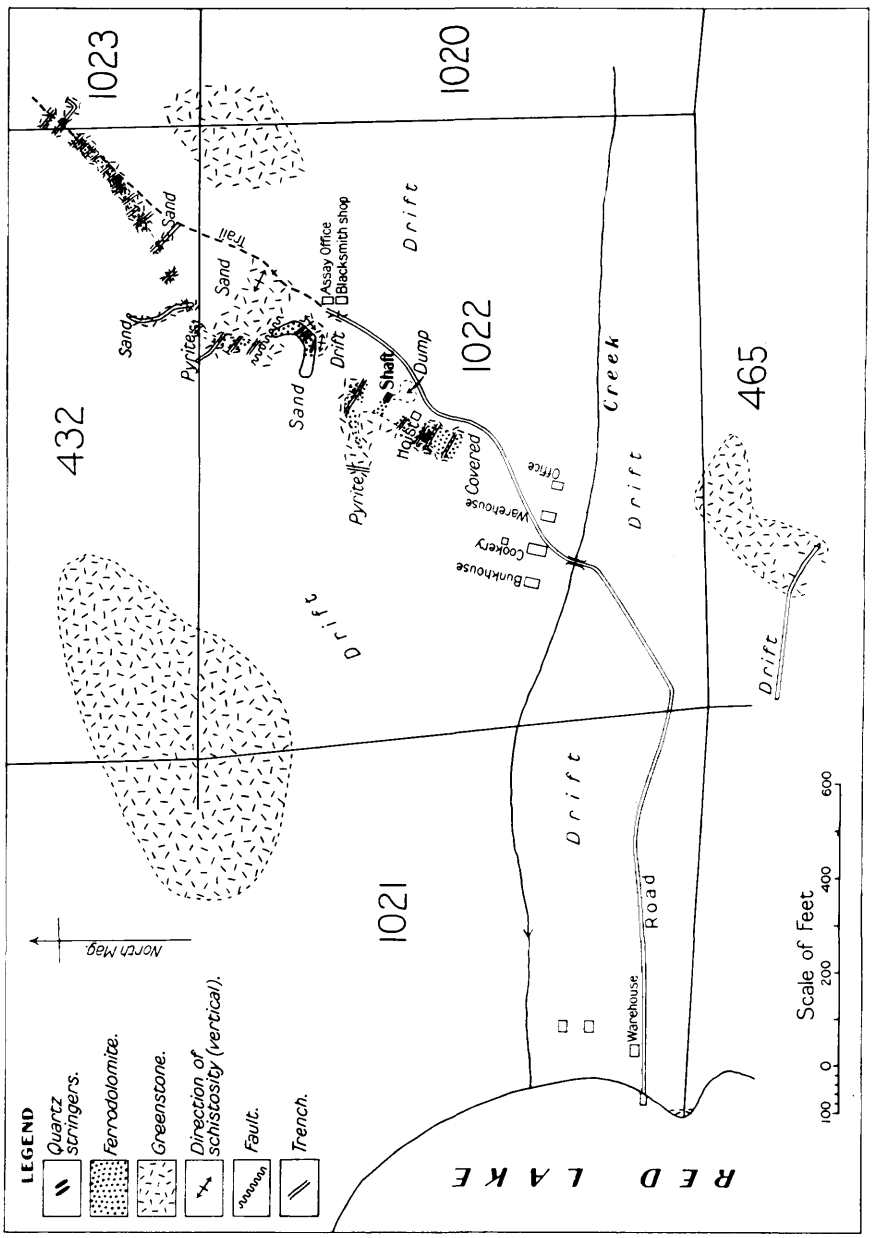
The ferrodolomite zone on which underground development has been done on the adjoining Nortricia property extends in a northeasterly direction across the southeast corner of claim No. 432. It is cut by auriferous quartz stringers that strike in a northwesterly direction. Sampling is said to have indicated an ore shoot with an average width of 5 feet for a length of 175 feet.

In the northeast corner of claim No. 433, trenching has exposed an area of carbonatized greenstone and ferrodolomite containing quartz stringers.

Nortricia Mining Company, Limited

In 1927, the Nortricia Mining Company, Limited, acquired a group of 52 surveyed claims, including the Smith-Morrison holdings, on the mainland east of Mackenzie island and west of the south end of East bay. During 1928–29, the property was taken over by Red Mammoth Gold, Limited, and a shaft was sunk near the north boundary of claim No. 1,022 to a depth of 75 feet. At the 65-foot level a crosscut was run S. 55° E. for a distance of 50 feet. No further work was done until the summer of 1933, when Margaret Mines, Limited, acquired an option on the property. Under the direction of W. S. Livingston, the shaft was extended to a depth of 188 feet and about 300 feet of lateral exploration was done at the 175-foot level. Operations were discontinued in November, 1933.

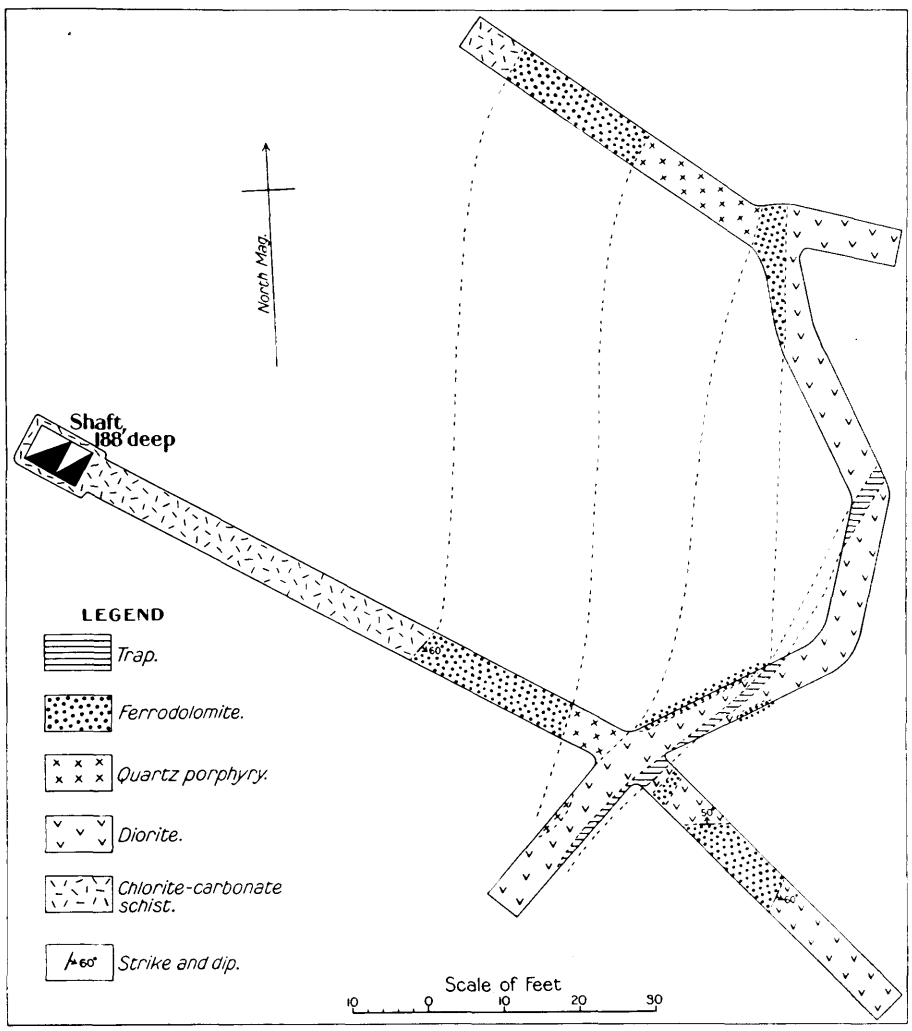
The general geology in the vicinity of the shaft is shown on the accompanying plan. A number of pits and trenches have been excavated along a rusty-weather-



Geological plan of surface workings on the claims of the Nortricia Mining Company.

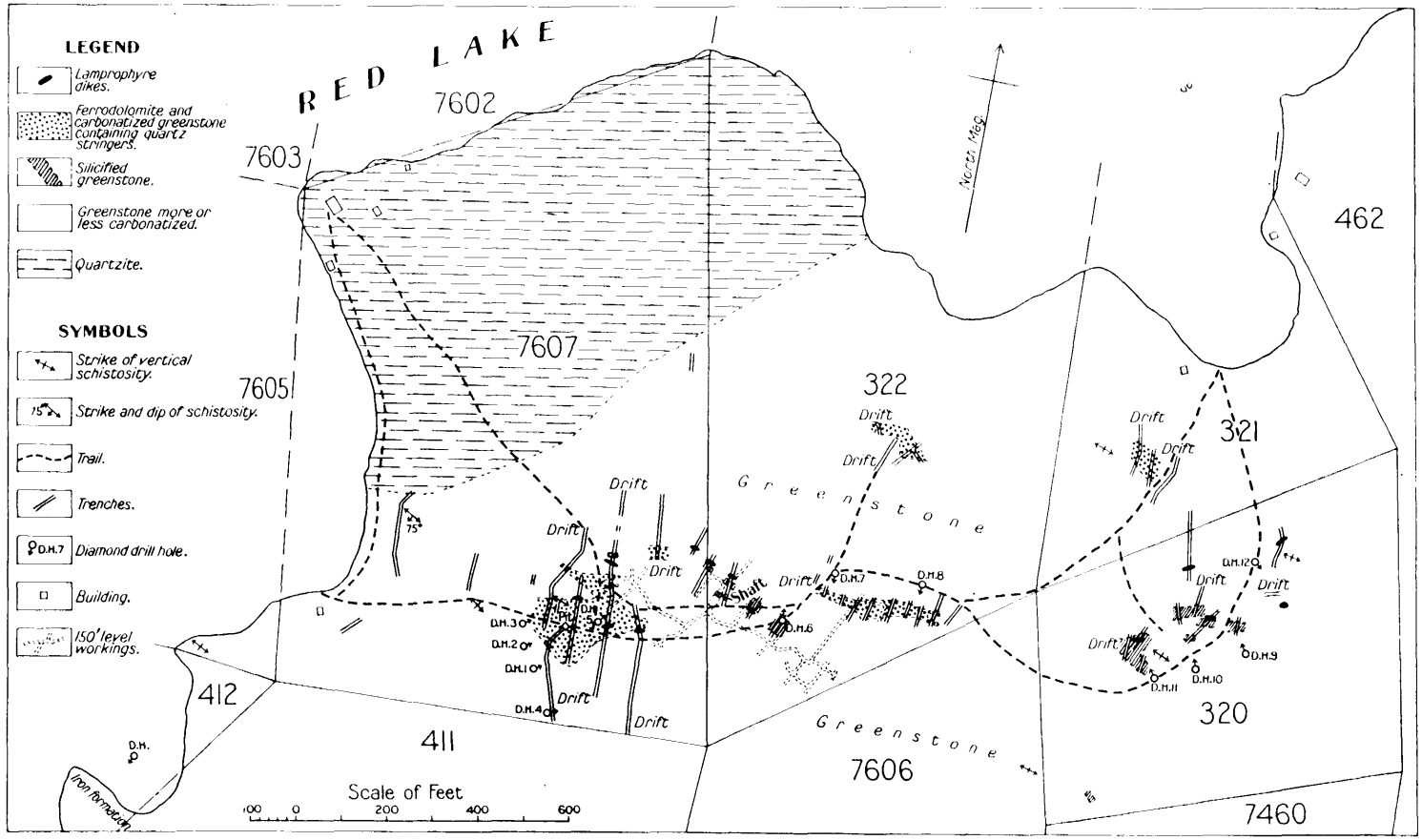
ing ferrodolomite zone, which has been exposed at intervals in a northeasterly direction for about 1,000 feet.

Since its formation the ferrodolomite body has been contorted, faulted, and shattered. Some of the fractures have been occupied by films and stringers of quartz having a prevailing northwesterly strike. In addition to native gold,



Geological plan of the 175-foot level, Nortricia mine, December, 1933. (After W. S. Livingston.)

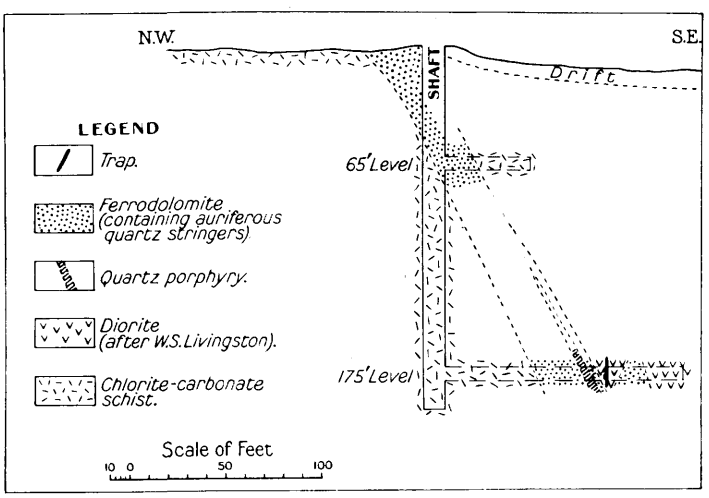
these veinlets contain a little tourmaline and fine-grained pyrite, arsenopyrite, chalcopyrite, and a grey mineral believed to be jamesonite. Owing to the erratic distribution of the auriferous quartz stringers, sampling across the carbonate zone shows a marked variation in gold content from place to place. This condition makes it difficult to determine the position and boundaries of possible ore shoots. At the north end, where the zone is considerably narrower, the quartz stringers are more closely spaced and the gold content may be sufficiently concentrated to form an ore shoot.



Geological plan of surface workings on the claims of the Cochenour-Willans Syndicate.

The shaft has been located at a point where the carbonate zone is about 40 feet in width. At the 65-foot level the footwall of the zone passes through the middle of the shaft. The crosscut runs to the southeast at this level intersected about 25 feet of ferrodolomite before passing into greenstone. At the 175-foot level, about 300 feet of drifting and crosscutting have been done in the area east of the shaft. The formations encountered in these workings are shown on the accompanying plan prepared by W. S. Livingston. It is reported that this exploration failed to disclose an ore shoot of commercial importance. It will be noted that a narrow tongue of quartz porphyry occurs within the main ferrodolomite zone at this level, whereas no such intrusion was encountered at the 65-foot level or in the surface workings. This condition affords considerable support for the generalization that ferrodolomite zones are underlain by bodies of quartz porphyry, even where such intrusions do not outcrop at the surface.

Descriptions of the showings on claims Nos. 1,516 and 1,517 are given in the report by E. L. Bruce and J. E. Hawley.[1]



Transverse vertical projection through the shaft, Nortricia mine.

Cochenour-Willans Syndicate

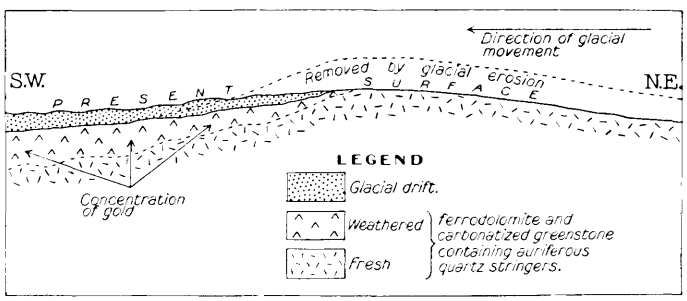
The Cochenour-Willans Syndicate controls a group of 13 surveyed claims adjoining the holdings of McKenzie Red Lake Gold Mines on the east. These claims include ground on the mainland east of Mackenzie island as well as the water area between the mainland and Mackenzie island.

Development work has been largely concentrated on claims Nos. 320, 321, 322, and 7,607. A series of trenches has been excavated at intervals along an east-west zone of fracturing, which has been traced about 2,000 feet. These workings have exposed several lenticular bodies of carbonatized (ferrodolomite) or silicified greenstone, each about 200 feet in length and 30 feet in width. The carbonate bodies are believed to be genetically related to and underlain by intrusions of quartz porphyry. Subsequent movement caused shattering within the areas of carbonatization and provided a network of fractures into which were introduced films and stringers of gold-bearing quartz. As these stringers are not uniformly distributed throughout the zone of fracturing, the gold content varies widely from place to place. In addition to visible gold, the quartz veinlets

[1]Ont. Dept. Mines, Vol. XXXVI, pt. 3, 1927, p. 68.

contain some fine-grained pyrite, arsenopyrite, zinc blende, galena, and jamesonite. In places pre-glacial weathering has been preserved to a depth of 10 or 15 feet. In such exposures sampling and panning show that the decomposition of the carbonate and disintegration of the auriferous quartz veinlets have given rise to a marked concentration of gold in the weathered material.

In the fall of 1932, 3,500 feet of diamond-drilling in 12 holes was done by Ventures, Limited, in the vicinity of the principal showings. This work indicated the presence of a mineralized zone in the southwest corner of claim No. 322. During the summer of 1934, surface exploration of this section led to the discovery of a siliceous zone, 6 to 25 feet in width, which strikes N.70°W. (mag.) and lies parallel to the schistosity of the enclosing carbonatized greenstone. This zone has been traced for a distance of 180 feet. The fracturing and mineralization



Vertical section showing removal and preservation of zone of pre-glacial weathering, Cochenour-Willans Syndicate.

occur in close proximity to one or more narrow, highly carbonatized lamprophyre dikes. The zone consists of a network of dark-grey quartz stringers intersecting silicified and altered greenstone and lamprophyre. In addition to quartz, the mineralized sections contain fine-grained, disseminated pyrite, arsenopyrite, jamesonite, and native gold.

In the fall of 1934, the property was taken under option by Hollinger Consolidated Gold Mines, Limited. A shaft was sunk to a depth of 170 feet near the southwest corner of claim No. 322, and considerable lateral exploration was done at the 150-foot level (as shown on the accompanying plan) before operations were discontinued in May, 1935.

Martin-McNeely Mines, Limited

Martin-McNeely Mines, Limited, holds a group of 7 surveyed claims on the mainland east of Mackenzie island. The principal showings are located in the east-central part of claim No. 93, about half a mile north of the camp on the lakeshore. Trenching and stripping have been done at intervals for a distance of 9 claims along a quartz porphyry dike that intersects schistose greenstone. The dike ranges from 30 to 50 feet in width and strikes N.82°E. In places it has undergone considerable fracturing. The fractures contain an intricate network of black tourmaline veinlets, which in many instances have been reopened and filled or cut by veinlets of quartz. Nests and stringers of pyrrhotite, chalcopyrite, and pyrite are associated with the tourmaline-quartz veinlets. Sampling of the showings is said to have yielded low values in gold.

During 1934 some surface exploration was done on the group of 8 claims held by this company on the east side of Slate bay. Several trenches were excavated near the lakeshore, on the boundary between claims Nos. 2,208 and

2,206. These workings exposed a small area of highly altered greenstone containing coarsely crystalline hornblende, streaks of magnetite, and abundant garnet and epidote. This mineral assemblage suggests that the greenstone has undergone contact metamorphism and that granitic intrusive rocks occur in the vicinity. In one pit, there is a body of quartz about 2 feet in width containing pyrrhotite, chalcopyrite, pyrite, and laths of black hornblende. Malachite and native copper occur in the weathered portions of the outcrop.

Rahill Red Lake Mining Company, Limited

The Rahill Red Lake Mining Company, Limited, controls two groups, totalling 17 claims, situated on the mainland east of Mackenzie island. These holdings adjoin those of Martin-McNeely Mines on the east and west. During 1934, portions of the property were explored by surface workings and diamond-drilling under the direction of A. Glendinning.

Surface exploration in the northwest corner of claim No. 6,687 has exposed an area of greenstone cut by tongues of quartz porphyry and highly carbonatized lamprophyre dikes. These intrusions lie approximately parallel to the shearing, which strikes N.70°–80°E. Irregularly shaped bodies of rusty-weathering ferrodolomite occur in the greenstone in the vicinity of the quartz porphyry tongues. In places these rocks have been intersected by branching quartz-tourmaline veinlets, which strike N.25°–30°W. and range from a fraction of an inch to 8 inches in width. In one section, extending for about 30 feet on either side of one of the larger lamprophyre dikes, the veinlets are reported to carry values in gold. Some shallow diamond-drilling was done in this vicinity.

During the latter part of 1934, several drill holes were put down on the mainland east of Mackenzie island in order to explore the projected continuation of the principal vein-bearing zones on the Gold Eagle and McKenzie Red Lake properties. The drilling was done from the sand spit on claim No. 10,919. About 70 feet of overburden, mostly sand, was found to overlie the bed rock. One hole drilled in a northeasterly direction for 1,050 feet at an angle of about 50 degrees, penetrated greywacké and slaty or tuffaceous sediments and tongues of waxy quartz porphyry. Another hole is said to have passed through 6 feet of vein quartz carrying values in gold.

McManus Red Lake Gold Mines, Limited

McManus Red Lake Gold Mines, Limited, controls a group of 16 surveyed claims in the southeast corner of Dome township. These holdings extend north and south of Chukuni river near the outlet of Red lake.

The main showings are on claim K. 1,593. Surface workings along the south side of a bay north of the outlet of the lake have exposed several widely separated quartz veins ranging from 1 to 6 inches in width. These veins occur in hard, massive greenstone. They strike N.10°E. to N.35°W. and have been traced for a distance of 50 to 100 feet. Visible gold is present in some of the veins.

On claim K. 1,600 some trenching has been done on a sheared diorite-greenstone contact that outcrops on the east side of a small bay opening to the south off Chukuni river. A quartz vein 1 to 12 inches wide occurs along this contact. It strikes N.35°E. and has been traced inland for about 100 feet.

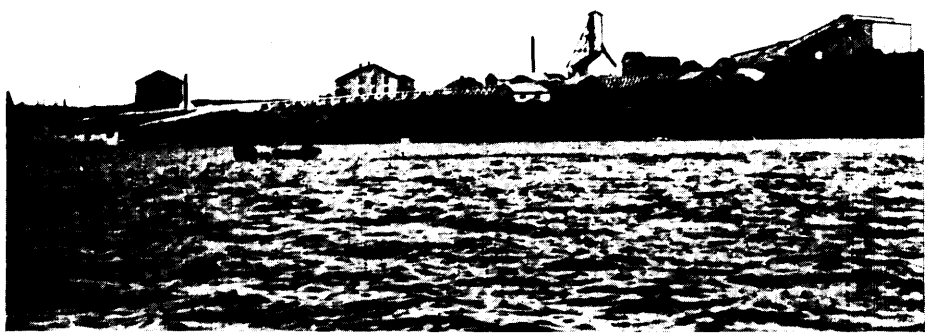
Near the northwest corner of claim K. 1,601, surface workings have exposed a shear zone in massive diorite. This zone strikes N.50°W. and has been traced for a distance of 150 feet. It contains stringers and bulges of quartz, 1 to 16 inches in width.

Red Lake Centre Mines, Limited

Red Lake Centre Mines, Limited, holds 23 claims in Dome and Heyson townships. One group adjoins Howey Gold Mines on the north and includes a part of the mainland and the adjacent islands. On claim K. 1,414, about 5 chains south of the lake, several quartz-tourmaline veins have been uncovered by stripping in an east-west direction. The veins occur in massive granodiorite, strike N.20°–30°W., and range from a fraction of an inch to 15 inches in width. In 1931 some diamond-drilling was done in the vicinity of the showings by Howey Gold Mines, but no mineralization of importance was encountered,

Howey Gold Mines, Limited

The holdings of Howey Gold Mines, Limited, consist of 23 claims located on the south side of Red lake about 2 miles west of the outlet. The general geology



Plant of Howey Gold Mines, 1933.

in the vicinity of the property and the preliminary exploration of the deposit have been described by E. L. Bruce and J. E. Hawley.[1] Underground development of the showings was begun in 1927. Gold production commenced in April, 1930, with the treatment of 500 tons of ore per day. The mill capacity was increased to 900 tons per day in 1932 and to 1,350 tons per day in the fall of 1933. Power is obtained from the plant of the Hydro-Electric Power Commission at Ear falls on the English river, 40.6 miles southeast of the mine. The connected load totals 3,225 horse-power and costs approximately $40 per horse-power delivered at the mine. For a detailed discussion of the methods, equipment, and costs of mining and milling, the reader is referred to a series of papers by the mine staff, published in the Canadian Mining Journal, Volume 55, October, 1934.

General Description of the Deposit

The deposit consists of a network of steeply dipping quartz veins in a zone of fracturing within a dike of quartz porphyry. The dike strikes N.65°E., dips 85°S.E., and intersects schistose greenstones. It ranges in width from 25 to 250 feet, the average within the mine workings being about 85 feet. In general,

[1]Ont. Dept. Mines, Vol. XXXVI, pt. 3, 1927, p. 56-65.

the fracture zone extends approximately parallel to the strike of the dike. It is best developed near the footwall in some parts of the dike and near the hanging wall in others.

For the most part the veins are related to one of three sets of fractures. The great majority of the veins occupy vertical or steeply dipping fractures, which trend N. 85°E. and intersect the strike of the dike at an angle of 20 degrees. A second but much weaker set of steeply dipping fractures strikes N.25°W. and intersects the dike at right angles. The third set is still more poorly developed and consists of horizontal or gently dipping fractures, intersecting the other two.

While at points of junction the veins may attain a width of several feet, they are seldom more than a foot wide, and probably do not average more than 4 inches. Individually the veins are quite limited in longitudinal and vertical extent, although they split and branch in such a way that collectively they form a continuous stockwork, 10 to 50 feet in width, which persists to the lowest level



A B

VEIN STRUCTURE, HOWEY MINE

"A" shows No. 250 stope, west of the shaft, June, 1933. "B" shows No. 1,315 stope, east of the winze, August, 1934.

so far attained by underground development. Exploration to date has not indicated any appreciable pitch to the ore zone. The dike is considerably wider (200 feet) at the 1,315-foot level than on the levels above.

Toward the west the porphyry dike passes into McIntyre ground, where it is largely obscured by overburden. It is well exposed on the surface to the east of the present limit of underground development. Here it is about 200 feet in width and shows little evidence of fracturing. Only occasional quartz veinlets are present, and these trend in a northwesterly direction across the strike of the dike. Drilling in this part of the dike failed to intersect any mineralization of importance.

The Quartz Porphyry Dike

The quartz porphyry varies considerably in appearance and composition in various parts of the dike. In the vicinity of the quartz veins it is slightly schistose and has a yellowish, waxy appearance. Elsewhere it is hard, massive, and grey in colour. Within the quartz porphyry there are numerous lenses or ribbon-like streaks of a dark-grey or black rock. These bodies extend roughly parallel to the strike of the dike and they are separated from the adjoining porphyry by sharply defined contacts. Like the porphyry, they have been

fractured and traversed by the quartz veins. The following analyses, made at the Provincial Assay Office, are typical of the quartz porphyry and of the basic bodies contained in it.

	No. 1	No. 2	No. 3
	per cent.	per cent.	per cent.
SiO_2	71.52	49.21	49.76
Al_2O_3	13.84	15.85	15.87
Fe_2O_3	.85	1.66	1.36
FeO	trace	3.98	4.93
CaO	1.37	6.31	5.96
MgO	.31	5.00	4.45
K_2O	1.99	5.82	4.21
Na_2O	4.48	.63	2.67
TiO_2	.48	.36	1.19
P_2O_5	.08	.28	.49
CO_2	1.15	8.32	6.72
H_2O	.89	1.83	1.50
MnO	.....	.....	.18
F_2S_2	2.89	.71	1.27
Total	99.85	99.96	100.56
Specific gravity	2.714	2.841	2.852

Specimen No. 1—Typical waxy quartz porphyry from the 375-foot level, Howey mine.
Specimen No. 2—Basic streak in specimen No. 1, from the 375-foot level, Howey mine.
Specimen No. 3—Basic streak in quartz porphyry from the 750-foot level, Howey mine.

Under the microscope the porphyry (No. 1) is seen to be composed of laths of albite embedded in a matrix of finer-grained feldspar and quartz. It contains in addition some sericite, carbonate, pyrite, and biotite. The basic rocks (Nos. 2 and 3) are highly altered. They are composed chiefly of biotite, carbonate, and remnants of feldspar, together with some sericite, apatite, pyrite, and quartz. Mineralogically and chemically they closely approach diorite or kersantite in composition. These basic rocks frequently possess a banded structure due to the parallel arrangement of the light and dark constituents.

It is difficult to account for the presence of the basic bodies within the quartz porphyry. Their mode of occurrence might suggest that they represent unassimilated inclusions of greenstone, but since they differ considerably in composition from the greenstones in the vicinity of the quartz porphyry dike, such an origin seems improbable. They can hardly be regarded as segregations *in situ*, for they lack the gradational contacts so characteristic of bodies of that type. Although they possess sharply defined contacts, they lack the chilled margins normally found in dikes. Furthermore, although the contacts are frequently slickensided, these bodies do not appear to occupy well-defined fractures. They seldom exhibit the tabular form of dikes but occur rather in lenses, which pinch out abruptly both longitudinally and vertically. In view of the objections to the modes of origin cited above, the writer believes these bodies can be most satisfactorily accounted for by assuming that they represent a basic differentiate derived from the same source as the quartz porphyry and intruded simultaneously with it.

Composition and Age Relationships of Veins

The veins consist of quartz and minor quantities of tourmaline, scheelite, orthoclase, ankerite, and calcite. The metallic minerals in order of abundance are pyrite, zinc blende, galena, chalcopyrite, and native gold. The tellurides of gold, silver, and bismuth are reported to be present, but none of these was

found in the specimens obtained by the writer. Pyrite occurs both in the vein filling and in the wall rock. In the former, it is usually coarsely crystalline and considerably brecciated; in the latter, it occurs sparingly in finely disseminated cubes. A specimen of ankerite from the vein filling was submitted to the Provincial Assay Office for analysis. It was found to have the following composition:—

	Per cent.
SiO_2	2.08
Al_2O_3	.85
Fe_2O_3	.80
FeO	12.68
CaO	30.13
MgO	10.91
MnO	1.62
CO_2	40.97
H_2O	.23
Total	100.27
Specific gravity	3.02

Study of the age relationships of the veins clearly shows that structural disturbances took place during the deposition of the vein matter. As a result of this dislocation two stages of vein formation can be recognized. The earlier generation of vein matter consisting of quartz containing coarsely crystalline, auriferous pyrite was deposited in the initial open spaces developed within the zone of fracturing. The pyrite in these veins is almost invariably brecciated and traversed by veinlets of later quartz, which, in appearance, is seldom distinguishable from the quartz originally deposited with the pyrite. It is believed, therefore, that the quartz-pyrite veins have been reopened and the original fractures appreciably enlarged. This disturbance also gave rise to a set of flat or gently dipping fractures, which intersect the quartz-pyrite veins. The newly formed open spaces were then occupied by a second generation of vein matter consisting of quartz containing visible gold, zinc blende, galena, and occasionally tourmaline. This generation of vein matter appears to be smaller in volume and more erratically distributed than the quartz-pyrite type. It is believed that the quartz-pyrite veins, where not reopened, are comparatively low-grade, since their gold content appears to be contained in and confined to the pyrite, which forms only about 2.5 per cent. (by weight) of the ore. Where the zinc blende–galena generation of vein matter is present, sampling shows conclusively that it is accompanied by a marked increase in the gold content. Samples of the coarsely crystalline, brecciated pyrite, selected in such a way as to contain a minimum of the second generation of quartz, yielded assays ranging from 0.60 to 1.3 ounces of gold per ton, whereas samples of pyrite cut by and containing the later quartz yielded 3.5 to 7.7 ounces of gold per ton.

Development

The deposit has been opened up by a vertical 3-compartment shaft to a depth of 1,500 feet, by a winze between the 1,000-foot and 1,500-foot levels, and by lateral workings at levels spaced approximately 125 feet apart. The ore zone has been developed by drifting and stoping for a length of 1,200 feet. The stoping width is delimited by assay boundaries based chiefly on sill sampling. Above the 1,000-foot level, the average width of the ore zone is about 35 feet. Between the 1,315- and 1,000-foot levels, east of the shaft, it is considerably greater but the grade of the ore is somewhat below that of the upper levels. The width of the ore zone is an important factor in the attainment of low mining costs, as it permits a relatively large tonnage (about 100 tons) of ore to be broken per

machine drill shift. In the upper levels the ore is removed by ordinary shrinkage stoping. Below the 1,000-foot level a combination of shrinkage stoping and stope-pillar caving has been adopted. Owing to the erratic distribution of the veins, more selective methods of mining would not be feasible. Considerable economy has been affected by limiting development to a few stopes, as this permits a greater and more efficient concentration of supervision and equipment.

The principal reserves of partially developed ore lie between the 750- and 250-foot levels west of the shaft and between the 1,315- and 1,000-foot levels east and west of the shaft. During 1934, exploration on the 1,000-foot level east of the present limit of stoping showed a narrow ore body striking at an angle



Specimen (nearly natural size) of vein matter containing brecciated pyrite traversed by quartz veinlets, from the Howey mine.

to the main zone; according to the management this shoot has a length of 110 feet, a width of 5 feet, and an average gold content of 0.24 ounces per ton. It has been found that this ore body does not extend upward to the 875-foot level. Its possible downward extension is now being explored by drifting east at the 1,175-foot level. Exploration of the main ore zone is now in progress at the 1,500-foot level. Its continuation in depth will be dependent upon the persistence of the fracturing and upon the volume and distribution of the zinc blende–galena generation of vein matter.

Milling

During the latter part of 1934, about 1,400 tons of ore were hoisted per day. Of this, 18 per cent., or roughly 250 tons, were sorted and discarded at a cost of $0.257 per ton. The balance of approximately 1,150 tons was sent to the mill. The present method of treatment involves grinding the mill feed so that about 78 per cent. passes 60 mesh and 41 per cent. is minus 200 mesh. The gold is

recovered by cyanidation without intermediate concentration and regrinding. The lime, cyanide, and zinc consumption per ton of ore milled are, respectively, 0.95 pounds, 0.215 pounds, and 0.042 pounds. Approximately 92 per cent. of the gold content in the ore milled is recovered.

Production, Operating, and Cost Data

The production of gold and silver since the commencement of milling operations in April, 1930, has been as follows:—

PRODUCTION

Year	Ore milled and sorted	Gold		Silver		Total Value of bullion	Total net recovery, including premium
		Quantity	Value[1]	Quantity	Value		
	tons	ounces		ounces			
1930	111,230	22,146.58	$457,810	8,785	$3,047	$460,857	$460,428
1931	226,876	41,702.44	862,066	15,963	4,540	866,606	914,290
1932	329,249	53,947.68	1,115,198	20,132	5,473	1,120,671	1,268,780
1933	344,135	40,460.06	836,384	15,337	5,199	841,583	1,158,470
1934	481,757	45,985.26	950,600	15,434	7,197	957,797	1,594,223
1935	484,966	37,673.91	778,789	12,185	7,643	786,432	1,319,764

[1]Gold valued at $20.67 per ounce.

The operating and cost data presented in the following tables have been taken from the annual reports of the company:—

OPERATING DATA

	1930	1931	1932	1933	1934	1935
Tonnage hoisted	111,230	226,876	329,249	344,135	481,757	484,966
Tonnage discarded by sorting	792	15,324	44,585	53,170	85,648	82,746
Tonnage milled	110,438	211,552	284,664	290,965	396,109	402,220
Value per ton of material discarded by sorting	.....	$0.60	$0.42	$0.54	$0.21	$0.21
Value per ton of ore milled	$4.42	$4.45	$4.21	$3.12	$2.64	$2.08
Loss in tailings per ton milled	$0.25	$0.35	$0.27	$0.24	$0.214	$0.127
Recovery per ton of ore milled	$4.17	$4.10	$3.94	$2.88	$2.426	$1.953
Recovery per ton of ore milled and sorted	$4.14	$3.81	$3.40	$2.44	$1.987	$1.62
Net percentage recovery per ton of ore hoisted	.....	91.5	92.4	89.5	90.3	92.1

N.B.—The values given above are based on gold at $20.67 per ounce.

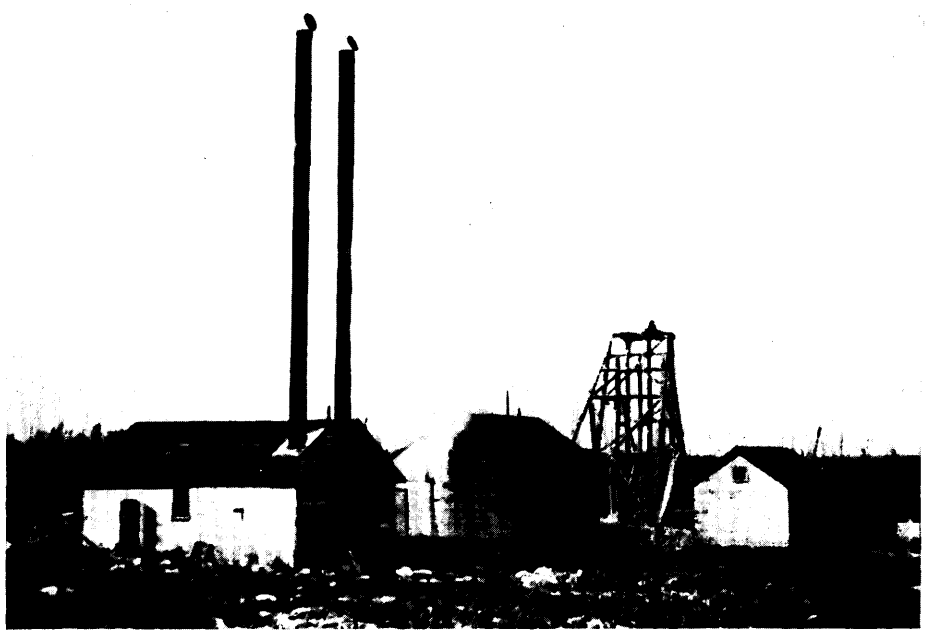
COST PER TON MILLED AND SORTED

	1931	1932	1933	1934	1935
Mine operation	$1.637	$1.292	$1.293	$1.032	$0.963
Outside exploration	.008	.006	.002	.005	.009
Crushing and conveying	.172	.118	.102	.093	.083
Ore sorting	.020	.039	.045	.049	.029
Milling	.777	.656	.578	.452	.450
General expense	.198	.180	.140	.133	.139
Total plant cost	$2.812	$2.291	$2.160	$1.764	$1.673
Head office expenses	.152	.138	.080	.066	.068
Interest charges	.162	.042	.....	.....	.....
Dominion and provincial taxes	.....	.....	.038	.090	.081
Depreciation (on 10 per cent. basis)	.477	.350	.346	.276	.280
Pre-operating charges	.560	.600	.300	.200	.200
Total cost	$4.163	$3.421	$2.924	$2.396	$2.302
Tonnage milled and sorted	226,876	329,249	344,135	481,757	484,966

ORE RESERVES

	May 31, 1931	Dec. 31, 1931	Dec. 31, 1932	Dec. 31, 1933	Dec. 31, 1934	Dec. 31, 1935
	tons	tons	tons	tons	tons	tons
Broken	156,379	195,724	206,150	276,526	301,990	456,958
Positive (unbroken)	373,000	372,051	500,000	1,751,755	1,853,097	1,267,500
Indicated	350,000	287,880	500,000	.....	.....	285,000
Total	879,379	855,655	1,206,150	2,028,281	2,155,087	2,009,458
Estimated grade[1]	$4.25	$4.25	.....	$3.75	$3.50	$3.25

[1]Gold at current price [approximately $35.00].



Plant of Red Lake Gold Shore Mines, September, 1934.

In February, 1934, the company paid an initial dividend of $150,000, or 3 cents per share on its capitalization. Total dividend payments were $500,000 in 1934 and $250,000 in 1935.

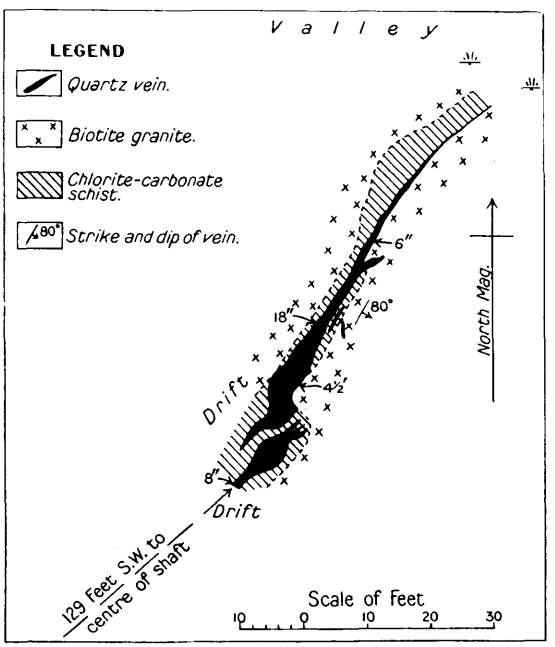
McIntyre-Porcupine Mines, Limited

McIntyre-Porcupine Mines, Limited, holds a group of 9 claims adjoining the property of Howey Gold Mines on the west. The quartz porphyry dike that contains the vein system on the Howey property has been traced by surface-trenching and diamond-drilling on to the McIntyre ground. Near the Howey boundary the dike ranges from 120 to 150 feet in width and becomes appreciably narrower toward the west. Vein structures and conditions of mineralization similar to those on the Howey property are said to have been encountered for a distance of several hundred feet west of the boundary.

Red Lake Gold Shore Mines, Limited

Red Lake Gold Shore Mines controls a group of 20 surveyed claims adjoining the Howey and McIntyre holdings on the northwest. These claims are located in the southern portion of the area underlain by the Mackenzie island granodiorite mass. A number of narrow auriferous quartz veins have been found on various parts of the property. They occupy fractures in the granodiorite or occur in association with ribbon-like inclusions of greenstone, which have been the loci of shearing and fracturing.

The principal showing is located about half a mile south of the lake on the north slope of an east-west ridge in the southwest corner of claim No. 820. Surface workings have exposed a quartz vein, ranging from a fraction of an inch to 4½ feet in width, for a distance of 60 feet. This vein strikes N.33°E. (mag.)



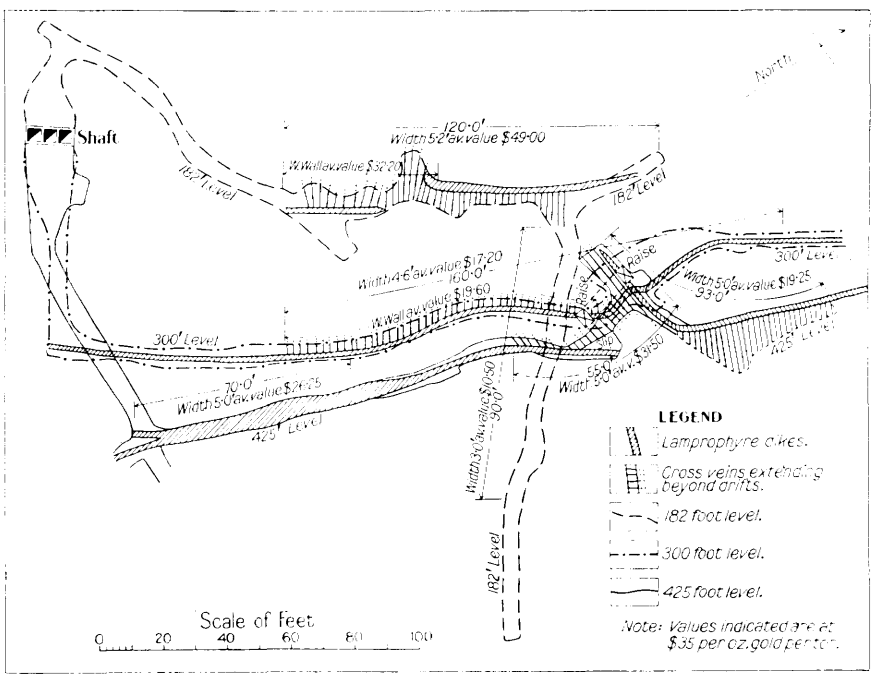
Surface plan of vein on claim No. 820,
Red Lake Gold Shore Mines.

and dips about 75°S.E. It occurs in a fracture zone developed along a band of chlorite-carbonate schist contained in mottled pink and grey biotite granite or granodiorite. The schist is believed by the management to represent an altered lamprophyre dike. The vein filling consists of quartz containing pyrite, chalcopyrite, tetradymite, galena, ankerite, and native gold. Pyrite is the earliest and most abundant sulphide in the deposit. It occurs as disseminated crystals in the wall rock and as grains and fracture fillings in the vein matter. The chalcopyrite, tetradymite, and gold occur chiefly in fractures in the quartz and appear for the most part to be later than the pyrite. Pyritization of the darker phases of the granitic wall rock is usually accompanied by the development of albite and rose quartz immediately adjoining the quartz veinlets.

In August, 1934, a 3-compartment shaft was begun at a point on the ridge about 140 feet southwest of the surface showing. By December, 1935, considerable lateral exploration had been done at the 182-, 300-, and 425-foot levels (as

shown on the accompanying plan). In February, 1936, the shaft was completed to the 550-foot horizon. In a progress report issued by the company on November 7, 1935, J. W. Shaw, consulting engineer, gives the following information concerning the underground development of the deposit:—

The shaft was sunk to a depth of 182 feet, the vein located and drifted on to the northeast for a distance of 120 feet. At this point an excessive flow of water was encountered . . . . This northeast face was left in ore but of somewhat lower grade than the average of the drift . . . . A branch vein was encountered on the hanging-wall side of the main drift and was followed for a distance of 155 feet . . . . The main vein on this level has a strike N. 40° E. and a dip of about 70° S.E. A lamprophyre dike follows the vein and in the southwest section forms the hanging-wall side of the vein. Farther to the northeast, however, vein matter shows on both sides of the



Official plan of underground workings, Red Lake Gold Shore mine, November, 1935.

dike . . . . A well-defined quartz vein follows along the strike next to the dike, but for fairly long distances branch veins, so close together that they form continuous ore, join the vein from the hanging-wall side . . . . The extent of this ore into the hanging wall was not definitely known, although one crosscut into the wall shows a width of 14 feet with values over this width about the same as the average of the drift.

The shaft was sunk to the 300-foot level and a crosscut driven to the northwest. The vein was cut and followed northeast, where values were encountered almost directly under the first appearance of ore on the 182-foot level. This ore shoot continues for a distance of 160 feet. The same conditions obtained here as on the 182-foot level. We have a lamprophyre dike with the ore along it and the branch veins as before.

The shaft was then continued to the 425-foot level and a crosscut driven to cut the vein southeast of the shaft. The dip and strike of the vein from the surface to the 300-foot level is normal, that is, it shows continuity of dip and strike on each level. On the 425-foot level, however, the vein was encountered in the crosscut about 30 feet nearer the shaft than was expected, and the dip of the lamprophyre dike on this level was nearly vertical. . . . High-grade ore was cut at the crosscut, which is much farther southwest than on the other two levels. The character of the ore at this point is different from that on the other two levels. The first section of ore developed on the 425-foot level occurs as quartz replacing the lamprophyre in the dike, and this ore is associated with considerable chalcopyrite, whereas on the upper levels the mineralization is for the most part pyrite. This condition continues for a distance of 70 feet. . . . The next 50 feet shows lamprophyre dike but without the quartz and without value. The dike continues, and at this point quartz appears . . . in the wall rock northwest of the dike. The drift turns more to

the west, and the dike is not in evidence for a distance of 55 feet. This section of drifting (?) cuts across a structure similar to that on the upper levels but without the dike. The cross-veins are so close together that they form continuous ore. . . . At this point the drift cuts a lamprophyre dike having a strike parallel with that of the cross-veins. . . . Several horizontal faults were encountered in the shaft between the 300-foot and the 425.

In a progress report issued by the company on January 9, 1936, W. P. Mackle, manager, states:—

Two raises were also driven from the 425-foot level. The first raise has been completed to the 300-foot level, and the second one is up 17 feet above the level. The results obtained from both of these raises have confirmed the results obtained from the drifting on the two levels and have proven the vertical continuity of the ore body between these levels.

In the same report the dimensions and gold content of the ore shoots so far developed are given as follows:—

	Width	Length	Value
	feet	feet	oz. per ton
Surface, main vein	3.6	50	0.564
182-foot level, main vein	10	120	.900
182-foot level, cross-vein	3	90	.300
300-foot level, main vein	12	170	.590
425-foot level, main vein:			
First section	5	60	.530
Second section	14	160	.545

On January 2, 1936, the ore reserves above the 425-foot level were estimated by W. P. Mackle, manager, to consist of 45,150 tons of assured ore, having an average gold content of 0.663 ounces per ton, and 6,700 tons of possible ore. This estimate does not include ore in the cross-vein exposed on the 182-foot level.

Skookum Gold Mines, Limited

Skookum Gold Mines, Limited, controls a group of 8 claims adjoining Red Lake Gold Shore Mines on the west. These holdings are situated near the southwest margin of the granodiorite boss that underlies a portion of Mackenzie island and the south shore of Red lake.

In a report to the company in February, 1936, F. M. Passow gives the following information concerning the showings on the property:—

A gold-bearing quartz vein has been traced for 200 feet from the southeast corner of claim No. 6,122 into the northeast part of claim No. 6,121. It occupies a strong fracture in granite and ranges from 6 inches to 3 feet in width.

A small quartz vein containing chalcopyrite and gold occurs in the southwest corner of claim No. 6,122 and the northwest corner of claim No. 6,121.

To the west of the centre of claim No. 6,121 there is a brecciated granite-greenstone contact containing quartz and values in gold.

A well-mineralized quartz vein has been uncovered on claim No. 12,946.

Madsen Red Lake Gold Mines, Limited

Madsen Red Lake Gold Mines, Limited, controls a group of 29 claims in the area between Flat lake and Faulkenham lake in Baird and Heyson townships. These holdings include a group of 8 claims, on which the No. 1 or discovery vein, staked by F. X. Hahn in 1927, is located. This ground was acquired and additonal claims were staked by M. Madsen in the fall of 1934.

Surface exploration up to the end of 1935 is said to have exposed 7 veins on various parts of the property. In the spring of 1935, about 2,500 feet of diamond-drilling was done on the No. 1 vein, which is the most important so far discovered.

A wagon road 7½ miles long has been constructed between the property and Red Lake village on Howey bay. In October, 1935, a two-compartment shaft was begun in the hanging wall to the southeast of the central part of No. 1 vein.

The writer is indebted to G. D. Furse for the following information concerning the geology in the vicinity of the showings:—

The country rocks are dominantly basic volcanics, which have been intruded by a small batholith of granite, which underlies Faulkenham lake and extends for about a mile west of the south end of the lake. Along the north contact of the granite there is a band of recrystallized greenstones about 1,000 feet wide. The tops of the flows are believed to face north. The greenstones are intruded by fine-grained quartz and feldspar porphyry dikes. The No. 1 vein occurs in one of these dikes. It is cut by granite dikes and sills, 6 inches to 2 feet in width. Small dikes of diorite porphyry or hornblende diabase also occur in the vicinity.

The No. 1 vein consists of a single vein or a set of branching veinlets. It strikes N.66° E., dips 59°S.E., and occurs, for the greater part of its exposed length, in fine-grained quartz-feldspar porphyry containing biotite. Toward the west end the vein passes from the south side of the porphyry dike into greenstone. The country rock north of the porphyry is a fine-grained, fairly massive altered basalt. To the south the rock is moderately coarse grained and appears to be a recrystallized basalt. The vein consists of light-grey quartz containing inclusions of porphyry. The solid vein matter varies from 8 to 16 inches in width. Frequently it splits into two parts, each about 4 or 6 inches in width, or into many half-inch veinlets separated by silicified porphyry. Some disseminated arsenopyrite is found at irregular intervals in the vein.

The No. 2 vein branches from the easterly portion of the No. 1 vein. It consists of dark-grey quartz and occurs in medium-grained basalt. It is narrow and short and has been faulted into two parts. Channel sampling indicates commercial values over widths of 7 to 11 inches for a length of 50 feet.

The No. 3 vein lies near the southwest corner of the property. It strikes S. 83° E., dips about 65° S.W., and occurs in hornblende schist. It varies from 4 to 16 inches in width and has been traced for about 150 feet. The vein matter consists of bluish-grey quartz containing pyrite, pyrrhotite, and visible gold.

According to the management, the exploration and sampling done on the No. 1 vein during 1935 yielded the following results:—

	Length	Width	Gold content
	feet	inches	oz. per ton
Main section, surface	591	27.9	0.505
Main section, diamond-drilling	307	38	.36
West section, surface	93	29	.37
West section, diamond-drilling	147	49	.016

In a bulletin issued by the company on January 2, 1936, the ore reserves in the No. 1 vein between the surface and the 200-foot level were estimated as follows:—

	Length	Quantity	Gold content
	feet	tons	oz. per ton
Indicated ore, main section	567	45,000	0.387
Probable ore, west section	179	13,500	.299
Probable ore, east section	200	18,000	.353
Total	946	76,500	0.362

In February, 1936, the shaft was completed to a depth of 325 feet. A crosscut driven north at this level intersected the vein 65 feet from the shaft.

Soumi (Finland)

The Soumi property consists of a group of 10 claims adjoining the boundary between Todd and Fairlie townships north of Martin bay. The principal showing lies about a mile north of the west end of Martin bay. A narrow quartz vein has been exposed by surface workings at intervals for a distance of 600 feet. It

occupies a fracture in pillow lava, strikes N.65°–70°W. (mag.), and dips steeply northeast. The vein matter ranges from a fraction of an inch to 7 inches in width. It consists of grey quartz containing streaks or disseminated grains of pyrrhotite, chalcopyrite, pyrite, galena, and calcite. Visible gold is reported to have been found in some parts of the vein. The wall rock consists of rather massive, unmineralized greenstone. Near the east end of the showing parallel stringers branch toward the northeast and southwest from the main vein. About 120 feet north of the main vein, a parallel vein 1 to 7 inches wide has been exposed for about 90 feet.

Paulore Gold Mines, Limited

Paulore Gold Mines, Limited, owns a group of 9 surveyed claims near the west end of Martin bay. These holdings adjoin the east group of Rowan Lake Gold Mines on the east. During 1934, surface exploration was done on various parts of the property under the direction of C. Campbell. This work uncovered several narrow quartz veins sparsely mineralized with sulphides and a rusty, pyritic zone containing a little chalcopyrite and native copper.

Since the property was visited in September, 1934, exploratory work is said to have exposed an east-west shear zone at a point about 700 feet east of the Rowan-Hall boundary. According to the management, the shearing has been traced for about 1,500 feet. The mineralized sections exposed in the test pits are reported to be from 4 to 7 feet wide and to consist of sheared diorite containing auriferous quartz stringers and arsenopyrite. Visible gold is said to be plentiful in one section 60 feet in length.

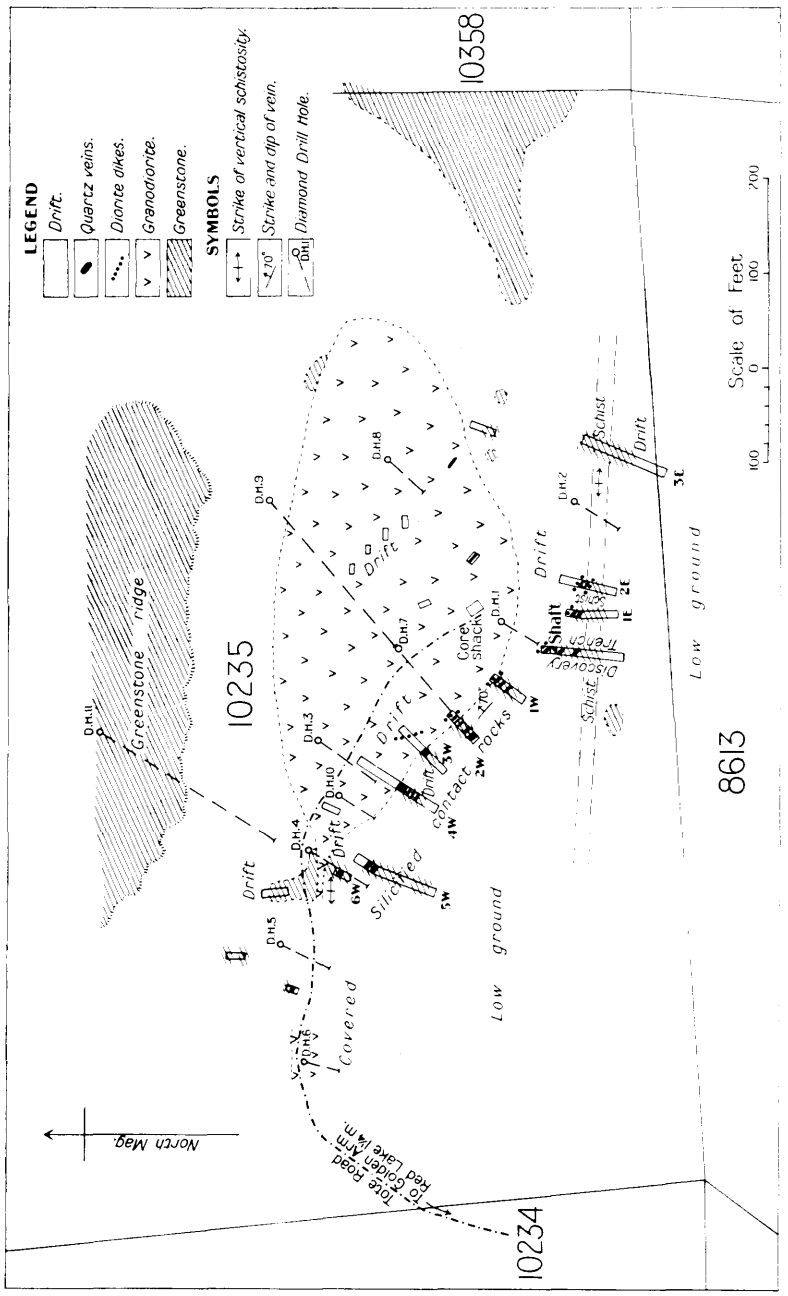
Red Crest Gold Mines, Limited

Early in 1934, Red Crest Gold Mines, Limited, acquired the holdings of the Rowan Discovery Syndicate consisting of 7 surveyed claims situated northeast of the head of Golden arm. The workings are located about 1¼ miles by road from the lake. A sketch map and a description of the deposit are contained in a report by G. D. Furse.[1]

The principal showings are in the southern part of claim No. 10,235. Trenches excavated along a granodiorite-greenstone contact have exposed a fracture zone containing several quartz veins. At the northwest end the zone passes into greenstone and is obscured by drift. Toward the southeast it merges with an east-west shear zone in the greenstones. The general geology in the vicinity of the deposit is shown on the accompanying plan.

The quartz veins occur in both granodiorite and greenstone. They strike N.50°–60°W. (mag.) and dip about 70°N.E. They range in width from a few inches to 6 feet and in some of the workings have a combined thickness of nearly 20 feet. The mineralization appears to have occurred in two stages separated from one another by minor fracturing. The bulk of the vein matter was introduced during the earlier stage. It consists of quartz containing nests and streaks of coarsely crystalline pyrite. Sampling shows that the pyrite is auriferous, whereas the quartz is quite low grade or barren. Subsequent fracturing of the quartz-pyrite veins gave rise to openings, in which were deposited quartz containing fine-grained pyrite, molybdenite, tellurides, and native gold. This second generation of vein matter is relatively small in volume and erratic in distribution. It has been discovered, by E. G. Bishop, that the high-grade sections occur in close proximity to two narrow diorite dikes, which lie within the fracture zone

[1]Ont. Dept. Mines, Vol. XLII, pt. 6, 1933, pp. 50, 51.

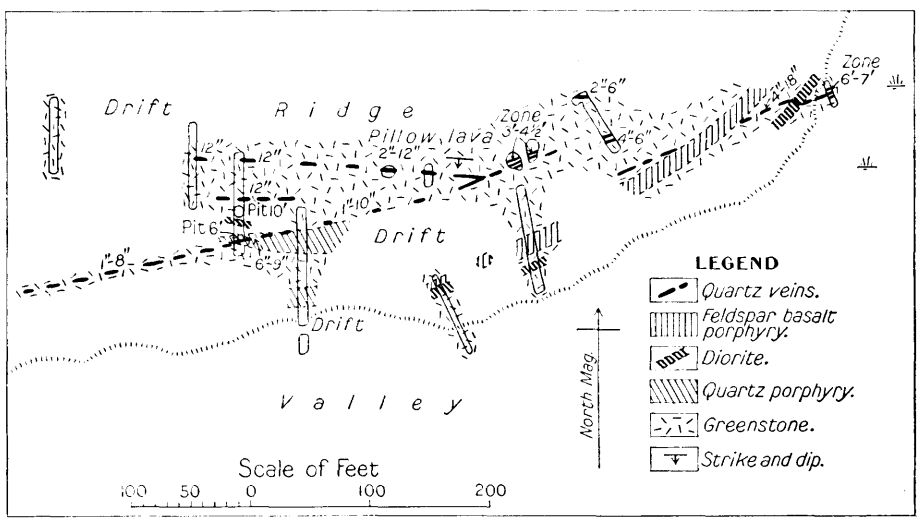


Geological plan of surface workings, claim No. 10,235, Red Crest Gold Mines.

and pass toward the northwest into the granodiorite. In places the wall rocks contain fine-grained auriferous pyrite. Sampling of the surface showings is said, by the management, to have indicated an ore shoot 222 feet long and 5.1 feet wide, containing an average of 0.634 ounces per ton in gold.

During 1931, about 2,000 feet of diamond-drilling, in 11 holes, was done on the principal showings by Coniagas Mines, Limited. This work indicated the continuation of the vein zone at depths ranging from 40 to 250 feet and for a distance of 500 feet along the strike. During 1934, an additional 2,000 feet of drilling was done by the company under the direction of J. M. Wilson. This confirmed the results of the earlier work and indicated the presence of two paystreaks within the fracture zone.

In December, 1935, a 5-ton mill was installed on the property.



Geological plan of workings, southeast corner of claim No. 6,181, Rowan Lake Gold Mines.

Rowan Lake Gold Mines, Limited

Rowan Lake Gold Mines, Limited, controls two groups of surveyed claims formerly held by the Rowan-Hall Syndicate and situated to the east and west of the head of Golden arm. The West group, consisting of 34 claims, adjoins the Red Crest property on the north and extends westward to Rowanhall lake. The East group consists of 7 claims lying immediately south of the Red Crest property.

The principal workings on the West group are located on the crest of a ridge in the southeast corner of claim No. 6,181, about 15 chains north of Rowanhall lake. A series of trenches has been excavated at intervals for 500 feet along an east-west fracture zone in andesitic pillow lava. These workings have exposed several quartz veins ranging from a fraction of an inch to 18 inches in width. The principal vein intersects the schistose zone in the greenstones at a low angle and has been traced for about 400 feet. It is joined on the north by several branch veins, which lie parallel to the schistosity. The best showings occur near the east end of the main vein, where the mineralized zone is 4 to 5 feet in width and consists of brecciated greenstone and

quartz stringers containing pyrrhotite, galena, chalcopyrite, pyrite, and zinc blende. Sampling of these exposures is said to have yielded high values in gold.

Several quartz veins and pyritic zones have been exposed by surface workings elsewhere on this group.

Surface exploration on the East group has exposed an east-west shear zone in the central part of claim No. 10,357. This zone occurs in andesitic greenstones intruded by numerous dikes of quartz porphyry and feldspar porphyry. It ranges from 3 to 6 feet in width and has been traced for about 400 feet. Quartz-ankerite stringers well mineralized with pyrite, chalcopyrite, galena, zinc blende, pyrrhotite, and arsenopyrite, together with streaks of massive sulphides, occur in some portions of the zone. The wall rocks in places are highly graphitic and contain finely disseminated pyrite and arsenopyrite. Sampling is said to have indicated low values in gold and silver.

Frontier Red Lake Gold Mines, Limited

Frontier Red Lake Gold Mines, Limited, controls a group of 11 claims east of Pipestone bay. These holdings include the former Kelly-Carlson property. The principal showings are situated about 1½ miles by trail from the lake. Development work so far has been concentrated in the central part of claim No. 10,395, where trenching has uncovered a fracture zone that strikes N.75°W. (mag.) and intersects tongues of quartz porphyry intruded into or containing strips of schistose greenstone. This zone has been exposed at intervals and appears to be persistent for a distance of 200 feet. Beyond this section the fracturing and mineralization are less well defined. The mineralized portions of the zone consist of altered greenstone and porphyry traversed by stringers and lenses of grey quartz containing pyrrhotite, pyrite, chalcopyrite, zinc blende, galena, and native gold. The mineralization extends over widths ranging from a few inches to 6 feet. It is rather erratic in distribution and continuity and appears in places to be interrupted by minor faulting. Parallel fractures containing stringers and lenses of quartz occur 70 feet north and 110 feet south of the principal zone.

Midway along the east boundary of claim No. 10,395, there is an east-west shear zone in greenstone. This zone contains quartz veinlets mineralized with zinc blende, chalcopyrite, and pyrite.

Near the southeast corner of claim No. 10,396, trenching has exposed large bodies of grey quartz sparsely mineralized with pyrite and tourmaline.

Exploration of the principal showing by diamond-drilling was begun in February, 1936, under the joint direction of Bunker Hill Extension Mines and Bagamac Rouyn Mines.

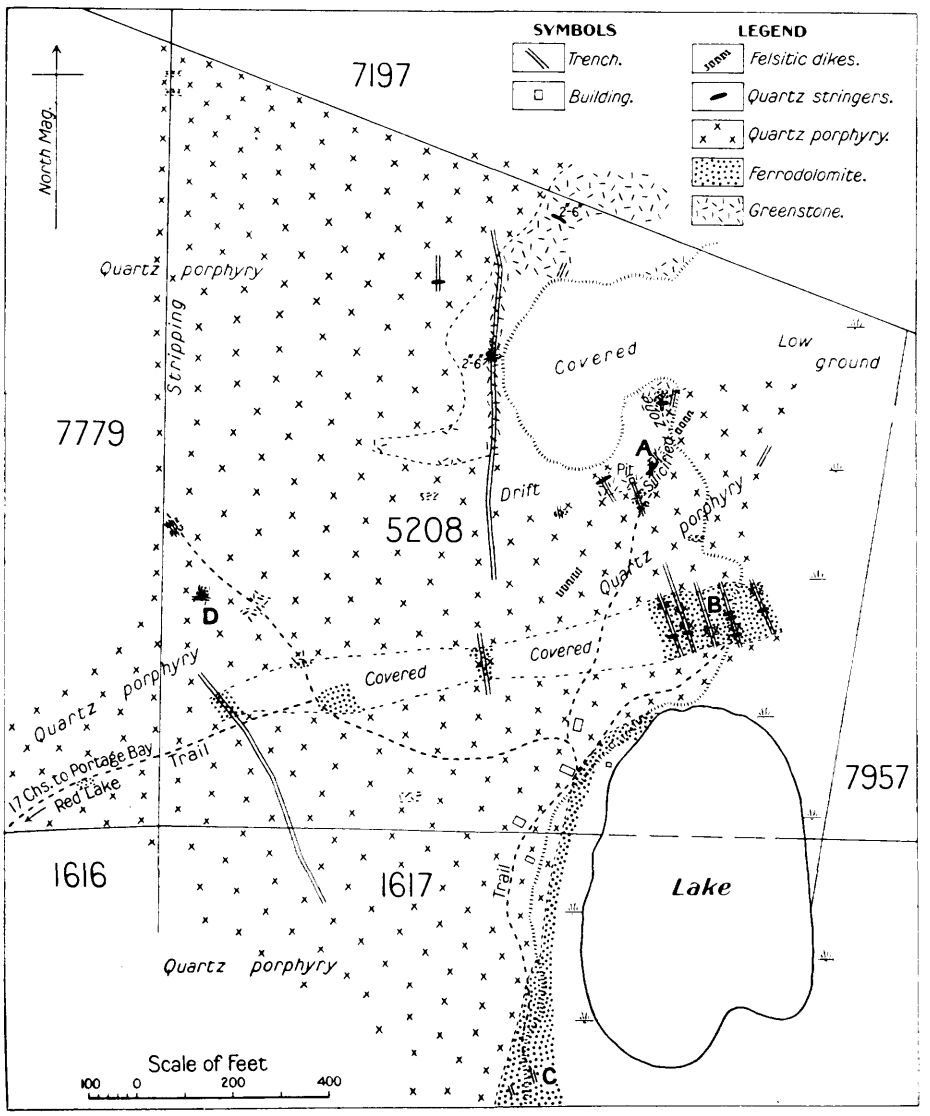
Graham

The Graham property consists of 11 surveyed claims located on the east side of Pipestone bay. At the southwest corner of claim No. 2,880, trenching has exposed two quartz veins, 50 feet apart, in the vicinity of a quartz porphyry–greenstone contact. These veins strike N.72°–85°E. (mag.) and range from a few inches to 4 feet in width. The southern vein is sparsely mineralized with pyrite, chalcopyrite, tourmaline, and ankerite.

A.R.L. Gold Mines, Limited

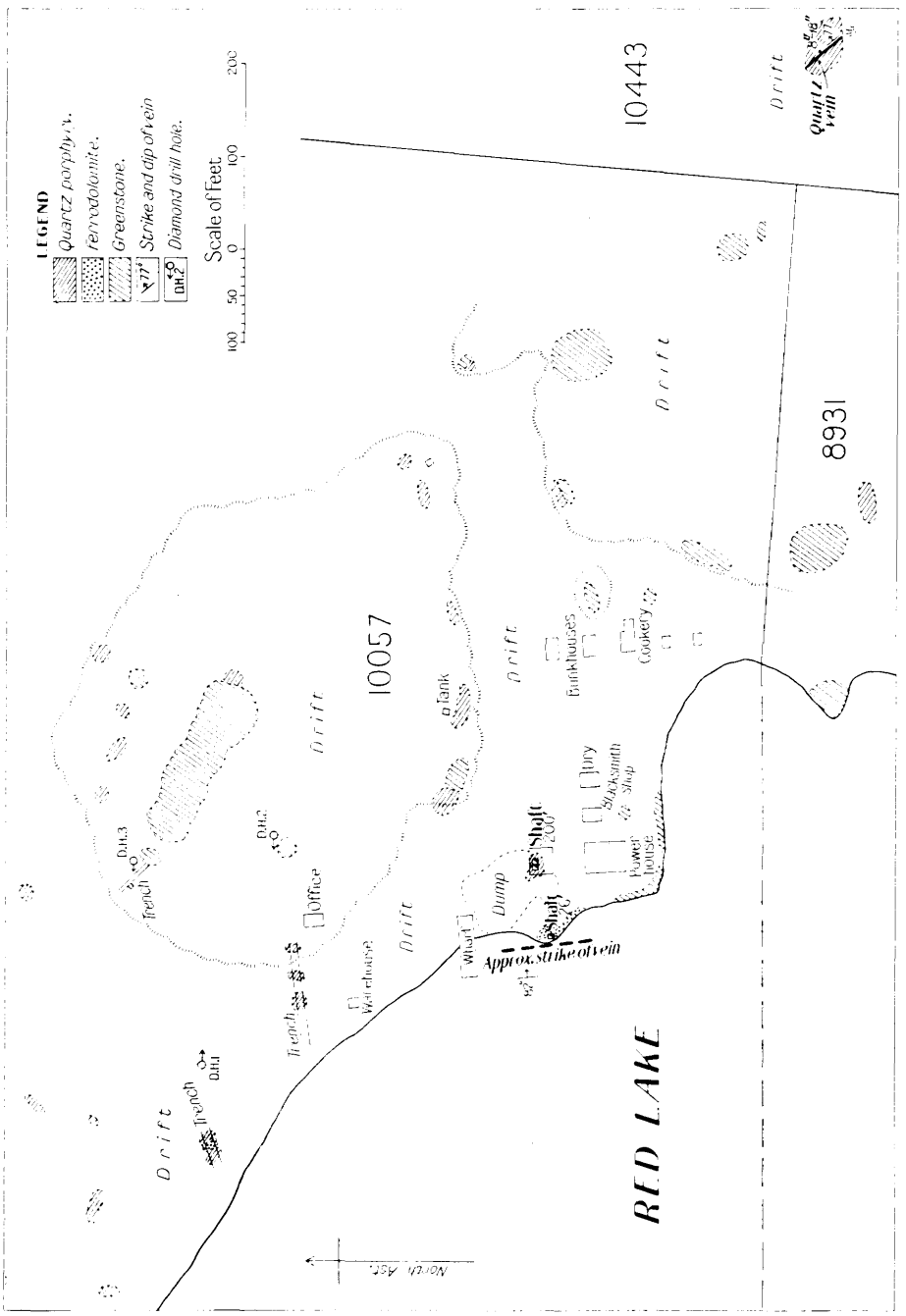
In October, 1934, A.R.L. Gold Mines, Limited, acquired the holdings of Abate Red Lake Development Company, Limited, consisting of a group of 18 surveyed claims located along the west side of Golden arm.

On claim No. 1,448, near the north end of Hahn lake, some surface work has been done on a zone consisting of highly contorted, siliceous iron formation interbanded with greenstone or tuffs. In places these rocks are heavily mineralized with pyrite and pyrrhotite.



Geological sketch map of the Madsen–Sadler Bay claims.

Considerable trenching has been done along a ridge lying southeast of the small lake on claims Nos. 1,449 and 1,451. These workings have exposed several rusty zones in schistose greenstone, banded iron formation, and altered quartz porphyry. The areas of mineralization range from a few feet to 25 feet in width and strike in a northeasterly direction. They consist of grey quartz and altered rock matter impregnated with pyrite and pyrrhotite or cut by stringers composed



Geological plan of surface workings, West Red Lake Gold Mines.

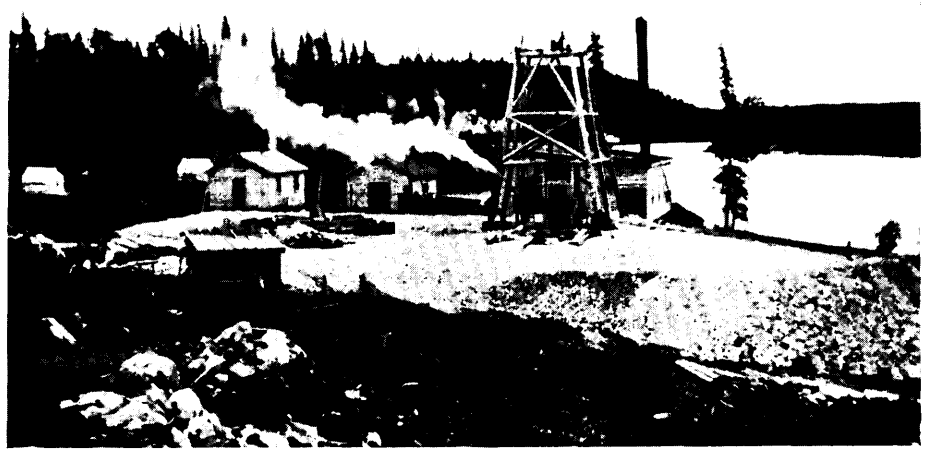
of these sulphides. Quartz veinlets containing zinc blende were encountered in some of the workings.

Madsen-Sadler Bay

The Madsen–Sadler Bay property consists of 14 surveyed claims situated between Sadler bay and Hahn lake. The camp and principal workings are located on claim No. 5,208, about half a mile by trail east of Sadler bay. During the summer of 1933, some diamond-drilling was done on various parts of the property by Sterling Collieries, Limited.

The showings consist chiefly of auriferous quartz veinlets. These occur where fracturing has taken place along quartz porphyry–greenstone contacts or within remnants of carbonatized greenstone caught up in bodies of porphyry.

The surface workings on claim No. 5,208 are shown on the accompanying plan. The principal showings occur along a quartz porphyry–greenstone contact,



Plant of West Red Lake Gold Mines, September, 1934.

which has been exposed at intervals for a distance of 250 feet. The rocks along this contact have been sheared, carbonatized, and impregnated with disseminated pyrite over widths ranging from a few feet to 15 feet. In places the mineralized zone has been cut by a network of quartz stringers containing visible gold, together with pyrite and small amounts of chalcopyrite, zinc blende, galena, and jamesonite (?). In the southern part of the claim a series of trenches has been excavated across a ferrodolomite zone, 25 to 100 feet in width, containing gash veinlets of quartz.

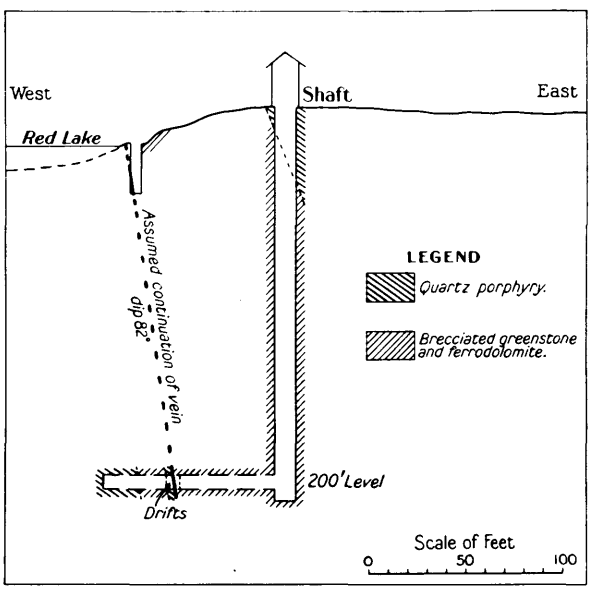
Quartz veinlets containing visible gold have also been found on claims Nos. 1,617, 7,779, and 5,207.

West Red Lake Gold Mines, Limited

Early in 1934, West Red Lake Gold Mines, Limited, took over the properties of the National Gold Syndicate. These holdings consist of four groups totalling 27 claims in the area between Pipestone bay and Martin bay. The most easterly group lies between Martin bay and Hammell lake; another group adjoins the

holdings of Red Crest Gold Mines on the west; a third group lies midway between Golden arm and Pipestone bay and adjoins the Rowan Lake Gold Mines and Graham holdings; and the fourth group is located on the peninsula between Sadler bay and Pipestone narrows. Development work to date has been largely concentrated on the last group.

Prior to the acquisition of these properties by the present company, an auriferous quartz vein had been discovered on claim No. 10,057 on the east side of Pipestone narrows. A shaft sunk near the water's edge to a depth of 26 feet is said to have intersected 12 to 15 inches of vein matter carrying high values in gold at a depth of 20 feet. In July, 1934, exploration of the deposit was resumed under the direction of A. H. Honsberger. A 2-compartment shaft was sunk to a depth of 200 feet in the hanging wall of the vein at a point 80 feet east of the lakeshore.



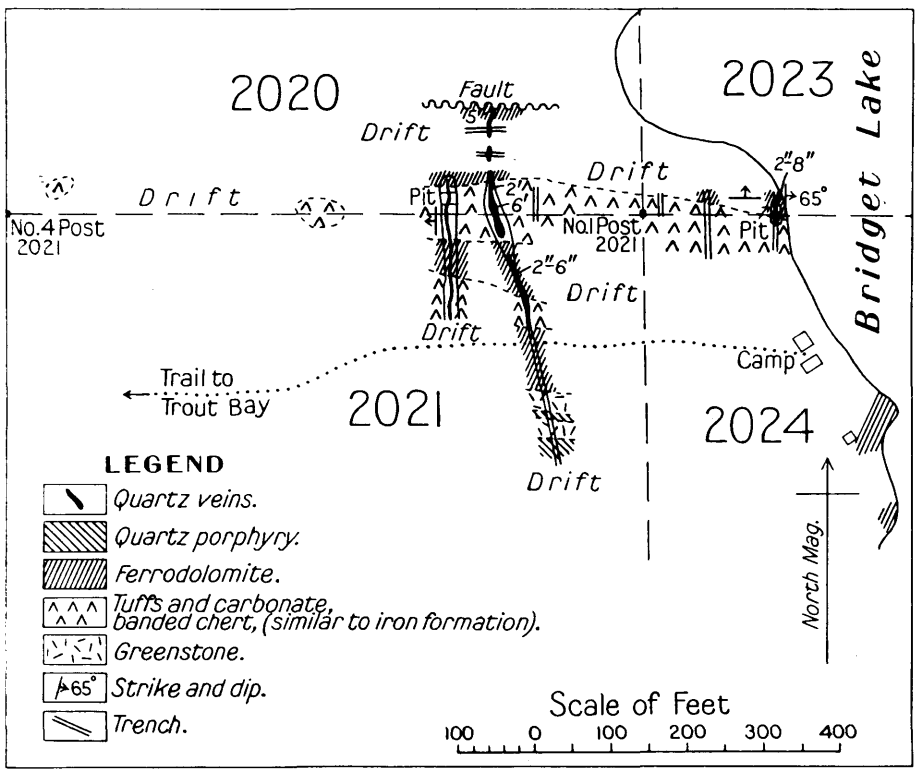
Transverse vertical projection through the shaft of the West Red Lake mine.

At a depth of 135 feet a heavy flow of water was encountered in the shaft. A crosscut run westward at the 200-foot level passed through a zone composed of ferrodolomite and brecciated, carbonatized greenstone and intersected the vein 58 feet from the shaft. The vein strikes N.10°W. (mag.) and dips about 82°E. In the vicinity of the crosscut it occurs on the hanging-wall side of a narrow quartz porphyry dike and lies about 20 feet east of what appears to be the main porphyry-greenstone contact. When the property was examined drifts had been run for a total of 40 feet north and south of the crosscut. In this section the vein matter ranges from 1 to 8 inches in width and consists of cellular grey quartz containing coarsely crystalline pyrite and small percentages of chalcopyrite, zinc blende, galena, and native gold. In places the wall rocks adjoining the vein are heavily impregnated with fine-grained, non-auriferous pyrite.

When operations were discontinued in November, 1934, the drifts had been extended for 120 feet north and 161 feet south of the crosscut. According to the management, sampling of these workings indicated a total length of 222 feet of ore containing 0.38 ounces gold per ton over an average width of 42 inches.

Development work was resumed in July, 1935, under the direction of C. H. E. Stewart, to whom the writer is indebted for the following information. The shaft was deepened to 217 feet to provide a sump, and the south drift was extended 347 feet to a point 508 feet south of the shaft crosscut. As the water course intersected in the shaft dips toward the north, exploration of the vein in that direction was done by diamond-drilling from the surface rather than by extending the north drift.

Throughout its explored length the vein follows a quartz porphyry–greenstone contact. The quartz vein filling is usually less than 8 inches in width and



Geological plan of the surface workings, Big-Lode Gold Mines.

it splits or pinches out at intervals. Resampling of the 222-foot section exposed in the old workings indicated the presence of two mineralized shoots, 112 feet and 60 feet in length. Across an average width of 46 inches, these shoots yielded slightly lower values than those reported by the previous operators (see above). In extending the drift to the south, two more mineralized shoots, 73 feet and 80 feet in length, were encountered. These yielded values below commercial grade across an average width of 46.8 inches. No mineralization of importance was found in the last 140 feet of the south drift.

Three diamond-drill holes, totalling 515 feet, were put down from the surface to explore the northerly continuation of the vein. Hole No. 2, located 280 feet north of the shaft, penetrated greenstone. Holes Nos. 1 and 3, located 355 feet and 430 feet north of the shaft, respectively, were drilled in quartz porphyry. A 3-inch quartz stringer carrying gold values was intersected in hole No. 3, but no

mineralization of importance was encountered in the other holes. Operations at the property were discontinued on October 28, 1935.

On claim No. 10,443, near the southeast corner of claim No. 10,057, surface workings have exposed a quartz vein, 8 to 18 inches in width, for a distance of 50 feet. The vein occurs in quartz porphyry, strikes N.40°W. (mag.), and dips 77°N.E. To the northeast it is covered by drift, and to the southeast it is overlain by swamp. The quartz is sparsely mineralized with pyrite and chalcopyrite and is reported to carry values in gold.

Big-Lode Gold Mines, Limited

Big-Lode Gold Mines, Limited, has acquired the holdings of the Trout Bay Syndicate in the vicinity of Bridget lake. The property consists of a group of 14 surveyed claims, which extend from Trout bay to Middle bay. The camp and principal workings are located at the west end of Bridget lake about a quarter of a mile by trail from Trout bay.

A number of trenches have been excavated at intervals across a body of banded chert, carbonate, and tuffs, which resembles iron formation in appearance. This zone ranges from 40 to 100 feet in width and extends westward from the lake for at least 1,000 feet. Large exposures of rusty-weathering ferrodolomite occur on both sides of the siliceous zone, and tongues of the carbonate occupy fractures penetrating it. These ferrodolomite bodies are believed to be structurally and genetically related to nearby intrusions of quartz porphyry. The carbonatization appears to be due in part to brecciation and replacement of the greenstones originally associated with the banded cherty formation and in part to the introduction of ferrodolomite in the form of veins. The carbonate contains radiating aggregates of pale-green actinolite.

Several veins composed of grey, smoky quartz, strike in a northerly direction across the carbonate-banded silica zone. Near the lakeshore, a vein, 2 to 6 inches wide, carrying visible gold has been exposed for about 30 feet. In the west workings, one vein has been exposed at intervals for about 300 feet along the strike and another for about 200 feet. These veins branch, pinch, and swell, and range from a fraction of an inch to 6 feet in width. The vein matter is sparingly mineralized with pyrite and is reported to contain, in places, visible gold.

May-Spiers Gold Mines, Limited

The holdings of May-Spiers Gold Mines, Limited, consist of a group of 8 surveyed claims extending across and along both sides of Middle bay. In 1933, a mineralized shear zone was traced for some distance on the property of Middle Bay Mines, Limited, situated at the west end of the bay. This zone appears to extend eastward beneath the lake on to the May-Spiers group. About half a mile east of the end of the bay, sheared formations of similar character outcrop on a small island on claim No. 8,121. The principal showing is on the northwest shore of the island, where test pits have exposed a band of chloritic schist, several feet in width, containing a network of quartz stringers. The schistosity strikes about N.70°W. and dips steeply to the north. Sampling of the exposure is said to have yielded encouraging values in gold. A small outcrop of quartz porphyry occurs on the island. Much of the bedrock surface on the island and on the mainland immediately to the north is obscured by drift.

During 1934, about 6,000 feet of diamond-drilling was done in the vicinity of the deposit. A series of holes was drilled from the ice and from the north shore

of the bay to intersect the formations at intervals along the strike and at depths of 50 to 300 feet. This exploration is said to have indicated that the shearing persists for a distance of 2,400 feet and that in some sections two or more parallel zones of mineralization are present. According to the management some of the mineralized sections encountered in the drill holes yielded commercial values in gold. One of the deeper holes directed beneath the outcrop on the island passed through chlorite-carbonate schist, sericite schist, and quartz porphyry. The mineralized sections encountered in this hole are composed of chloritic schist containing veinlets of quartz and disseminated pyrite, chalcopyrite, and pyrrhotite. A mining plant was installed on the island during the summer of 1935.



Drill rig of May-Spiers Gold Mines, September, 1934.

Middle Bay Mines, Limited

Middle Bay Mines, Limited, controls a group of 17 claims, formerly held by A. C. Stevens and associates, in the area north of Trout bay and west of Middle bay. During 1934, some surface exploration and diamond-drilling were done on the property under the direction of T. W. Dean. This work was largely concentrated on two parallel shear zones lying about 900 feet apart. The workings on the north zone lie within a few chains of the west end of Middle bay, and those on the south zone are about 24 chains west of the lake.

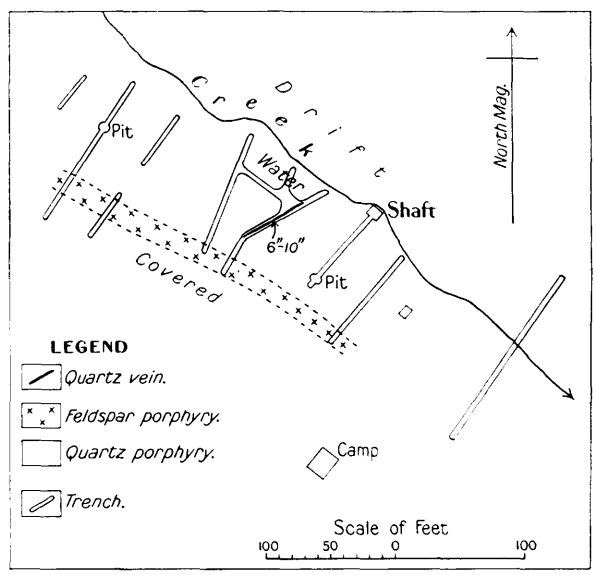
Under the previous owners, the south zone had been traced by surface workings for about 350 feet. This exploration disclosed the presence of two parallel horizons of shearing and mineralization, about 50 feet apart, in an area underlain by greenstone and tongues of quartz porphyry. The shearing strikes N.68°W. (mag.), dips 65°N.E., and extends over widths ranging from a few inches to 6 feet. Veins and stringers of quartz, 1 to 18 inches wide, containing pyrite, chalcopyrite, zinc blende, and galena, occur along these lines of weakness. In places the wall rocks are heavily mineralized with pyrite and pyrrhotite. In a pit, sunk to a depth of 15 feet on the southern vein zone, the shearing extends over a width of 5 feet, and one part, 16 to 24 inches wide, consists of quartz and massive sulphides. Samples from this section are said to have yielded commercial values in gold. During the summer of 1934, 8 holes totalling 2,325 feet, were

drilled in the vicinity of the showings. This work indicated that the shearing and mineralization continue over narrow widths for several hundred feet to the east of the surface showings.

The north zone has been traced for several hundred feet in a series of trenches excavated at intervals along the southwest slope of a low ridge composed of greenstone intruded by tongues of quartz porphyry. These workings have exposed from 5 to 7 feet of highly sheared greenstone containing lenses and narrow veins of coarsely crystalline pyrite and dark-grey quartz. The shearing strikes N.60°–65°W. (mag.) and dips 65°N.E. Exploration of this zone by diamond-drilling was in progress when the property was visited.

Cardinal Gold Mines, Limited

The property of Cardinal Gold Mines, Limited, adjoins that of Middle Bay Mines on the west. It lies northwest of the west end of Trout bay and includes



Plan of surface workings, Cardinal Gold Mines.

two groups totalling 20 claims formerly held by Pipestone Red Lake Gold Mines, Limited, and the Foley Red Lake Mining Company, Limited (Black property). Although this ground has lain idle during the past few years, considerable surface work was done by the previous owners in various parts of the property.

The property, formerly controlled by the Foley Red Lake Mining Company, consists of a group of 10 surveyed claims. Several showings have been partially explored. About half a mile by trail northwest of the end of Trout bay, a number of pits and trenches have been excavated across a wide quartz porphyry dike. The dike has a banded appearance due to shearing and the presence of streaks of basic material. Stringers and bulges of quartz, sparsely mineralized with pyrite, were encountered in some of the workings. Between 54 and 60 chains northwest of the lake, a series of trenches, 200 to 300 feet in length, has been excavated at intervals of 100 feet across a zone composed of bands of schistose greenstone and ferrodolomite separated by tongues of quartz porphyry. In the various workings there are exposed from 4 to 8 quartz veins having a combined width of 12 to 16 feet. Individually the veins range from a few inches to 10 feet

in width. They consist of barren-looking, white or grey quartz containing only a trace of pyrite. Both the rock formations and the veins strike approximately N.50°W. (mag.).

The ground formerly held by Pipestone Red Lake Gold Mines lies between the Foley group and the Middle Bay Mines group. The camp and principal workings are located about 10 chains northeast of the No. 2 post of claim No. 2,964. A series of trenches has been excavated along a creek that flows eastward into Middle bay. The accessible parts of these workings are chiefly in quartz porphyry. A feldspar porphyry dike, about 15 feet in width, lies about 100 feet south of the creek and extends in a northwesterly direction in close proximity to the quartz porphyry–greenstone contact. In one trench a grey quartz vein, 6 to 10 inches wide, is exposed for a distance of 35 feet. It strikes N.61°E. (mag.), dips 58°N.W., and is well mineralized with pyrite. A shallow shaft has been sunk alongside the creek on a white quartz vein containing massive pyrite, chalcopyrite, and a little zinc blende. A grab sample of the heavily pyritized vein matter taken from the dump yielded 1.93 ounces per ton in gold. As the workings were filled with water, the dimensions and trend of this vein could not be ascertained. In the opinion of the management the main shear zone strikes about N.60°W. (mag.), and extends beneath the low ground to the north of the present workings.

Scott Gold Mining Syndicate

The principal holdings of the Scott Gold Mining Syndicate consist of a group of 17 surveyed claims situated along the south side of Pipestone bay, west of Pipestone narrows.

The principal showing is located on claim No. 1,720, a short distance west of the camp. A rock cut has been excavated for 115 feet along a fault surface that marks the contact between soapstone and diorite. This trench intersects a number of white quartz veins ranging from a few inches to 30 inches in width. These veins strike N.5°–15°W. (mag.). They occur in the diorite and appear to terminate at the fault surface. The diorite contains a little disseminated pyrite and chalcopyrite, but the quartz is very sparsely mineralized. The vein matter is reported to carry low values in gold.

On claim No. 1,716, just south of the lake, numerous gash veinlets of quartz occur in a small body of granite. In the southern part of this claim trenching has exposed a quartz vein containing a little chalcopyrite. This vein strikes east and west and ranges from 6 to 16 inches in width. It occurs in sheared garnetiferous greenstone.

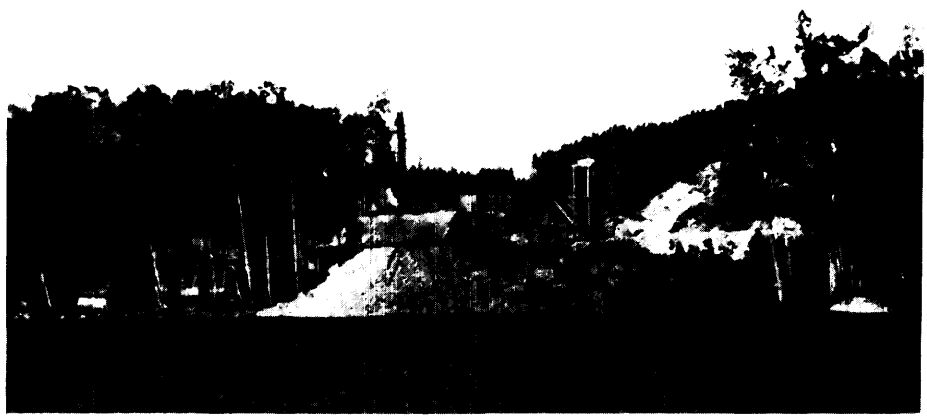
Near the southeast corner of claim No. 5,261, a rock cut has been excavated for a distance of 75 feet in a northerly direction from the shore of Middle bay. This has exposed a 12-foot band of carbonatized greenstone lying between walls of quartz porphyry. Several stringers and bulges of quartz, 1 to 18 inches wide, occur at or near the contacts between these rocks. The vein matter and wall rocks are very sparsely mineralized with pyrite.

Cole Gold Mines, Limited

Cole Gold Mines, Limited, holds a group of 24 surveyed claims located on the west side of Pipestone bay. The camp and principal workings are on claim No. 1,629. Development work has been concentrated on a broad shear zone which occupies the depression between two prominent ridges of quartz porphyry. Except along the lakeshore the surface workings on this zone are no longer accessible. Where exposed the zone consists of quartz porphyry of very variable

composition and appearance, together with streaks of basic material and stringers of quartz. Diabase dikes occur within the shear zone and intersect the massive quartz porphyry north of the workings.

Underground exploration of the shear zone was begun in 1933 under the direction of J. Y. Cole, Jr. A two-compartment shaft has been sunk to a depth of 200 feet at a point about 125 feet from the lakeshore. At this level drifts have been run for several hundred feet east and west of the shaft. From these workings crosscuts have been driven at intervals for about 200 feet north and south. To the east and south of the shaft the crosscuts intersected a quartz porphyry–greenstone contact. North of this contact the workings have penetrated bodies of schistose quartz porphyry separated by a strip of greenstone and cut by two narrow diabase dikes. The planes of shearing strike N.85°W. (mag.) and dip 65°–75°N. Along certain planes within the quartz porphyry and along some of



Plant of Cole Gold Mines, August, 1933.

greenstone and diabase contacts the shearing movement has been quite pronounced. These planes of weakness are marked by the presence of mud seams, which in places contain calcite and botryoidal masses of marcasite.

A post-vein normal fault passes through the shaft at the 200-foot level. It strikes slightly east of north and dips westward at about 74 degrees. As the veins and rock structure dip to the north, the downward movement of the hanging-wall or west fault block has given rise to a horizontal separation of the formations along the fault plane. At the 200-foot level this displacement is believed to be about 165 feet.

When the property was visited in September, 1934, three parallel vein zones had been intersected in the workings east of the fault on the 200-foot level. A crosscut driven toward the south on the west side of the fault encountered what are believed to be the extensions of these zones. The mineralization occurs in the form of quartz stringers, which for the most part strike in the same direction as the schistosity of the quartz porphyry. Development work has been concentrated chiefly on the No. 1 zone, which is the best defined of the three. Drifts having a total length of about 250 feet have been driven along this zone from the

fault eastward beneath the lake. The workings follow one or other of two sets of veinlets, known as No. 1 and No. 1A, which lie a few feet apart. Where observed, the mineralized sections consist of sheared quartz porphyry containing one or more stringers or lenses of bluish-grey quartz, a fraction of an inch to 24 inches wide, within a width of 2 to 3 feet. The quartz contains coarsely crystalline and fine-grained varieties of pyrite, some chalcopyrite, a little pyrrhotite, and, in places, visible gold. In the area west of the fault, about 75 feet of drifting has been done on what is regarded as the westerly continuation of the No. 1 zone. According to the management, sampling of the drifts both east and west of the fault has indicated the presence of encouraging values in gold.

The No. 2 and No. 3 vein zones lie, respectively, to the north and south of the No. 1 zone. They appear to be somewhat narrower, and only a small amount of drifting had been done on them when the property was visited. Zinc blende is a characteristic constituent of the No. 2 vein.

Surface exploration on other parts of the property has uncovered showings, sampling of which is said, by the management, to have yielded values in gold.

Since the property was visited further exploration has been carried out at the 200-foot level; the shaft has been deepened; and some drifting has been done on the No. 1 zone at the 300-foot level.

Biron

The Biron property is located on the south side and at the west end of Pipestone bay. The showings occur along the northeast slope of a ridge that crosses the northern parts of claims Nos. 3,475 and 3,476. Rock cuts have been excavated at intervals along a fracture zone that marks the north contact between a narrow strip of hornblendic greenstone and quartz porphyry. This zone strikes N.55°–65°W. (mag.) and dips at about 65°N.E. Where exposed it ranges from 15 to 20 feet in width and contains veins and irregularly shaped bodies of sugary, white or grey quartz. The quartz is cut by veinlets composed of pyrite, chalcopyrite, pyrrhotite, and zinc blende. Near the quartz porphyry contact, the greenstone is garnetiferous and contains streaks of fine-grained pyrite.

Brown

The Brown property is located near the mouth of the creek that empties into the west end of Pipestone bay. Surface workings on the quartz porphyry ridge just north of the creek have exposed several stringers and bulges of grey quartz containing chalcopyrite. At the soapstone contact on the north side of the quartz porphyry body, a 14-foot pit has been sunk on a white quartz vein 12 to 24 inches wide. This vein is reported to be auriferous.

Pendleton

The Pendleton property lies southwest of the west end of Pipestone bay. The camp is located near the south boundary of claim No. 9,486 and on the east side of a small lake about a mile distant by trail from Pipestone bay.

Between 12 and 30 chains east of the camp there are a series of trenches along a rusty fracture zone, which intersects quartz porphyry containing inclusions of greenstone. Where exposed, the zone is 1 to 4 feet in width and strikes N.55°–70°W. (mag.). It contains narrow veins and stringers of quartz sparsely mineralized with pyrite and chalcopyrite.

Near the southwest corner of claim No. 9,483 trenching has exposed several narrow quartz veins in greenstone and iron formation.

Other Properties

The holdings of the companies listed below were not examined, as little or no development work has been done on them in recent years.

The Red Lake Goldfields Company, Limited, owns a group of 15 claims located on the east side of East bay.

East Bay Mines of Red Lake, Limited, controls a group of 18 claims lying between the Nortricia property and East bay. This ground was acquired from Red Lake Goldfields in 1928.

Red Lake Bay Mines, Limited, represents an amalgamation of properties formerly held by Red Lake Bay Syndicate, Cochenour Red Lake, Limited, Cockeram and McLeod, and Red Lake Prospectors, Limited. These holdings consist of 24 claims divided into two groups, one of which lies to the south and west of the property of Red Lake Gold Shore Mines and the other adjoins the property of Howey Gold Mines on the east.

Buffalo Red Lake Mines, Limited, owns a group of 26 claims adjoining the holdings of McIntyre-Porcupine Mines on the south and west.

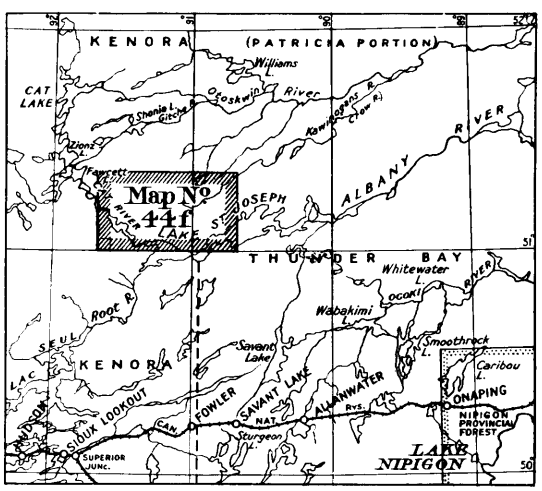
The Miller Red Lake Syndicate did some development work in 1926 on a group of 7 claims in the vicinity of Wolf narrows.

Geology of the Cat River-Kawinogans Lake Area

By W. D. Harding

INTRODUCTION

The region adjacent to Lake St. Joseph and the Cat river has been known to explorers since the early days of Canadian history. Both Lake St. Joseph and the Cat river belong to the Albany River system, the early exploration of which was undertaken by way of Hudson bay. Fort Albany, near the mouth of the Albany river, was one of the first posts established by the Hudson's Bay Company after receiving its charter. It was built between 1673 and 1685,[1] and was the scene of much fighting between early French and English traders. Osnaburgh House, the Hudson's Bay Company's post near the east end of Lake St. Joseph



Key map showing the location of the Cat River–Kawinogans Lake area. Scale, 60 miles to the inch.

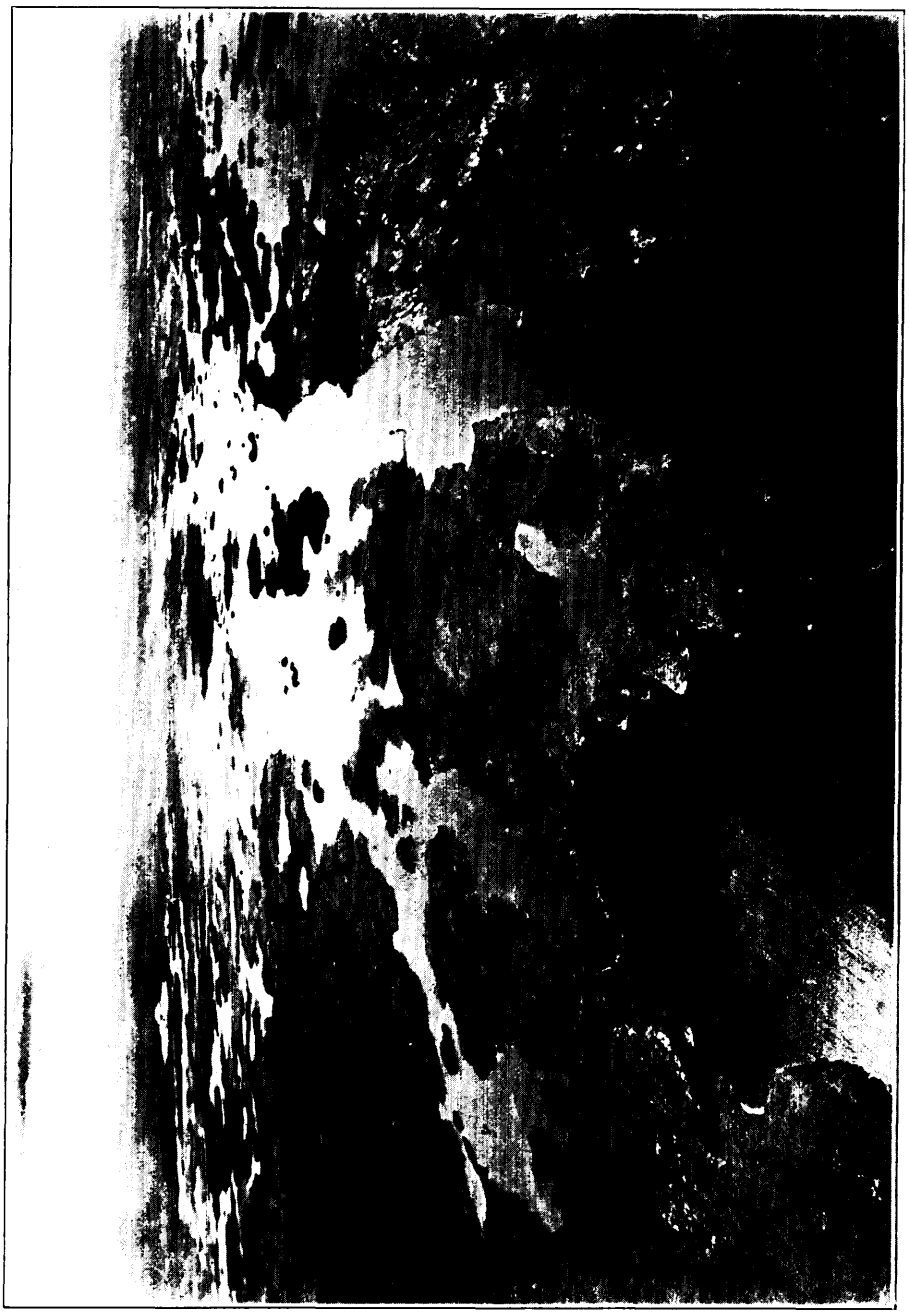
(at that time called Osnaburgh lake), was established over a hundred years later, in 1786.[2] This was the first post in that region. From that date until the completion of the Canadian Pacific railway, navigation by means of the Albany river and Hudson bay provided the only means of communication between the Lake St. Joseph region and the outside world. During its early history Osnaburgh House was the trading centre for a wide area. It held an important position during the time of the York boat brigades, and relatives and descendants of the early day *voyageurs* still reside in the area.

General Description of the Map Area

The Cat River–Kawinogans Lake area lies in Patricia portion of Kenora

[1]The exact year in which Fort Albany was established is not stated in most of the histories of the Hudson's Bay Company. "The Oxford Encyclopaedia of Canadian History" on page 200 states that it was built about 1683. "The Remarkable History of the Hudson Bay Company," by George Bryce, gives a list of the Hudson's Bay Company's posts in existence in 1685, and Fort Albany is included. "The Conquest of the Great North West," by Agnes Laut, places the building of Fort Albany prior to 1685.

[2]Communications from the Winnipeg office of the Hudson's Bay Company.



Royal Canadian Air Force Photograph

Oblique aerial photograph looking southwest on Bamaji lake.

district, northwest of Lake St. Joseph. It forms a rectangle about fifty miles long and twenty miles wide. The eastern part extends south from Kawinogans and Wright lakes to Lake St. Joseph. The western part includes Fry lake, Austin lake, and most of Bamaji lake. The west limit of the area is in the vicinity of Slate falls of the Cat river, and the area is bounded on the southwest, south, and southeast by the waters of the Cat river (Bamaji lake, Roadhouse lake, and Blackstone lake) and Lake St. Joseph.

To the north extends a wilderness of forest and lakes and unmapped pre-Cambrian rocks. To the west lies the Woman Lake area. To the northeast lies the Pickle Lake–Crow River gold area, the geology of which was mapped by Hurst[1] in 1929. To the south lies the western part of the Lake St. Joseph area[2] mapped by Bruce in 1921.

In the summer of 1934 a geological survey of this area was undertaken by the Ontario Department of Mines, and the writer, accompanied by three assistants, proceeded to the area during the latter part of May; the work was concluded early in the following October. A geological map (No. 44f), on a scale of 2 miles to the inch, accompanies this report.

Acknowledgments

It is a pleasure for the writer to acknowledge the services of J. F. Caley, Stanley Duffell, and B. D. Weaver, field assistants, all from the University of Toronto. Their willing and generous efforts are largely responsible for the amount of work accomplished. Dr. Caley, who accompanied the party as senior assistant, undertook much of the geological mapping.

The assistance rendered by the Provincial Air Service, through the courtesy of A. B. Connell, of Sioux Lookout, was much appreciated. The location and character of the country examined demanded a good deal of air transportation for supplies, and co-operation and favours in this connection were received from the various pilots of the Provincial Air Service at Sioux Lookout.

Thanks are due for hospitality and favours received from Morley Roadhouse and Victor Johnston, of the staff of the Ontario Forestry Branch at Lake St. Joseph.

The Ojibway names of many of the lakes, as well as much other valuable information concerning the area, were furnished by Simon Wesley, of the Osnaburgh Indian Reserve at Lake St. Joseph. On the geological map accompanying this report the spelling of these Indian names is entirely phonetic.

Acknowledgments must also be made to the Hudson's Bay Company at Sioux Lookout and at Winnipeg for the prompt forwarding of supplies and for information pertaining to the area.

The gold assays of various samples as well as the rock analyses were made by W. K. McNeill, Provincial Assayer.

History of Exploration

Despite the proximity of this section to old travel routes, it has had little mention in the records of explorers. No previous detailed geological survey has been made in the area, and prior to the examination described in this report, little was known of its rock formations. References in the literature appear to

[1]M. E. Hurst, "Pickle Lake–Crow River Area," Ont. Dept. Mines, Vol. XXXIX, pt. 2, 1930, pp. 1-35.

[2]E. L. Bruce, "Iron Formation of Lake St. Joseph," Ont. Dept. Mines, Vol. XXXI, pt. 8, 1930, pp. 1-32.

be confined to a few remarks by geologists who explored the Lake St. Joseph–Cat River waterway. In 1885, Thos. Fawcett, D.T.S., made a micrometer survey of the Cat river. He worked north from Lake St. Joseph and described this route in his report.[1] In 1886, Robert Bell, of the Canadian Geological Survey, examined a large area north of Lake Superior.[2] In the course of this work he detailed two of his assistants, J. MacMillan and A. P. Murray, to make a reconnaissance survey of the Cat river from Osnaburgh lake (Lake St. Joseph) to Cat lake, and they described the various rocks along this route. In 1909, A. W. G. Wilson, of the Canadian Geological Survey, also explored part of the Cat River system.[3] His route to the area was from Lac Seul via the Wenasaga river to the Cat river. His survey, however, has little bearing on the present report.

Propinquity to well-known water routes has, since the early days, seemingly failed to exert a patent influence in the development of that section of the wilderness directly north of Lake St. Joseph. Probably the natural resources of that area were not attractively displayed to the few who ventured within its borders. No doubt the absence of convenient travel routes and the presence of numerous stretches of muskeg and rather extensive areas of overburden did not constitute an inviting picture to explorer or prospector. In spite of the advances of exploration in surrounding areas, its character has, until recently, remained unknown.

During recent years interesting gold discoveries have been made in the neighbouring areas of Pickle lake and Woman lake. In 1933 Karl Whitmore, prospector, of Red Lake, reported that an extensive belt of greenstones and other interesting rocks was to be found in the region north of Lake St. Joseph. In previous years geological work in adjacent areas also suggested the existence of a belt of favourable rocks.

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E. L. BRUCE, "Gold Deposits of Woman, Narrow, and Confederation Lakes," Ont. Dept. Mines, Vol. XXXVII, pt. 4, 1928, pp. 1-51.
H. C. LAIRD, "Geology of the Shonia Lake Area," Ont. Dept. Mines, Vol. XXXIX, pt. 3, 1930, pp. 1-21.
M. E. HURST, "Pickle Lake–Crow River Area," Ont. Dept. Mines, Vol. XXXIX, pt. 2, 1930, pp. 1-35.
GEO. D. FURSE, "Geology of the Shabumeni–Birch Lake Area," Ont. Dept. Mines, Vol. XLII, pt. 6, 1933, pp. 21-51.

Means of Access

The Cat River–Kawinogans Lake area is most conveniently reached from Sioux Lookout or from the neighbouring station of Hudson, both on the main line of the Canadian National Railways.

[1]Dept. of the Interior, Canada, Ann. Rept. 1885, pt. II, pp. 30-38.
[2]Robt. Bell, Geol. Surv. Can., Vol. II, pt. G, 1886.
[3]A. W. G. Wilson, Geol. Surv. Can., Pub. No. 1006, 1909.

Airplane transportation provides the quickest and most direct means of access. Several competing companies offer both passenger and freight service at moderate rates. The flight from Sioux Lookout or Hudson to the camp of the Ontario Forestry Branch on Lake St. Joseph, a distance of approximately 65 miles, requires about 50 minutes. The most remote parts of the area may be reached in less than 90 minutes.

The best canoe route is from Hudson via the English river, Lac Seul, and the Root river. The canoe journey, without motor, from Hudson to Root portage at the west end of Lake St. Joseph, a distance of about 85 miles, requires about four days. From Hudson to Slate Falls requires about seven days.

An alternative route to the area goes north from Savant Station on the main line of the Canadian National Railways, via Savant lake and the Savant river, to the east end of Lake St. Joseph. The numerous portages make this an arduous route for summer travel. The proximity of Savant Station to the Pickle Lake–Crow River mining area gives this route, however, considerable merit as a winter haulage way.

Recent improvements on the upper part of the Root river now make that the best waterway, both for passengers and freight, to Lake St. Joseph and the immediate neighbourhood.

The Cat River–Kawinogans Lake area may be separated into an eastern and western part, each accessible by a different route from Lake St. Joseph. The eastern part may be reached from the northeast end of Matapesatakun bay of Lake St. Joseph. This route provides access to all waters in that vicinity including Jarrow, Carpenter, Caley, Whitmore, Duffell, Dempster, Kawinogans, and Wright lakes. Graniteboss, Mousetrap, Jacknife, Kawashe, and Kaminiskag lakes are the most westerly waters easily accessible from this section of the area. There is a poorly blazed trail between Kaminiskag lake and Muskegsagagen lake, which might, with a little work, be made into a portage.

The western part of the area is accessible by means of the Cat river and Fry lake, from which routes lead to Nabemakoseka (Ojibway for Birch), Obaskaka (Green Narrows), Muskegsagagen (Muskeg), and Billett lakes. At the present time there is no convenient means of access between the two parts of the area, except by way of Lake St. Joseph. For example, there has been no portage cut between Billett lake and Kawashe lake, and to travel from one to the other can be accomplished only by walking directly through the bush without a trail, cutting a portage, or resorting to the circuitous route via Lake St. Joseph.

During the course of the examination it was necessary to establish new canoe routes, and numerous portages, totalling more than six miles, were cut in various places to facilitate travelling within the area.

The Pembina river, which flows through the southern part of the area and drains a low, wet section, is navigable with some difficulty for about ten miles from Lake St. Joseph, but it does not provide a route to the interior of the area.

Improvements to Navigation on the Root River

Important mining developments in the Pickle Lake–Crow River area to the northeast of Lake St. Joseph and the presence of potential wealth in the natural resources of neighbouring areas were the reasons for recent improvements to navigation on the Root river. In the early part of 1934 the problem of freight transportation to the mines of the Pickle Lake–Crow River area became acute when the lack of a satisfactory navigable route seriously threatened mining development. Improvements to navigation on the Root river were undertaken

by the Ontario Government, the work being carried out during the summer of 1934 under the field direction of J. MacIntosh, of the Ontario Hydro-Electric Power Commission. As a result of the construction of dams and marine railways, scows loaded at Hudson may now be taken up the Root river to a point about three miles from Lake St. Joseph. This last distance has been spanned by a standard-gauge railway, over which a gasoline locomotive began operating in the fall of 1934. The northern terminal of this railroad lies at the west end of Lake St. Joseph.

Topography

The Cat River–Kawinogans Lake area is one of low relief containing a network of lakes and small streams, which are separated by low rock ridges and by unconsolidated glacial material. The altitude of Lake St. Joseph is 1,218 feet; elsewhere altitudes range between 1,218 and 1,350 feet. Conspicuous topographical forms are absent. Rock ridges, mounds, and ridges of glacial debris, sink-holes,



Glacial striae striking southwest, northwest arm of Fry lake.

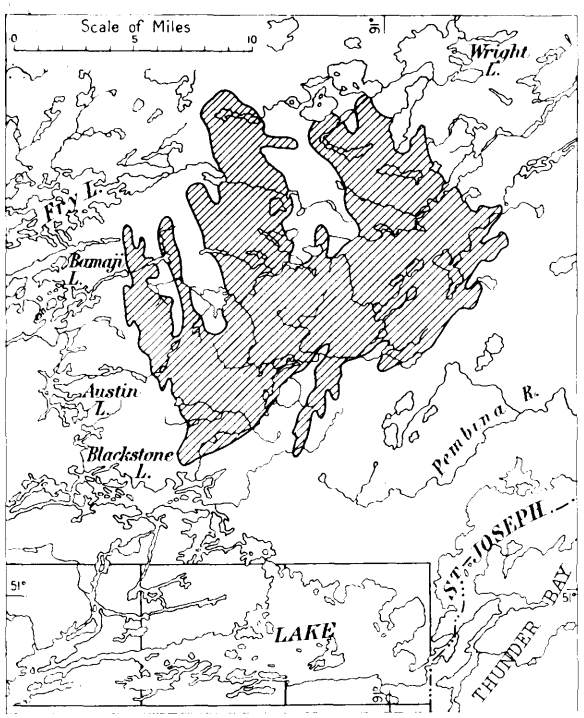
and remnants of eroded eskers provide some variety to the rather monotonous topography. The Cat River–Lake St. Joseph drainage channel constitutes the outstanding physiographic feature. A low height-of-land strikes northwest through the area and separates the Cat River–Lake St. Joseph drainage, which passes down the Albany river, from another system, the waters of which reach James bay by rivers flowing to the northeast. In the greenstone-sediments belt the drainage channels conform to the strikes of the folded rocks. In the granite areas the drainage follows irregular courses.

In the western part of the field, particularly in that part between Slate falls and the east end of Fry lake and in the vicinity of Bamaji lake, there are excellent rock exposures. Much rock is also exposed in the north central part of the area, particularly in that part south of Wright lake. The southern, central, and eastern parts of the area are largely obscured by overburden.

Glaciation

Glaciation of continental proportions, which operated over the northeastern part of Canada, modified the surface of this previously base-levelled country. The pre-glacial mantle of soil and decomposed rock was swept away, and the sur-

face was smoothed and polished. To some extent the debris was redistributed in patches over the transformed surface. In general, the amount of post-glacial erosion has been small. If the existing vegetation were removed the surface would present much the same appearance as it possessed immediately after the retreat of the ice-sheet. The processes of sedimentation since glacial time have consisted largely in the reworking of the glacial debris. Glacial striae at various places show that the movement of the ice, except where it conformed to local topography, was mainly to the southwest. Mounds of boulder clay and gravel, remnants of eroded eskers, most of which were observed in the central parts of



Sketch map showing the section burned during the fire of July, 1932. The devastated area extends from Blackstone lake to Wright lake and covers over 100 square miles. (Courtesy of the Ontario Forestry Branch, Sioux Lookout.)

the area, and rounded outcrops of rock, constitute the most striking evidence of the effect of glaciation on the topography.

Natural Resources

Forests and Trees

Practically the whole area is forested, the exceptions being patches of muskeg and country recently burned. Spruce, birch, poplar, and jackpine flourish under suitable conditions of soil and moisture and are the commonest trees in the area. Balsam, Balm-of-Gilead, ash, and cedar are not plentiful. Alder and willow are found in the swamps and along the streams. Small tamarac are plentiful along the borders of the muskegs. There are no red pine in the area. In general the

timber is small and of relatively little value. Some of it might in the future find a market as pulpwood, and some might be suitable for mine timbers and lagging. Owing to the isolation of the area and to the lack of the more valuable kinds of timber, no exploitation of these resources has been attempted.

Much of the area is covered with muskeg and low wet ground, which is incapable of producing valuable timber. According to the Indian residents, forest fires have, since earliest times, periodically ravaged large sections of the region. The country in the vicinity of Bamaji and Blackstone lakes and smaller sections in other parts of the area are now covered with small second growth.

In 1932 a destructive forest fire spread north and devastated an area of more than 100 square miles from Blackstone lake to Wright lake.

Animals, Birds, Fish

Deer are not plentiful, and moose have become relatively scarce in recent years. Woodland caribou are very rare, but some have been seen in recent winters in the vicinity of Obaskaka lake. Bear, fox, lynx, mink, otter, skunk, muskrat, porcupine, wolf, rabbit, and weasel are found. Beaver, marten, and fisher, once hunted in the area, are now practically unknown.

On account of the scarcity of the more valuable fur-bearing animals, trapping is gradually becoming less profitable, and the few Indians who depend upon this industry will soon have to seek a living by other means. Fox, lynx, and muskrat provide most of the fur catch.

Birds are plentiful. The variety of species is quite extensive and includes most of those found elsewhere in Ontario. In the winter ptarmigan and snow birds are found in the area. The larger bird species include heron, loon, several varieties of wild duck, ptarmigan, owl, osprey, partridge, raven, gull, tern, and bittern. No Canadian wild geese were seen except during the migrating season.

Pickerel, pike, and whitefish are plentiful in the larger lakes. Sturgeon may be caught in the Lake St. Joseph and Cat River waters. Commercial fishing has been confined to desultory attempts in Lake St. Joseph.

Water Power

The Cat river is the only stream with sufficient volume for the development of water power, and in the summer, particularly in dry seasons, the flow is considerably reduced. Between Lake St. Joseph and Slate falls, there are five rapids, the drop at each being less than 12 feet. It may be stated generally that there is insufficient head for a large power development. None of the rapids on the Cat river between Slate falls and Cat lake was examined by the writer.

The construction of the Ontario Hydro-Electric Power Commission's plant at Rat rapids at the east end of Lake St. Joseph, which was planned for the purpose of providing power to the mines of the Pickle Lake–Crow River area, is now practically completed. This plant is at present equipped to produce about 1,500 horse-power, which amount will not greatly exceed the present requirements of the mines in that neighbourhood. It has been estimated that the maximum power available at this site amounts to about 3,000 horse-power, an amount which future developments at these mines might conceivably utilize. Power from this site, therefore, could not safely be regarded as available for future mining enterprises. With the development of new mines, new power projects would have to be undertaken.

Agriculture

On account of the large sections of rock and muskeg and the uncertainty of the summer season, the area in general is unsuited to agriculture. Some stretches

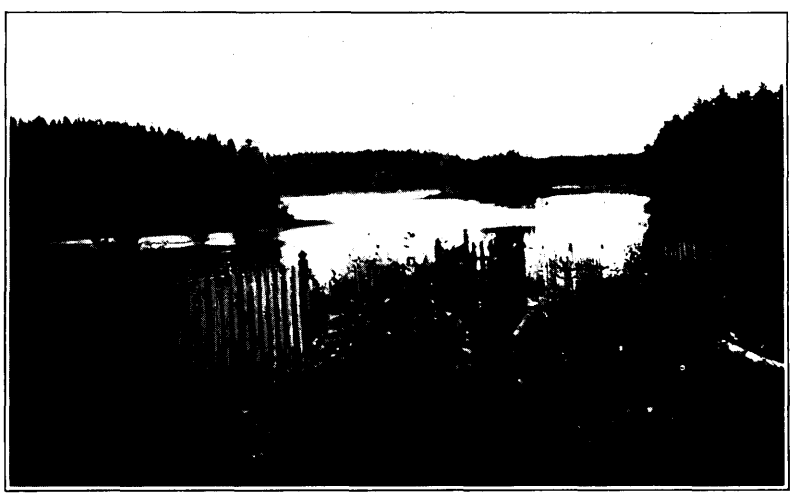
of clay land to the north of Matapesatakun bay constitute the most favourable agricultural land.

Inhabitants

At the time of writing there are no white residents in the area. Apparently the field has never been a popular one with trappers and other temporary residents.

A few Indian families from the Osnaburgh Indian Reserve reside in the area during most of the year. In the winter they live in teepees or log cabins adjacent to their trap lines, but in general their habits are nomadic.

John Carpenter, present chief of the Osnaburgh Indians, and his family reside during most of the year at Slate Falls. Many of the Indian children from the area attend the residential Indian school at Pelican.



Indian cemetery at Slate Falls.

General Summary of Geological Survey

The most important work achieved by the survey was the location of a previously unmapped belt of pre-Cambrian rocks of Keewatin age, including greenstones and sediments, which extends east from the vicinity of Slate falls on the Cat river for a distance of over fifty miles.

The rocks in this belt resemble in age and character those found in other parts of Ontario where gold occurs. They contain sulphide-bearing shear zones, mineralized dikes, and quartz veins. Assays showing traces of gold and, in some instances, low gold values were obtained from samples from various localities. It should be interesting ground for prospectors.

This relatively narrow Keewatin belt is flanked on the north and south by batholithic masses of granite and granite gneiss. The width of the belt ranges from less than a mile in the vicinity of Slate falls to over fifteen miles in the centre of the map area. To the east the belt is continuous with the Kawinogans Lake greenstones mapped by Hurst in 1929.

In the southern part of the area, east of Blackstone lake, the greenstones are continuous with those of the Lake St. Joseph area mapped by Bruce[1] in 1921.

[1]E. L. Bruce, map No. 31e, "Western Part of Lake St. Joseph," Ont. Dept. Mines, Vol XXXI, pt. 8, 1922.

West of Slate falls the boundaries of the belt were not delimited, and the extent and disposition of the greenstones in that direction are unknown.

GENERAL GEOLOGY

All the consolidated rocks of the area are of pre-Cambrian age and may be divided into two groups: The older or Keewatin group, is composed predominantly of lava flows and intercalated sediments; the younger or Algoman group consists largely of granite and its correlatives.

Table of Formations

QUATERNARY	
PLEISTOCENE:	Glacial clays and gravels and other unconsolidated sediments.
PRE-CAMBRIAN	
ALGOMAN:	Granite, granite gneiss, pegmatite. Quartz porphyry dikes, feldspar porphyry dikes. Quartz veins.
KEEWATIN:	Conglomerate. Iron formation. Agglomerates, greywacké, quartzite, arkose, slate. Basic and acid intrusives. Basic lavas, rhyolites.

Keewatin

The Keewatin rocks, which are the oldest in the area, constitute an irregularly-shaped continuous belt extending from the east to the west boundary of the map-sheet. They are essentially types formed at or near the surface of the earth and, in the order of their areal importance, consist of lava flows, sediments, and intrusives.

Lava Flows

The lava flows, which have the widest areal distribution, consist of two types, basic and acid. The basic flows consist predominantly of dark-coloured andesites, which range from fine to medium-coarse in texture. Pillow structures are common, particularly in the section southeast of Wright lake, in the vicinity of Muskegsagagen and Fry lakes, and west of Fry lake. Spherulitic lavas are rare, but this type was identified about a mile north of Whitmore lake and about 3 miles directly northeast of Drum lake. Amygdaloidal, brecciated, and ropy structures characterize the lavas in various localities. A few horizons between the lava flows and between the sediments contain beds of pyroclastic material. As a general rule the thickness of these beds of tuff and agglomerate is only a few feet. They are not continuous and may be regarded as small lenses.

Sedimentary beds are common between the flows. They vary considerably in size and in the character of their material.

The acid flows are not extensive. They cover small linear-shaped areas between flows and between sediments, and were identified at only a few places in the area. White to light-green-weathering rhyolites occur east of Fry lake, north and northeast of Drum lake, and in a few other places.

A dark-coloured porphyritic rhyolite occurs along the south shore of Fry lake, about 2 miles northeast of the portage leading to the long northeast arm of Bamaji lake. The rhyolite here is associated with Keewatin pillow lavas.

Some unusual flow structures, as much as 50 feet in length, are strikingly exposed on the north shore of the western part of Rockmere lake. They occur in an eastward-plunging synclinal trough.

A belt of highly altered dark-coloured rock of unusual appearance, with a maximum width of half a mile, strikes approximately northeast through the north end of Dempster lake. In some places the texture of this rock is felsitic. Much of it is porphyritic, and quartz phenocrysts are easily recognized. Part of it is brown-weathering, due to the presence of iron oxide. The belt is flanked on the north and south by Keewatin flows, with which are associated dark-coloured pillow lavas. On account of its highly metamorphosed character the origin of this rock is obscure. Under the microscope the rock is found to consist predominantly of quartz and decomposed feldspar.

A chemical analysis made under the direction of W. K. McNeill, Provincial Assayer, gave the following constituents:—

	Per cent.
SiO_2	64.68
Al_2O_3	14.24
Fe_2O_3	1.17
FeO	1.94
CaO	5.27
MgO	.94
K_2O	1.01
Na_2O	3.15
TiO_2	.47
P_2O_5	.14
MnO	.33
CO_2	4.91
H_2O	1.90
FeS_2	.19
Total	100.34

The predominance of lime over magnesia and of soda over potash, as shown in the above analysis, points to an igneous origin for this rock. It is probably a quartz porphyry or rhyolite.

Intrusives

The Keewatin intrusives consist chiefly of hornblendite, gabbro-diorite, quartz porphyry, and feldspar porphyry. Their occurence is widespread, but they constitute probably less than 5 per cent. of the area of greenstones and sediments. Early in the season an attempt was made to separate and delimit these rocks for mapping purposes, but time did not permit of such detail in a reconnaissance survey.

Hornblendite, Gabbro, and Diorite.—The best exposures of hornblendite, gabbro, and diorite occur about 5 miles south of Jacknife lake. They cut both the lava flows and sediments and appear to be late Keewatin in age. At the northwest end of Jacknife lake on the east side of the creek, hornblendite grades imperceptibly into diorite. These two rocks are also closely associated in the area south of Wright lake, and it is thought that they belong to the same intrusive period. They appear to be similar in age and character to the hornblendite and diorite[1] described by Bruce in the Lake St. Joseph area. In some places, as for example in the central part of the area south of Wright lake, lava flows pass gradually into massive diorites. In several places small areas of hornblendite and diorite occur near granite contacts as metamorphosed phases of basic lava flows.

Quartz Porphyry Dikes.—A few light-coloured, white-weathering dikes, with a maximum width of 25 feet, occur in the area, chiefly between Fry lake and

[1]E. L. Bruce, Ont. Dept. Mines, Vol. XXXI, pt. 8, 1922, p. 17.

Dempster lake. They have all been intruded parallel to the lava flows and sedimentary beds. In texture they vary considerably. Some are so fine that the individual crystals cannot be recognized in a hand specimen. In most places, however, there are visible quartz phenocrysts; and locally feldspar crystals can also be identified. Most of the dikes contain small amounts of disseminated pyrite. In several cases small quartz veins were observed cutting the porphyry dikes.

Sediments

The Keewatin sediments consist mainly of coarse clastics of the continental type. They are distributed from Fry lake to the east boundary of the map-sheet and beyond, but they make up probably less than 10 per cent. of the Keewatin belt. They include beds of greywacké, quartzite, conglomerate, and



Keewatin banded sediments intruded by *lit par lit* injections of quartz and granite, north shore of Matapesatakun bay, Lake St. Joseph.

shale, which are intercalated with the Keewatin lava flows. In nearly all the occurrences in the area the sedimentary beds strike in an east-west direction and dip almost vertically. Most of the beds are thin, being from one to two feet in thickness, but occasionally they have a thickness of 300 to 400 feet. In a few places as, for example, south of Mousetrap lake and north of Matapesatakun bay of Lake St. Joseph, they attain a thickness of over a mile. At both these places, however, the sediments contain small lava flows. In the vicinity of Billett lake the conglomerate has an apparent thickness of over a mile, but the structure is obscured by overburden. It may be that, in this section of the area, which is the location of a large drag fold, both sedimentary beds and lava flows have been thickened by rock flowage.

Greywacké and Quartzite.—Greywacké and quartzite make up the bulk of the sedimentary rocks of the area. Much of the rock that was designated as greywacké in the field, on analysis and microscopic examination, proved to be quartzite, since it was found to contain from 63 to 80 per cent. quartz. Both greywacké and impure quartzite are grey-weathering and are, as a rule, well bedded. Gradations are common between the two, and various transitions occur between them and conglomerate and shale. More commonly, however, the sedimentary types are separated by well-defined bedding planes. In some places

the bedding is very fine, the *laminae* being pronounced but only a fraction of an inch in thickness. Occasionally visible detrital quartz can be recognized.

Under the microscope both quartzite and greywacké show much recrystallized quartz. The other minerals are mainly biotite, tourmaline, sericite, and kaolin. There is very little feldspar.



Contorted iron formation, north shore of Jacknife lake.

The following table shows the siliceous character of these rocks:—

Specimen No.	Locality	Method of determination	Silica	Quartz
			per cent.	per cent.
AA	North shore of Fry lake	Chemical analysis	67.88	.....
120	Billett lake	Chemical analysis	68.36	.....
76	Matapesatakun bay	Chemical analysis	71.01	.....
164	Drum lake	Microscope	.....	70
165	East of Bamaji lake	Microscope	.....	63
41	Southwest of Dempster lake.	Microscope	.....	80

Conglomerate.—The largest area of conglomerate lies in the vicinity of Billett lake. In extent and structural position are largely unknown on account of the surrounding overburden. The presence of lavas both to the north and south suggest it was laid down in a small Keewatin lava basin and subsequently covered by other flow rocks. The boulders and pebbles are well rounded, with a maximum diameter of 2 feet. They consist of greenstone, various dark-coloured lavas, fine-textured rhyolite, quartz porphyry, greywacké, and quartz. Some of the boulders resemble metamorphosed granite. The character of the matrix suggests that it was derived from the Keewatin rocks that occur in the area.

Thin beds and lenses of conglomerate, a few feet thick, occur with the other sediments in various other parts of the area.

Banded Iron Formation.—Iron formation was identified along the north shore of Jacknife lake, where it is flanked by pillow lavas and other flow rocks. From the west end of Jacknife lake it may be followed eastward along its strike for about 3 miles, where it is cut off by the granite west of Graniteboss lake. Its original width is difficult to estimate on account of the folding in the vicinity but it probably ranged from 100 to 300 feet. Locally it is contorted and thickened to such an extent that near the east end of Jacknife lake the folded zone reaches a maximum thickness of over a quarter of a mile. Here it is intruded by small irregularly shaped masses of granite. Banded chert would be a more appropriate term for this rock, as it consists largely of parallel bands of chert, which range in width from a few feet to a fraction of an inch. Impurities in the chert beds accentuate the banding. Thin beds of clastic material, such as greywacké, quartzite, and shale, are associated with the chert, which also contains small amounts of magnetite. Similar rocks occur north of the northwest arm of Fry lake. Although iron formation was not seen elsewhere, the erratic behaviour of the compass in the vicinity of a small lake about four miles east of Fry lake suggests the presence of magnetite in that locality.

Slate.—The amount of slate in the area is small. It occurs in the banded sediments as thin beds between the coarser sediments. The beds rarely reach a thickness of more than a foot or two.

Algoman

The rocks of the Algoman group consist predominantly of granite and granite gneiss with occasional dikes of pegmatite, feldspar porphyry, and quartz porphyry and quartz veins. All these rocks intrude the rocks of the Keewatin group.

Granite Gneiss

Granite gneiss, which forms the greater part of the Algoman rocks, covers large areas in the vicinity of Blackstone, Austin, Bamaji, and Wesleyan lakes, and along the north shore of Lake St. Joseph. In conjunction with smaller masses of granite it constitutes the two large batholithic masses which lie to the north and south of the greenstone-sediments belt. Its weathered surface varies in colour from pink to grey, and as a general rule foliation is quite pronounced. With the increase in hornblende it grades locally into hornblende schist. It contains irregular bodies of massive granite, and in some parts of the area it is intruded by numerous dikes and masses of pegmatite. In many instances, particularly along the north shore of Lake St. Joseph, the gneiss, near its contact with the greenstones and sediments, contains numerous inclusions of these rocks. Along the shore of the northeast arm of Bamaji lake, and on some of the nearby islands, there are a few places where the granite gneiss has a foliation that conforms to that of the green schists lying farther north. In the vicinity of Fry and Moosetegon lakes there is a gradual transition from gneiss to schistose greenstone.

Granite

Good exposures of granite occur in the vicinity of Obaskaka and Caley lakes. Massive granite free from foliation and banding is not common. The granite in the neighbourhood of Graniteboss lake and much of the granite in the eastern part of the area, between Kawinogans lake and Lake St. Joseph, are fairly massive. Distinctly foliated granite occurs on the north shore at the west end of Kawinogans lake and farther to the west between Kawinogans lake and

Wright lake. This foliation conforms to that of the nearby greenstones south of Jewett lake. With some reservations it is reasonable to regard the origin of the local foliation in these two rocks as contemporaneous.

The colour of the granite varies from grey to pink, depending to some extent upon its proximity to the greenstones. Near contacts the granite is locally darkened by the assimilation of basic material. In many instances this process has produced small masses of granodiorite and diorite.

Two distinct boss-like masses of granite occur to the south and southwest of Wright lake. Granite dikes radiate from these bosses into the surrounding greenstones. A few of these dikes are poorly mineralized with pyrite.

The microscope shows the granite to be composed mostly of quartz and orthoclase with varying amounts of oligoclase, biotite, and hornblende.

Pegmatite

Pegmatite dikes and pegmatite intrusions of irregular shape cut both the granite and the gneiss, as well as all the Keewatin rocks. Pegmatite intrusions are very common in the granite gneiss area in the neighborhood of Bamaji lake, as they are south and southeast of Drum lake, where they cut both greenstones and sediments. Pegmatite containing considerable muscovite occurs on the north shore of Whitmore lake and in the vicinity of Carpenter lake.

Quartz Porphyry and Feldspar Porphyry

Quartz porphyry and feldspar porphyry are rare and appear to be limited to a few dikes. Most of those identified occur in the central and eastern parts of the area. On the south shore of the eastern part of Caley lake a feldspar porphyry dike, a few feet in width, cuts the dark-coloured lavas. It strikes northeast, dips almost vertically, and for a short distance follows the water's edge. It carries disseminated pyrite. A larger dike of feldspar porphyry strikes northeast along the north shore of Sky lake just south of Caley lake. Near the entrance to the small creek that flows out of Sky lake this dike contains so much quartz that it might be called a quartz vein. At this location it contains disseminated pyrite.

Some mineralized dikes of quartz porphyry and feldspar porphyry occur on the south shore of Kaminiskag lake in association with granite. On the south shore of Moosetegon lake a quartz porphyry dike of fresh appearance, which might easily be mistaken for arkose, strikes approximately east-west between lava flows. Another dike of similar appearance skirts the north shore of the western part of Rockmere lake. Neither of these dikes appear to carry any mineralization.

The existence of other quartz porphyries, of Keewatin age, is proved by the presence of boulders in the Keewatin conglomerates. In some cases it is difficult to distinguish between the dikes of the two periods. The Keewatin dikes, however, are infolded with the sediments and greenstones and are found chiefly in the centre of the belt. To a great extent the visible quartz phenocrysts of the Keewatin porphyries lie within a fine-textured groundmass lacking other visible crystal forms. The Algoman quartz porphyry, on the other hand, appears to be associated with apophyses of granite found along the margins of the greenstone-sediments belt. The rock is pale-green and has a fresh appearance, which is lacking in the Keewatin porphyry. Gradations occur between the Algoman granite, quartz porphyry, feldspar porphyry, and vein quartz, the last-named representing the latest intrusion of the Algoman period.

Mineralization

Mineralized dikes, quartz veins containing sulphides, and shear zones containing both quartz veins and sulphides were found within the area. Locally, low gold values are associated with the mineralization.

In the vicinity of Slate falls and Wesleyan lake, granite dikes and quartz veins contain disseminated sulphides. In this part of the area the dikes and quartz veins lie parallel to east-west-striking greenstones. The quartz veins, which are small, are later than the granite. They carry pyrite, chalcopyrite, pyrrhotite, zinc blende, molybdenite, and galena. The greenstone belt in this



Quartz vein cutting greenstone, northwest of the long west bay of Fry lake.

vicinity is narrow, and the rocks are much altered by contact metamorphism. Some claims staked in this part of the area in 1928 were shortly afterwards abandoned. In July, 1934, part of the ground was restaked by A. B. Connell, J. H. Stirrett, and S. Williams. The veins are said to carry medium values in gold. This section of the area was described by Laird[1] in 1929.

A few miles east of Slate falls the greenstones, which consist largely of pillow lavas, are more chloritic and have been subjected to moderate shearing. Zones of well-foliated chlorite-carbonate schist extend eastward through Moosetegon, Rockmere, and Fry lakes. The planes of schistosity, which are almost vertical, lie parallel to the westward-striking lava flows. Locally these schist bands contain considerable pyrite and small quartz veins, which, in most cases, strike parallel to the foliation. The veins in the vicinity, which are of the quartz-

[1]H. C. Laird, Ont. Dept. Mines, Vol. XXXIX, pt. 3, 1930, pp. 22, 23.

tourmaline-carbonate type, contain pyrite, chalcopyrite, and pyrrhotite. Mineralogically they bear some resemblance to the veins of the gold-producing zone of the Porcupine field.[1] There is little or no fracturing of the schist in this part of the area. Mineralized quartz from a vein on the north shore of Fry lake gave 0.22 ounces per ton in gold. This ground was staked in February, 1935, by the Connell Mining and Exploration Company.

On the south shore of Fry lake, about two miles northeast of the portage leading to Bamaji lake, rusty-weathering pillow lavas contain pyrrhotite.

Southeast of Wright lake the lava flows have been moderately sheared and cut by numerous small veins and lenses of quartz. The sulphides in this vicinity are meagre and appear to be composed chiefly of pyrite. In this section there has been considerable deformation, which postdated the quartz veins, many of which show well-developed drag folds. South of Jewett lake pyrrhotite was identified in basic pillow lavas.

In the vicinity of the south shore of Kaminiskag lake, dikes of granite and granite prophyry with quartz veins occur in a fracture zone about half a mile in width. Some of these dikes and veins are mineralized with pyrite. They probably represent injections and emanations from a linear-shaped granite boss exposed farther to the west. Another granite boss lies to the east of this fracture zone and it is possible that the greenstone separating the two bosses is only a rather shallow covering.

On the south shore of Mousetrap lake, toward the south margin of the granite boss, a small quartz vein, less than an inch wide, carries galena and pyrite.

Small quartz veins intruding both greenstones and sediments are scattered throughout the area east of Fry lake and south of Wright lake. As a general rule the sulphides in this section consist mainly of pyrite.

A grab sample from a mineralized quartz porphyry dike, which strikes in an east-west direction between the first and second small lakes southwest of Dempster lake, gave 0.02 ounces per ton in gold. There are other dikes in the vicinity.

A grab sample of the mineralized quartz associated with the porphyry near the entrance to the creek on the north shore of Sky lake yielded 0.01 ounces per ton in gold.

Near the south shore of the narrows leading to the large western expansion of Carpenter lake, flakes of molybdenite occur in pegmatite dikes which cut the granite.

From a number of grab samples of mineralized material obtained from dikes and veins at various places in the area, nine gave a trace of gold and four gave from 0.01 to 0.22 ounces per ton in gold. The occurrences of the last four have been described in the preceding paragraphs.

Structure

Toward the end of Keewatin time the Cat River–Kawinogans Lake area was probably a country of low relief overlain by a succession of lava flows and thin, intercalated beds of sediment. Coarse-textured sediments, derived from these older rocks and from minor intrusives, had accumulated in shallow basins. In Algoman time, this assemblage of lavas and sediments was compressed into steeply dipping folds and intruded by batholithic masses of granite. Only the most deeply infolded portions of these formations have escaped erosion.

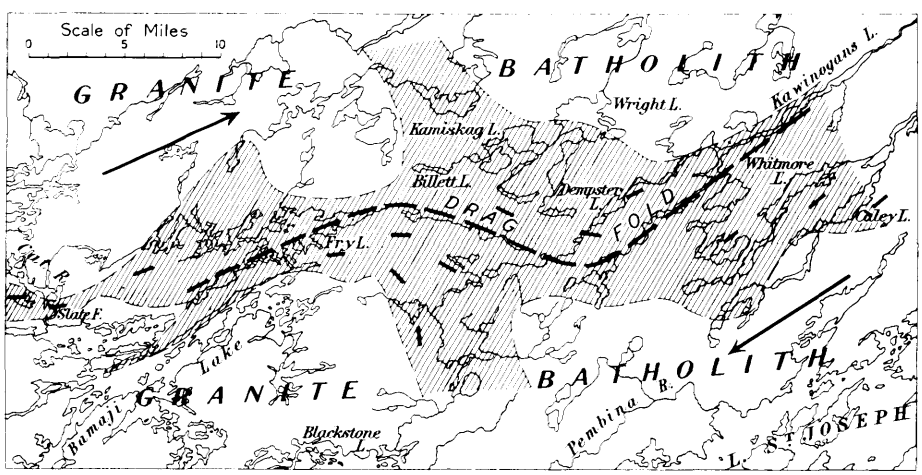
[1]A. G. Burrows, "The Porcupine Gold Area," Ont. Dept. Mines, Vol. XXXIII, pt. 1, 1924, pp. 41-54.

The sequence of structural disturbances that have affected the belt of Keewatin rocks is thought to have been as follows: (1) folding due to compression between the batholithic masses of granite lying to the north and south, this



Large eastward-plunging pillow-like lava structures, north shore of Rockmere lake.

deformation, it is thought, having determined the strike of the beds and flows and the direction of schistosity; (2) fracturing and the introduction of quartz veins; and (3) differential movement between the batholithic masses resulting



Sketch map illustrating the folding of the Cat River–Kawinogans Lake belt of Keewatin greenstones and sediments. The short heavy lines indicate the strikes of the almost vertically dipping beds and flows. The belt was first subjected to compression and isoclinal folding between the two batholiths (resulting in the development of foliation parallel to the bedding), then to differential movement, the stresses of which were relieved by the formation of a large drag fold.

in the development of a huge drag fold in the centre of the belt and folding of the quartz veins and iron formation (see sketch map above). The greenstone-sediments mass to the northeast of Blackstone lake and that in the vicinity of

Muskegsagagen lake are large fragments partly detached from the belt by this later shearing movement.

Owing to the highly metamorphosed character of the belt and the absence of distinguishable marker horizons, the problems of detailed structure are not easy ones. Throughout the area the flows and beds are almost vertical; in some places they must be overturned. Dips vary in most cases between 65 and 90 degrees. Alternate sedimentary beds and lava flows conform in parallel sequence, and there is no appreciable angular discordance. Locally both are intricately contorted, as, for instance, in small sections in the vicinity of Jacknife, Dempster,



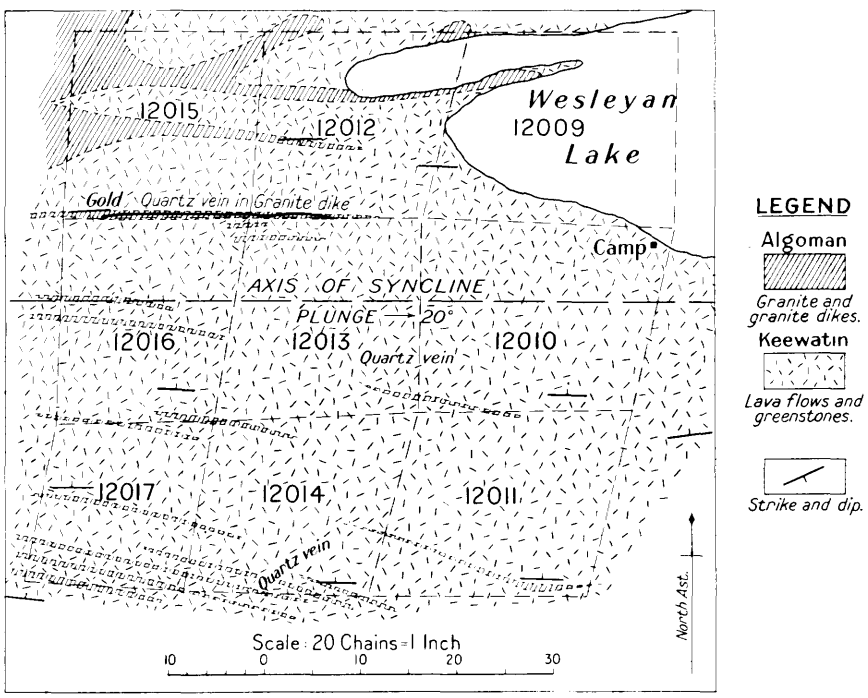
View looking east along the strike of the gold-quartz vein on the Connell-Stirrett-Williams claims.

and Muskegsagagen lakes. Throughout most of the area the planes of schistosity have developed parallel to the beds and flows.

The thickness of the folded greenstones and sediments, measured across the strike, varies, with a maximum of more than 12 miles. This thickness suggests that the rocks have been compressed into a series of isoclinal folds. At only two places in the area were folded structures identified. About 2 miles northwest of Slate falls, near the south shore of Wesleyan lake, the Connell-Stirrett-Williams group of claims lies within a greenstone trough. The synclinal axis strikes east-west and plunges eastward. Another synclinal structure was identified in the vicinity of the western part of Rockmere lake. The north limb of this structure lies along the north shore of the lake. The synclinal axis has an easterly plunge of about 20 degrees. Both of these structures appear to be confined to small areas. They suggest, however, that the folded structures in the neighbourhood of Slate falls and Fry lake have, in general, an easterly plunge.

There is some evidence, based upon the position of lava flow tops to the northeast of Obaskaka lake, that the rocks in the vicinity represent the north limb of an anticlinal structure. The identification of the tops of sedimentary beds, by the gradation of clastic grain texture, southwest of Wright lake and in the vicinity of Mousetrap lake gives a little support to this theory. If, however, this is the true structure, the beds must be locally overturned. There is no conclusive evidence of the presence of an anticlinal limb; it is offered as a theory, which some of the facts corroborate. More work of a detailed nature will have to be done in this section before the problem of the true structure is worked out.

The structural relationships in the eastern part of the area are difficult to determine on account of the overburden and the highly altered character of the



Geological sketch map of the Connell-Stirrett-Williams group of claims.

rocks. The previously existing structures in this section have been disrupted by large intrusions of granite.

In spite of the extensive areas of sediments, structures such as ripple marks and channels of contemporaneous erosion were not positively identified. In many places there were suggestions of cross-bedding, but in no instance was this structure sufficiently well developed to be of use in identifying the tops of beds.

Faulting

No major faults were found in the area, but numerous small displacements were identified in various sections. Most of these minor faults have occurred between sedimentary beds. Southwest of Wright lake a 6-inch quartz vein intersecting a thin bed of greywacké is cut off by a fault of unknown displacement. This shows that at least some of the faulting is later than the veins. No doubt

some faulting occurred when the quartz veins in the vicinity of Jewett lake were folded. Although most of the identified faults appear to be of minor character, in many cases the amount of displacement is unknown. It may be that the movement between the beds has in some cases been considerable.

PROPERTIES

Connell-Stirrett-Williams Group

The Connell-Stirrett-Williams group of nine claims lies on the south shore of Wesleyan lake, about 2 miles northwest of Slate falls. These claims constitute the only mining location at present held in the area. The claims lie within a synclinal trough, the axis of which strikes approximately east-west, in greenstones and pillow lavas. The syncline has an easterly plunge of about 20 degrees. The greenstone belt in this part of the area is about 1½ miles wide and is cut by numerous granite dikes, which strike with the lava flows and parallel the synclinal axis.

The main showing consists of a vertical granite dike, which has been reopened along the strike and in which has been deposited quartz mineralized with pyrite, chalcopyrite, pyrrhotite, and galena. There has been some shearing and faulting, the movement of which has been confined to the plane of the dike. Some of the movement has taken place since the quartz deposition. The vein zone, which includes a little schist, together with the dike material and the quartz, ranges in width from a few inches up to 6 feet. It has been stripped and trenched intermittently along the strike for about half a mile. The greenstone wall rocks are massive rather than schistose. They have been hardened and converted to amphibolite by the hydrothermal solutions from the granite. Gold values as high as 0.5 ounces per ton are said to have been obtained from the vein material. No visible gold was identified in any of the vein matter examined. An assay of a random sample of the best-looking sulphide material gave 0.15 ounces per ton in gold.

INDEX, PART VI

A

PAGE

Abate Red Lake Development Co. . . . 40
Access.
  Cat R.-Kawinogans L. area 56, 57
  Red Lake area 1, 2
Acid rocks 62, 63
  See also Granite; Rhyolite.
Acknowledgments 1, 55
Actinolite 5, 46
Agglomerates 62
Agricultural land 60, 61
Airplane transport.
  Cat R.-Kawinogans L. area 57
  Red Lake area 1, 2
Albany r. 53, 58
Algoman intrusives.
  See also Diorite; Granite; Lamprophyre; Porphyry.
  Cat R.-Kawinogans L. area 62, 66, 67
  Red Lake area 3
Altitudes, Cat R.-Kawinogans L. area. 58
Amphibolite 73
Amygdaloidal structure 62
Analyses.
  Ankerite, Howey g. m. 29
  Diorite, fresh and altered 12
  Ferrodolomite 4
  Limestone, crystalline 5
  Quartz porphyry, Howey g. m. 28
  Rhyolite porphyry 63
  Syenitic lamprophyre 12
Andesite 39, 62
Ankerite 11, 13, 17, 33, 40
  Howey g. m., analysis 29
Anticlines 72
Arkose 3, 8, 62
A. R. L. Gold Mines, Ltd.
  Property, geology and workings 40-42
    location, map showing . . . . . *facing* 6
Arsenopyrite 6, 11, 13, 17, 21, 24, 37, 40
Austin lake 55, 66

B

Bagamac Rouyn Mines, Ltd. 40
Baird tp., gold mg. 35
Bamaji lake 55, 58
  Aerial photo 54
  Forest fires 60
  Rocks 65-67
Basalt 36
  See also Greenstones.
Basic rocks.
  See also Basalt; Diabase; Diorite; Gabbro.
  Cat R.-Kawinogans L. area 62, 63
  Howey g. m., notes and analysis 27, 28
Batholiths.
  Cat R.-Kawinogans L. area 61, 66
    folds due to, sketch map of 70
  Red Lake area 3, 36
Bear 60

PAGE

Beaton, N. S. 1
Beaumont gold claims 6
Beaver 60
Bell, Robert 56
Big-Lode Gold Mines, Ltd.
  Property, geology and workings 45, 46
    location, map showing . . . . . *facing* 6
Billett lake 57
  Rocks 64, 65
    conglomerate, thickness 64
Biotite granite 7, 33
Birch l. *See* Nabemakoseka l.
Birds 60
Biron gold claims.
  Geology and workings 51
  Location, map showing . . . . . *facing* 6
Bishop, E. G. 1, 37
Bismuth telluride. *See* Tetradymite.
Black gold claims 48
Blackstone lake 55
  Forest fires near 59, 60
  Rocks 66, 70
Boat services.
  Hudson to Lake St. Joseph 57, 58
    to Red Lake area 2
Boulder clay 59
Bouzan, M. 1, 7
Boyle-Rutherford gold claims.
  Geology and workings 19
  Location, maps showing . . . . . *facing* 6, 9
Bridget lake 46
Brown gold claims.
  Location, map showing . . . . . *facing* 6
  Mineralization 51
Bruce, E. L. 3, 6, 26, 55, 56, 61, 63
Bryce, George 53
Buffalo Red Lake Mines, Ltd. 52
Bunker Hill Extension Mines, Ltd. 40

C

Calcite 37
Caley, J. F. 55
Caley lake 57, 66
Campbell, C. 37
Canoe routes.
  Cat R.-Kawinogans L. area 57
  Red Lake area. *See* Boat services.
Carbonate.
  See also Ankerite; Ferrodolomite; Lamprophyre.
  Cat R.-Kawinogans L. area 69
  Red Lake area 4, 46
    analysis 5
Cardinal Gold Mines, Ltd.
  Property, geology and workings 48, 49
    location, map showing . . . . . *facing* 6
Caribou 60
Carpenter, John 61
Carpenter lake 57, 67
  Molybdenite 69

PAGE
Cat river.
See also Slate falls.
Canoe route 57
Surveys, early 56
Water power 60
Cat R.-Kawinogans L. area.
Geology, rept. by W. D. Harding ... 53-73
Chalcopyrite.
Cat R.-Kawinogans L. area 68, 73
Red Lake area. *See* Geology, economic.
Chert 46, 66
Chisholm, C. D. 7, 19
Chlorite-carbonate schist.
Cat R.-Kawinogans L. area 68
Red Lake area 33, 46
Chukuni r.
Gold claims on 25
Rail-power haulage, photo 2
Chukuni Red Lake Syndicate 6
Claims. *See* Mining claims.
Clays, lacustrine 3, 4
See also Boulder clay.
Cochenour, W. M. 1
Cochenour Red Lake, Ltd. 52
Cochenour–Rose Quartz gold claims.
Geology and workings 8, 9
Location, map showing ..... *facing* 6
Cochenour-Willans Syndicate.
Property, geology and workings 23, 24
ferrodolomite, analysis 4
location, maps showing ..... *facing* 6, 9
plan, geological 22
Cockeram and McLeod 52
Cole, J. Y., Jr. 1, 50
Cole Gold Mines, Ltd.
Plant, photo 50
Property, geology and workings 49-51
location, map showing ..... *facing* 6
Conglomerate.
Cat R.-Kawinogans L. area 62, 64, 65
Red Lake area 3, 8
Coniagas Mines, Ltd. 6
Explorations by 9, 11, 39
Connell, A. B. 55, 68
Connell Mining and Exploration Co. 69
Connell-Stirrett-Williams g. claims 72, 73
Vein, photo 71
Contacts, gold deposits at 6
Copper.
See also Chalcopyrite.
Native 25, 37
Crystalline limestone.
Red Lake area, notes and analysis ... 4, 5

D

Davison, John E. 56
Dean, T. W. 1, 47
Deer 60
Dempster lake 57
Rocks 63-65
mineralized 69
structure 71
Diabase 3, 36, 50
Diorite.
See also Basalt; Diabase; Diorite porphyry.
Cat R.-Kawinogans L. area 63, 67
Red Lake area 3, 8, 11, 17, 25, 37
quartz veins in 49
Diorite porphyry 36
Dome Mines, Ltd. 6
Dome tp., gold mining 25, 26
Dorion island, Red l.
Geology; minerals; sketch map 9
Location, map showing ..... *facing* 6
Dowling, D. B. 3
Drag folds 64, 69
Sketch map illustrating 70
Drainage, Cat R.-Kawinogans L. area 58
Drill-rig, May-Spiers g. m., photo 47
Drum lake 62, 65, 67
Duck, wild 60
Duffell, Stanley 55
Duffell lake 57
Dunlop Red Lake Syndicate 6

E

Ear falls, power plant 2
East bay, Red l. 7, 9, 19, 52
East Bay Mines of Red Lake, Ltd. 52
Economic geology. *See* Geology, economic.
Electric power.
See also Hydro-Electric Power Commission.
Howey g. m., costs 2, 26
English r. 57
Water power 2, 26
Erosion, glacial.
Cat R.-Kawinogans L. area 69
Red Lake area, notes and section ... 4, 24
Eskers 58
Explorations, early.
Cat R.-Kawinogans L. area 55, 56
Red Lake area 3

F

Fairlie tp., gold mining 8, 36
Farm land 60, 61
Faulkenham lake 35
Granite batholith 36
Faults 50, 72
Fawcett, Thomas 56
Feldspar porphyry.
Cat R.-Kawinogans L. area 63, 67
Red Lake area 4, 36, 40, 49
Ferrodolomite 19, 21, 25, 44, 48
Analyses 4
Auriferous quartz in 5, 21, 43
Relation to quartz porphyry 4, 23, 26
Finland gold claims. *See* Soumi g. claims.
Fish 60
Fisher 60
Flat lake 35
Flow structure 64
Folding.
See also Drag folds.
Cat R.-Kawinogans L. area 66, 70, 71
Red Lake area 3
Foley Red Lake Mg. Co., Ltd. 48
Forest fires 59, 60
Formations, tables of 3, 62
Fort Albany 53
Fox 60
Fracture zones.
Ferrodolomite in 4, 5
Mineralized. *See* Geology, economic.

PAGE

Fragmental rocks.
See Agglomerates; Tuffs.
Freight rate, Hudson–Red Lake..... 2
See also Transportation.
Frontier Red Lake Gold Mines, Ltd.
Property, geology and workings..... 40
location, map showing.....*facing* 6
Fry lake.....55, 57
Glacial striae, photo..... 58
Gold, value..... 69
Rocks.....62-66, 69
quartz vein near, photo..... 68
schist, mineralized..... 68
Fur-bearing animals..... 60
Furse, Geo. D.....9, 36, 37, 56
Futterer, E..... 1

G

Gabbro..... 63
Galena.
Cat R.-Kawinogans L. area.....68, 73
Red L. area, indicates high grade....6, 29
see also Geology, economic.
Game..... 60
Garnets.....25, 49, 51
Geese, wild..... 60
Geology, economic.
Cat R.-Kawinogans L. area.....68, 69, 73
Red Lake area..... 5-52
Geology, general.
Cat R.-Kawinogans L. area..... 62-67
Red Lake area..... 3-5
Geology, structural.
See also Faults; Folding.
Cat R.-Kawinogans L. area..... 69-73
Red Lake area..... 4
Gillies, A..... 1, 17
Glacial deposits.
Cat R.-Kawinogans L. area.....59, 62
Red Lake area..... 3, 4
Glaciation.
See also Erosion, glacial.
Cat R.-Kawinogans L. area.....58, 59
striae, Fry l., photo..... 58
Red Lake area..... 4
Glendinning, A..... 25
Glendinning, G..... 1
Gneiss. *See* Granite gneiss.
Gold.
Concentrated in weathered zones.... 5, 24
Deposits, nature of.....5, 6, 17, 61, 68
see also Quartz veins, auriferous.
Discoveries.....1, 35, 56
Mining properties described.
Cat R.-Kawinogans L. area..... 73
Red Lake area..... 6-52
Native.
Red Lake area. *See* Geology, economic.
Ore, Howey g. m., photo..... 30
Origin..... 4
Telluride..... 28
Values. *See* Geology, economic.
Gold Eagle Gold Mines, Ltd.
Property, geology and workings....17, 18
location, maps showing.....*facing* 6, 9
Golden arm, Red lake.....5, 37, 39, 40
Goldside Mining Co., Ltd.
Property, geology and workings..... 6, 7
location, map showing.....*facing* 6

PAGE

Graham gold claim.
Location, map showing.....*facing* 6
Mineralization..... 40
Granite.
See also Batholiths; Biotite granite; Granodiorite.
Cat R.-Kawinogans L. area.....61, 62, 66
intrusive, effect of.....70, 72
mineralized.....68, 69, 73
Red Lake area..... 3
gold associated with.....6, 7, 35, 36, 49
Mackenzie is..... 11
Granite gneiss.....62, 66
Granite porphyry..... 69
Graniteboss lake.....57, 66
Granodiorite.
Cat R.-Kawinogans L. area..... 67
Red Lake area.....3, 11, 17, 19, 26, 33, 35
Gravel.....59, 62
Green Narrows l. *See* Obaskaka l.
Greenstones.
See also Basalt.
Cat R.-Kawinogans L. area..... 70-73
drag-folded.....70, 71
Red Lake area.....3, 26, 37, 41, 43, 47
carbonatized.....19, 24, 43, 44
gold assoc. with.6, 11, 23, 33, 37, 40, 51
silicified.....23, 24
Greig, J. W..... 56
Greywacké.
Cat R.-Kawinogans L. area.....62, 64
Red Lake area..... 3, 7

H

Hahn, F. X., gold discovery..... 35
Hahn lake.....5, 41, 43
Hall, W. S..... 1
Halpenny, R., Sr..... 1
Hammell lake..... 43
Harding, W. D.
Rept. by, on Cat R.-Kawinogans L. area..... 53-73
Harvey gold claims.
Geology and workings..... 7
Location, map showing.....*facing* 6
Hawley, J. E.....3, 6, 26
Heyson tp., gold mining.....26, 35
Historical notes.
Cat R.-Kawinogans L. area.....53, 55, 56, 68
Red Lake area..... 3
Hollinger Consolidated Gold Mines, Ltd. 24
Honsberger, A. H..... 1, 44
Hornblende schist.
Cat. R.-Kawinogans L. area..... 66
Red Lake area..... 36
Hornblendite..... 63
Howey gold m.
See also Howey Gold Mines.
Aerial photo.....*frontispiece*
Historical notes..... 1, 26
Ore, photo..... 30
Ore reserves.....30, 32
Production.....5, 26, 31
Workings; milling practice..... 29-31
projections.....*facing* 26, 30
Howey Gold Mines, Ltd.
Dividends paid by..... 32
Operating and cost data..... 31
Plant, photo..... 26

PAGE

Howey Gold Mines, Ltd.—*Continued*
Power consumption, costs 2, 26
Property, geology and workings 26-30
location, map showing ..... *facing* 6
see also Howey g. m.
Hudson.
Air service 2, 57
Routes from, to areas. *See* Access.
Hudson's Bay Co. 55
Post, Lake St. Joseph 53
Hunting. *See* Game.
Huronian Belt Co., Ltd. 6
Hurst, M. E. 55, 56, 61
Report by, on Red Lake area 1-52
Hydro-Electric Power Commission.
Plant, Ear falls, English river 2, 26
Rat falls, Lake St. Joseph 60
Root r., navigation improved by 58, 59

I

Indians, Cat R.-Kawinogans L. area 61
Cemetery, Slate Falls, photo 61
Iron formation.
Cat R.-Kawinogans L. area 66
folded 70, 71
photo 65
Red Lake area 3, 5
sulphides in 9, 41, 51

J

Jacknife lake 57
Rocks 63, 65
iron formation, photo 65
structure 71
Jamesonite 6, 13, 17, 21, 24, 23
Jarrow lake 57
Jewett lake 66, 69
Structure 72
Johnson, Victor 55

K

K. 1,414 gold claim 26
K. 1,526-29 gold claims 6
K. 1,593 gold claim 25
K. 1,600, 1,601 gold claims 25
Kaminiskag lake 57, 67
Quartz veins in granite 69
Kawashe lake 57
Kawinogans lake 57, 66
See also Cat R.-Kawinogans L. area.
Keewatin series.
See also Greenstones; Lava flows; Post-Keewatin.
Cat R.-Kawinogans L. area 61-66
Red Lake area 3
Kelly-Carlson gold claims 40
Kenora, air service 2
Kersantite 28
Kert gold claims.
Geology and workings 11
Location, maps showing ..... *facing* 6, 9
K. R. L. 1,516, 1,517 gold claims 6, 23

L

Lac Seul 56, 57
Lacustrine deposits 3, 4
Laird, H. C. 56, 68

PAGE

Lake St. Joseph.
See also Matapesatakun bay.
Airplane service to 57
Altitude 58
Fishing, commercial 60
Railway from Root r. 58
Rocks 66
Routes to 57
Surveys, early 56
Water power 60
Lamprophyre 3, 4
Carbonatized 24, 25, 33
McKenzie Red Lake g. m., related to mineralization 13, 16
Syenitic, analysis 12
Lang gold claim 6
Laut, Agnes 53
Lava flows.
Cat R.-Kawinogans L. area 62, 63
sulphide veins in 69
Lead. *See* Galena.
Limestone, crystalline.
Red Lake area, notes and analysis 4, 5
Livingstone, W. S. 1, 19, 21
Lynx 60

M

Macandrew Red Lake Gold Mines, Ltd.
Property, geology and workings 19
location, maps showing ..... *facing* 6, 9
McChesney Gold Mines, Ltd. 6
McCuaig Red Lake Gold Mines, Ltd.
Property, geology and workings 11
location, maps showing ..... *facing* 6, 9
MacIntosh, J. 58
McIntyre-Porcupine Mines, Ltd. 32
Property, map showing location, *facing* 6
Mackenzie island, Red l.
Geology; mining properties 10-19
see also McKenzie Red Lake g. m.
Map, sketch 9
McKenzie Red Lake gold m.
See also McKenzie Red Lake Gold Mines.
Mill, capacity 17
Ore reserves 16
Power line to 3, 17
Production 5, 17
Veins, mineralization 6, 13, 16
Workings 10, 14-17
McKenzie Red Lake Gold Mines, Ltd.
Plant, photo 13
Property, geology and workings 11-17
location, map showing ..... *facing* 6
see also McKenzie Red Lake g. m.
Mackle, W. P. 1, 35
McManus Red Lake Gold Mines, Ltd.
Property, geology and workings 25, 26
location, map showing ..... *facing* 6
MacMillan, J. 56
McNeely gold claims.
See McKenzie Red Lake Gold Mines; Martin-McNeely Mines.
McNeill, W. K. 55, 63
See also Analyses.
Madsen, M. 1, 35
Madsen Red Lake Gold Mines, Ltd.
Ore reserves 36
Property, geology and workings 35, 36
location, map showing ..... *facing* 6

PAGE
Madsen-Sadler Bay gold claims.
Geology and workings 43
Sketch map, geological 41
Location, map showing ..... *facing* 6
Malachite 25
Map, geological, coloured.
Cat R.-Kawinogans L. area (No. 44f) ..... *in pocket*
Maps, geological, sketch.
See also Plans, geological.
Connell-Stirrett-Williams g. claims .. 72
Mackenzie is., Red l. 9
Madsen-Sadler Bay g. claims 41
Maps, key.
Cat R.-Kawinogans L. area 53
Red Lake area, properties ..... *facing* 6
Maps, sketch.
See also Maps, geological, sketch.
Burned area, Blackstone-Wright lakes 59
Drag-folds, Cat R.-Kawinogans L. area 70
Marcasite 50
Margaret Mines, Ltd. 19
Marten 60
Martin bay, Red l. 36, 37, 43
Martin-McNeeley Mines, Ltd.
Property, geology and workings 24, 25
location, maps showing ..... *facing* 6, 9
Matapesatakun bay, L. St. Joseph 57
Agricultural land 61
Keewatin sediments 64, 65
photo 64
May, O. 1
May-Spiers Gold Mines, Ltd.
Property, geology and workings 46, 47
location, map showing ..... *facing* 6
Meen, V. B. 1
Middle bay, Red l. 46, 49
Middle Bay Mines, Ltd.
Property, geology and workings 47, 48
location, map showing ..... *facing* 6
Miller, W. G. 56
Miller Red Lake Syndicate 52
Mining claims.
See also K., K.R.L. g. claims.
87 ..... 10, 11
93 24
320, 321 ..... 22, 23
322 22-24
432, 433 ..... 19, 20
820 33
1,022 19
1,448, 1,449, 1,451 41
1,617 ..... 41, 43
1,627 7
1,629 49
1,716, 1,720 49
2,206 25
2,208 24
2,880 40
2,964 49
3,475, 3,476 51
5,207 43
5,208 ..... 41, 43
5,261 49
6,121, 6,122 35
6,181 39
6,687 25
7,607 ..... 22, 23
7,779 ..... 41, 43
8,121 46

PAGE
Mining claims—*Continued*
9,483, 9,486 51
10,047 8
10,057 ..... 42, 44, 46
10,205 5
10,225 11
10,235 ..... 37, 38
10,286, 10,287, 10,322, 10,323 7
10,357, 10,395, 10,396 40
10,443 ..... 42, 46
10,631 17
10,919 25
11,048 11
11,418 19
12,946 35
Mink 60
Molybdenite.
Cat R.-Kawinogans L. area 68, 69
Red Lake area 37
Monzonite 11
Moose 60
Moosetegon lake 66, 67
Mineralized schist 68
Mousetrap lake 57, 64
Quartz veins 69
Structure 72
Mud seams 50
Murray, A. P. 56
Muskeg 56
Muskegsagagen lake 57
Rocks 62
structure 71
Muskrat 60

N

Nabemakoseka lake 57
National Gold Syndicate 43
Natural resources.
Cat R.-Kawinogans L. area 59-61
Navigable waterways. *See* Canoe routes.
Noranda Mines, Ltd. 6
Northern Mineral Areas, Ltd. 6
Nortricia Mining Co., Ltd.
Property, geology and workings 19-23
ferrodolomite, analysis 4
location, maps showing ..... *facing* 6, 9

O

Obaskaka lake 57, 66
Anticline 72
Caribou 60
Ontario Forestry Branch 55, 57, 59
Radio station, Red Lake 2
Osnaburgh House 53
Osnaburgh Indian Reserve 61
Osnaburgh lake. *See* L. St. Joseph.
Otter 60
Overburden.
Red Lake area, thickness 25
Oxidation. *See* Weathering.

P

Partridge 60
Passow, F. M. 35
Patricia gold claim 6
Paul Martin Syndicate.
Property, geology and workings 7, 8
location, map showing ..... *facing* 6

PAGE

Paulore Gold Mines, Ltd.
Property, geology and workings..... 37
location, map showing.....*facing* 6
Pegmatite.....62, 66, 67
Molybdenite in..... 69
Pelican, Indian school..... 61
Pembina r., navigability..... 57
Pendleton gold claims.
Location, map showing.....*facing* 6
Mineralization..... 51
Pickerel..... 60
Pickle lake..... 56
Pickle L.-Crow R. area.
Hydro-electric power for..... 60
Winter road to..... 57
Pike..... 60
Pillow lava.
Cat R.-Kawinogans L. area.....62, 63
pyrrhotite..... 69
Red Lake area.....37, 39
Pipestone bay, Red l.....40, 43, 49, 51
Pipestone narrows, Red l..... 44
Pipestone Red Lake Gold Mines, Ltd..48, 49
Plans.
See also Plans, geological; Projections, vertical.
Cardinal g. m., workings..... 48
Gold Eagle g. m., workings..... 18
McKenzie Red Lake g. m., workings. 14
Red Lake Gold Shore g. m., workings 34
Plans, geological.
See also Maps, geological, sketch.
Big-Lode g. m..... 45
Cochenour-Willans g. m..... 22
McKenzie Red Lake g. m..... 10
Nortricia g. m.....20, 21
Paul Martin Syndicate..... 8
Red Crest g. m..... 38
Red Lake Gold Shore g. m..... 33
Rowan Lake g. m..... 39
West Red Lake g. m..... 38
Pleistocene..... 3, 62
See also Erosion, glacial; Glaciation.
Porcupine..... 60
Porphyritic rhyolite..... 62
Analysis..... 63
Porphyry. *See* Diorite, Feldspar, Granite, Quartz, and Rhyolite porphyries.
Post narrows, Red l..... 7
Post-Keewatin (?)..... 3
See also Diorite.
Power.
See Electric power; Water power.
Pre-Cambrian.
Cat R.-Kawinogans L. area..... 62-67
Red Lake area..... 3
Projections, vertical.
Howey g. m., longitudinal.....*facing* 30
transverse.....*facing* 26
McKenzie Red Lake g. m..... 15
Nortricia g. m..... 23
West Red Lake g. m..... 44
Prospectors, notes for.
Cat R.-Kawinogans L. area..... 61
Red Lake area..... 6
Provincial Air Service..... 55
Provincial Assay Office.
See Analyses.
Ptarmigan..... 60
Pulpwood..... 60

PAGE

Pyrite.
Cat R.-Kawinogans L. area.....68, 73
Red Lake area, auriferous.....6, 29, 73
Howey g. m., photo..... 30
see also Geology, economic.
Pyroclastics. *See* Agglomerates; Tuffs.
Pyrrhotite.
Cat R.-Kawinogans L. area.....68, 73
Red Lake area. *See* Geology, economic.

Q

Quartz monzonite..... 11
Quartz porphyry.
Cat R.-Kawinogans L. area.....63, 67
mineralized..... 69
Red Lake area.....7, 17, 19, 25, 36, 40
ferrodolomite assoc. with..4, 5, 23, 24, 48
gold assoc. with...6, 9, 11, 43, 44, 47-51
Howey g. m., notes and analysis 27,28
Quartz veins, auriferous.
See also Geology, economic.
Cat R.-Kawinogans L. area.....61, 64, 67
age..... 67
photos.....68, 71
Red Lake area.
age; occurrence.....5, 6, 13, 15, 29, 37
Howey g. m., notes and photo.... 27-29
McKenzie Red Lake g. m.....6, 13, 16
Origin..... 4
Quartzite.....62, 64
Quaternary..... 3, 62

R

Rabbit..... 60
Radio station, Red Lake..... 2
Rahill Red Lake Mining Co., Ltd.
Property, geology and workings..... 25
location, maps showing.....*facing* 6, 9
Railways, marine.
Hudson-Red L. route, notes and photo 2
Root r..... 58
Ramsell, J. L..... 1
Rat rapids, power plant..... 60
Red Crest Gold Mines, Ltd.
Property, geology and workings..... 37-39
location, map showing.....*facing* 6
Red Lake area.
Access to..... 1
Air and boat service to..... 1, 2
Freight rate from Hudson..... 2
Gold deposits in vicinity, report by M. E. Hurst..... 1-52
Radio station..... 2
Red Lake Bay Mines, Ltd..... 52
Red Lake Bay Syndicate..... 52
Red Lake Centre Mines, Ltd.
Property, geology and workings..... 26
location, map showing.....*facing* 6
Red Lake Gold Shore Mines, Ltd.
Plant, photo..... 32
Power line to..... 3
Property, aerial photo.....*frontispiece*
geology and workings..... 33-35
location, map showing.....*facing* 6
Red Lake Goldfields Co., Ltd..... 52
Red Lake Prospectors, Ltd..... 52
Red Lake Prospectors Syndicate..... 6
Red Mammoth Gold, Ltd..... 19

PAGE

Rhyolite.
Cat R.-Kawinogans L. area 62
Red Lake area 3
Rhyolite porphyry.
Cat R.-Kawinogans L. area, analysis 63
Rice, W. M. 1, 18
Roadhouse, Morley 55
Roadhouse lake 55
Rockmere lake 62, 67
Pillow lava, photo 70
mineralized 68
Syncline 71
Root r., navigation 57
Rowan Discovery Syndicate 37
Rowan-Hall Syndicate 39
Rowan Lake Gold Mines, Ltd.
Property, geology and workings 39, 40
location, map showing ..... *facing* 6
Rowanhall lake 39

S

Sadler bay, Red l. 43, 44
Sadler Bay gold claims. *See* Madsen-Sadler Bay g. claims.
St. Joseph lake. *See* L. St. Joseph.
St. Paul, C. E. 1
Sam's portage, Chukuni r.
Rail-power haulage, photo 2
Sand, Red L. area, thickness 25
Savant Station.
Route from, to L. St. Joseph 57
Scheelite 28
Schists.
See also Chlorite-carbonate schist; Hornblende schist.
Red Lake area 3
Scott, G. H. 1
Scott Gold Mining Syndicate.
Property, geology and workings 49
location, map showing ..... *facing* 6
Section, vertical.
See also Projections, vertical.
Weathered zone, Cochenour-Willans g. m. 24
Sedimentary rocks.
Cat R.-Kawinogans L. area 61, 64-66
structure 70-72
thickness 64, 71
Red Lake area 3, 18
Shaw, J. W. 1, 34
Shear zones, mineralized.
See also Geology, economic.
McKenzie Red Lake g. m. 13-16
Siliceous rocks.
Cat R.-Kawinogans L. area 65
Red Lake area 5, 9, 40, 46
see also Greenstones, silicified.
Silver.
Red Lake area 40
Howey g. m, production and value 31
telluride of 28
Sioux Lookout, air service 2, 55, 57
Sketch maps.
See Maps, sketch; Plans.
Skookum Gold Mines, Ltd.
Property, geology and mineralization 35
location, map showing ..... *facing* 6
Skunk 60
Sky lake 67
Mineralized quartz 69

PAGE

Slate.
Cat R.-Kawinogans L. area 66
Red Lake area 3
Slate bay, Red l. 7, 8, 24
Slate Falls 57
Indian cemetery, photo 61
Slate falls, Cat r. 55, 60
Rocks 61
mineralized 68
structure 71
Smith-Morrison gold claims 19
Soapstone 49, 51
Soumi (Finland) gold claims.
Geology, workings 36, 37
Location, map showing ..... *facing* 6
South McKenzie Island Mines, Ltd.
Property, geology and workings 18, 19
location, maps showing ..... *facing* 6, 9
Sphalerite. *See* Zinc blende.
Spherulitic lava 62
Sterling Collieries, Ltd. 43
Stevens, A. C. 47
Stewart, C. H. E. 45
Stirrett, J. H.
Gold claims 68, 72, 73
Structural geology. *See* Geology, structural.
Sturgeon 60
Sulphides.
See also Arsenopyrite; Chalcopyrite; Galena; Pyrite; Pyrrhotite; Zinc blende.
Cat R.-Kawinogans L. area 68, 69
Red Lake area 6, 13
massive 40, 47
Surveys. *See* Explorations, early.
Syenitic lamprophyre.
McKenzie Red Lake g. m., analysis. 12
Synclines 62, 71-73

T

Tellurides, Red Lake area 28, 37
Bismuth. *See* Tetradymite.
Tetradymite 28, 33
Timber, Cat R.-Kawinogans L. area ... 59, 60
Timiskaming series.
Red Lake area 3
Todd tp., gold mining 36
Topography.
Cat R.-Kawinogans L. area 58
Toronto Red Lake Syndicate 6
Tourmaline.
Cat R.-Kawinogans L. area 69
Red Lake area .. 7, 8, 11, 21, 24, 26, 28, 40
Transportation.
Cat R.-Kawinogans L. area 57
Red Lake area 1, 2
Trapping 60
Trees, Cat R.-Kawinogans L. area 59, 60
Trout bay, Red l. 46-48
Trout Bay Syndicate 46
Tuffs.
Cat R.-Kawinogans L. area 62
Red Lake area 7, 41, 46
Tyrrell Red Lake Syndicate 6

V

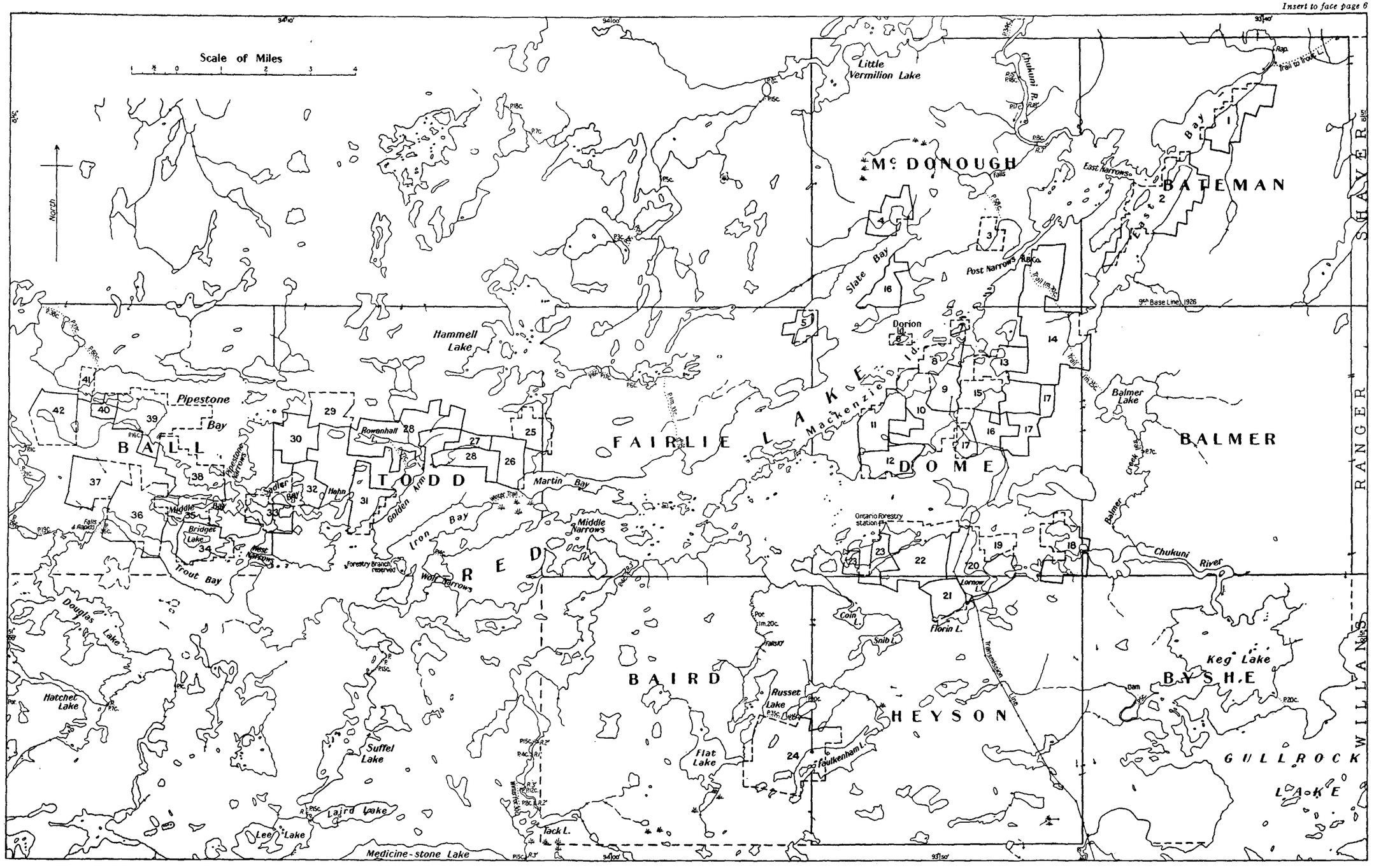
Ventures, Ltd. 24
Victoria Syndicate 6

W

PAGE
Water power.
See also Electric power; Hydro-Electric Power Commission.
Cat R.-Kawinogans L. area 60
Waterways. *See* Boat services; Canoe routes.
Weasel 60
Weathering, pre-glacial.
Preservation of 24
Residual gold concentration 5, 24
Weaver, B. D. 55
Wenasaga river, early survey 56
Wesley, Simon 55
Wesleyan lake 66
Mineralization; mg. claims 68, 73
Structure 71, 72
West Red Lake Gold Mines, Ltd.
Plant, photo 43
Property, geology and workings 42-46
location, map showing ..... *facing* 6
West vein 16, 17
Whitefish 60
Whitmore, Karl 56
PAGE
Whitmore lake 57
Rocks 62, 67
Williams, S., gold claims 68, 72, 73
Wilson, A. W. G. 56
Wilson, J. M. 39
Wilson Red Lake Gold Mines, Ltd.
Property, geology and workings 7
location, map showing ..... *facing* 6
Wolf 60
Wolf narrows, Red l. 52
Woman lake 56
Wright lake 57
Forest fires near 59, 60
Rocks 62
structure 72
sulphide veins 69

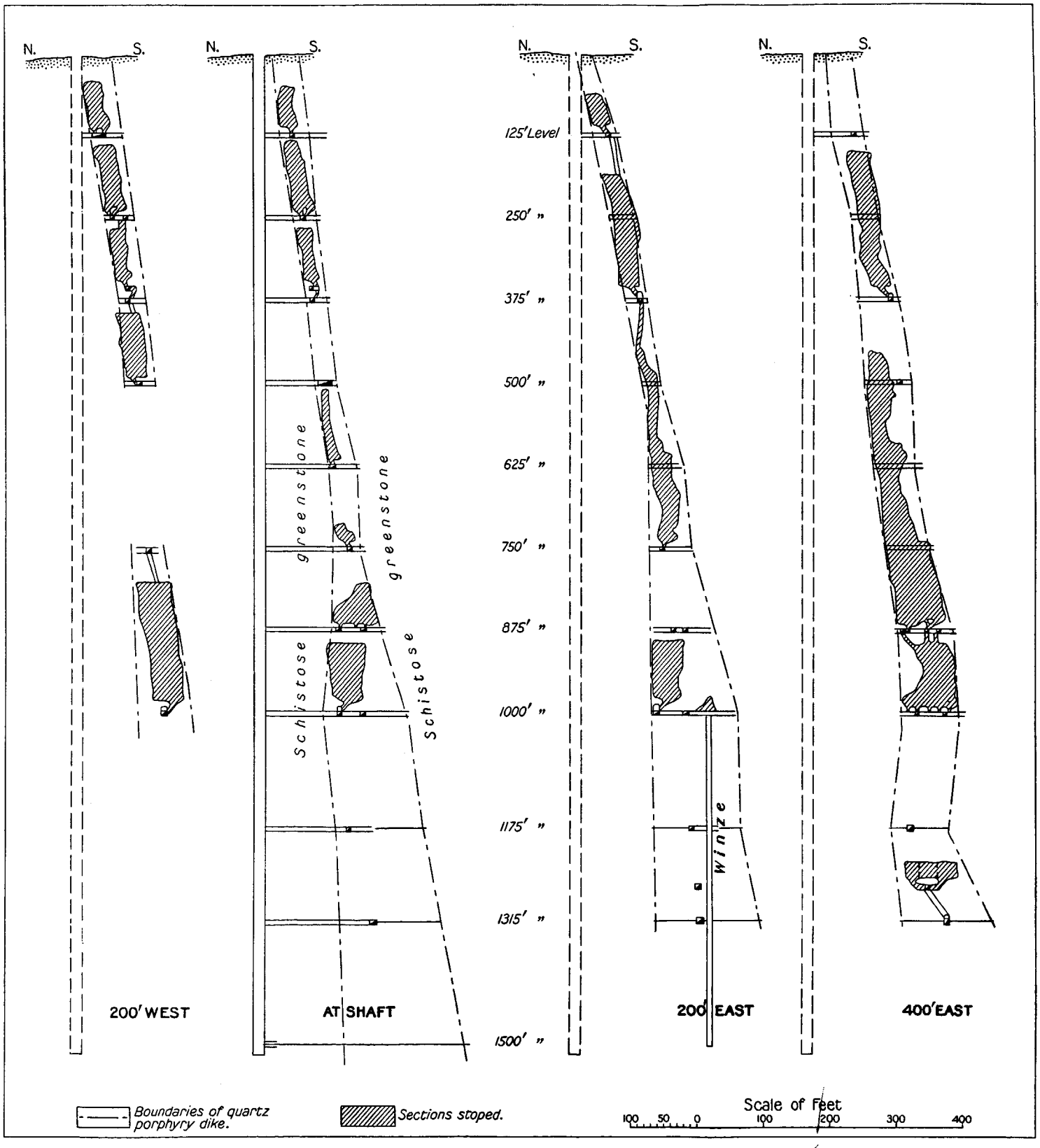
Z

Zinc blende.
Cat R.-Kawinogans L. area 68
Red Lake area indicates high grade .. 6 29
see also Geology, economic.

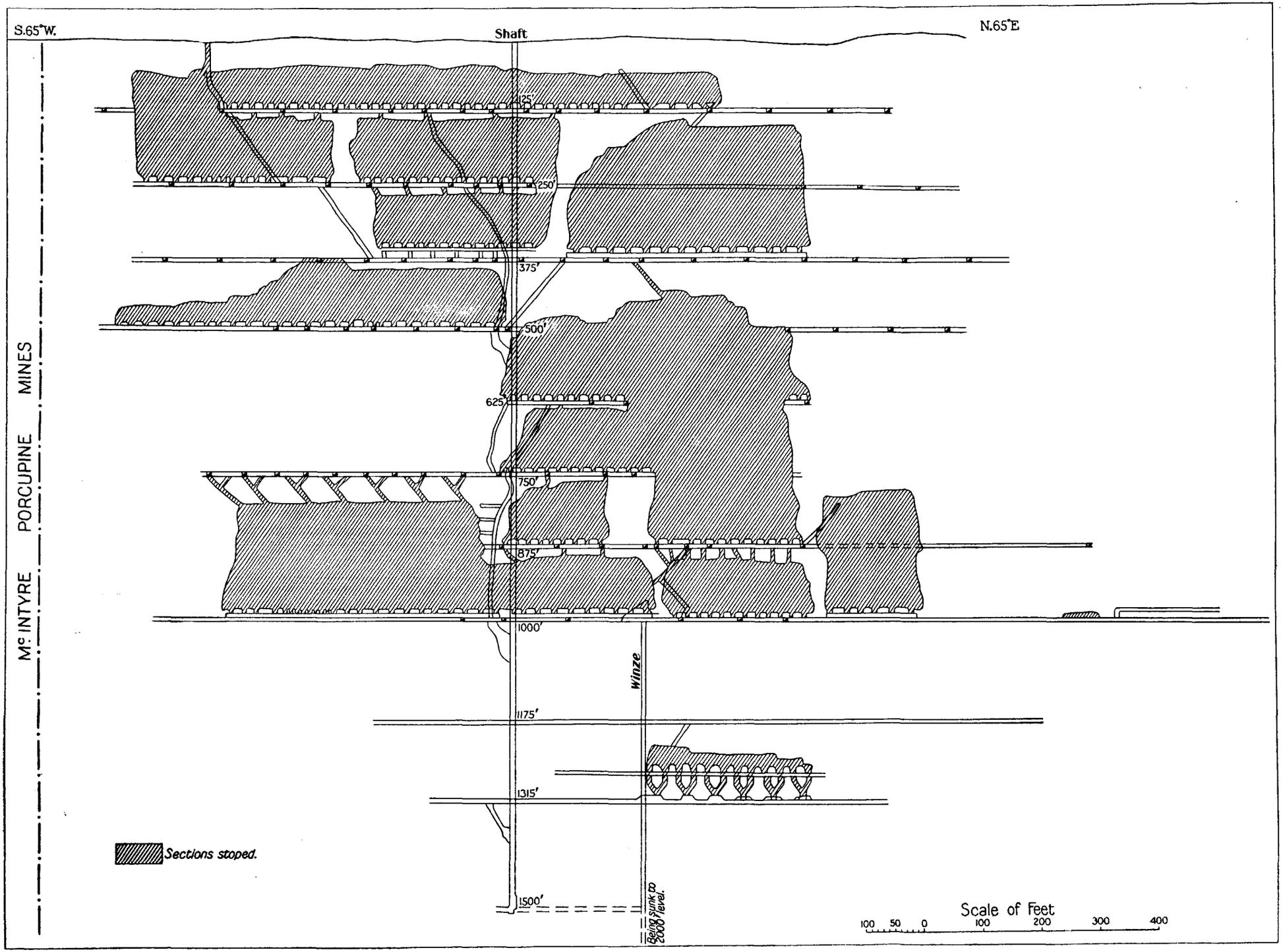


1. Goldside Mining Company
2. Wilson Red Lake Gold Mines
3. Harvey
4. Paul Martin Syndicate
5. Cochenour–Rose Quartz
6. Dorion Island
7. Kert
8. McCuaig Red Lake Gold Mines
9. McKenzie Red Lake Gold Mines
10. Gold Eagle Gold Mines
11. South McKenzie Island Mines
12. Macandrew Red Lake Gold Mines
13. Boyle-Rutherford
14. Nortricia Mining Company
15. Cochenour-Willans Syndicate
16. Martin-McNeely Mines
17. Rahill Red Lake Mining Company
18. McManus Red Lake Gold Mines
19. Red Lake Centre Mines
20. Howey Gold Mines
21. McIntyre-Porcupine Mines
22. Red Lake Gold Shore Mines
23. Skookum Gold Mines
24. Madsen Red Lake Gold Mines
25. Soumi (Finland)
26. Paulore Gold Mines
27. Red Crest Gold Mines
28. Rowan Lake Gold Mines
29. Frontier Red Lake Gold Mines
30. Graham
31. A.R.L. Gold Mines
32. Madsen–Sadler Bay
33. West Red Lake Gold Mines
34. Big-Lode Gold Mines
35. May-Spiers Gold Mines
36. Middle Bay Mines
37. Cardinal Gold Mines
38. Scott Gold Mining Syndicate
39. Cole Gold Mines
40. Biron
41. Brown
42. Pendleton

KEY MAP OF THE RED LAKE AREA SHOWING THE LOCATION OF THE PROPERTIES DESCRIBED IN THE REPORT



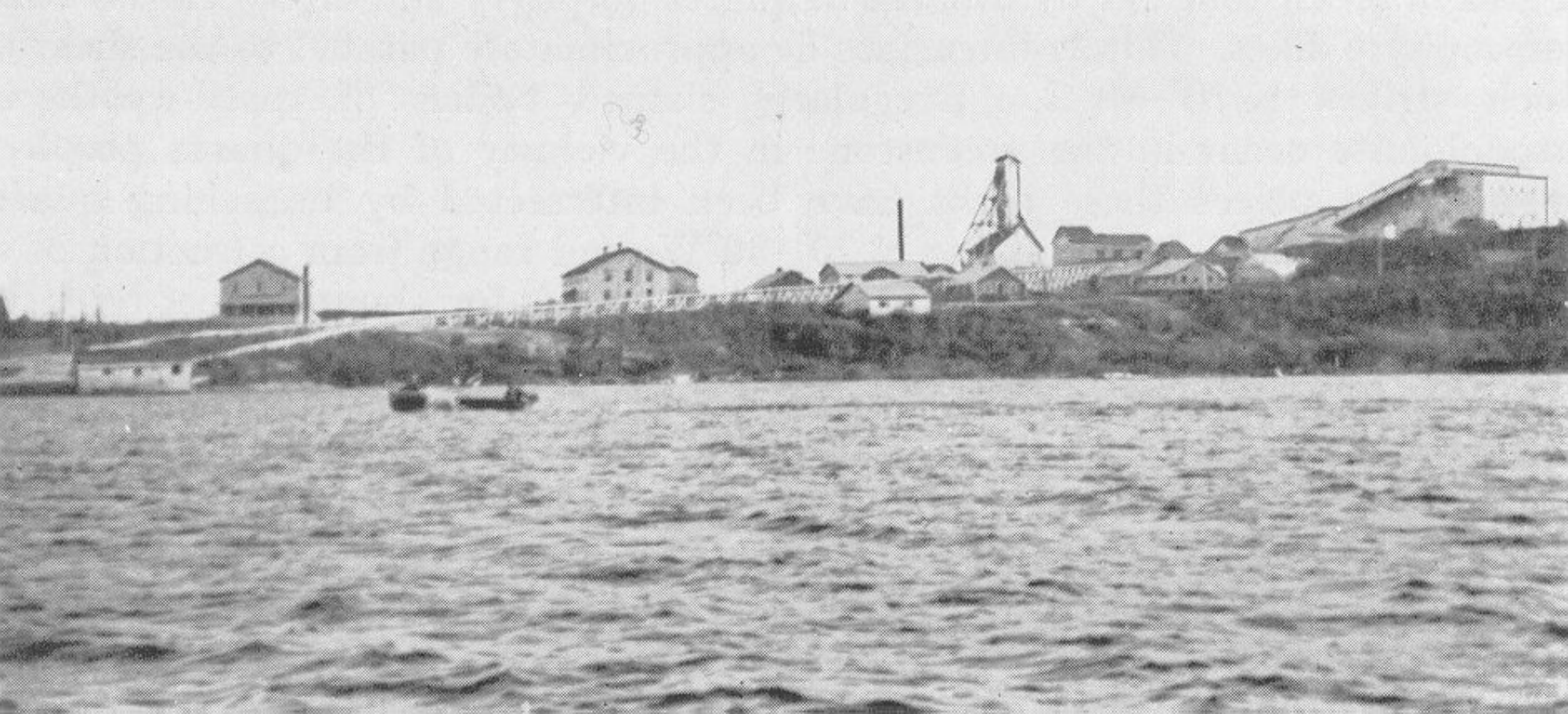
TRANSVERSE VERTICAL PROJECTIONS AT 200-FOOT INTERVALS ALONG THE ORE ZONE, HOWEY MINE, APRIL, 1935.



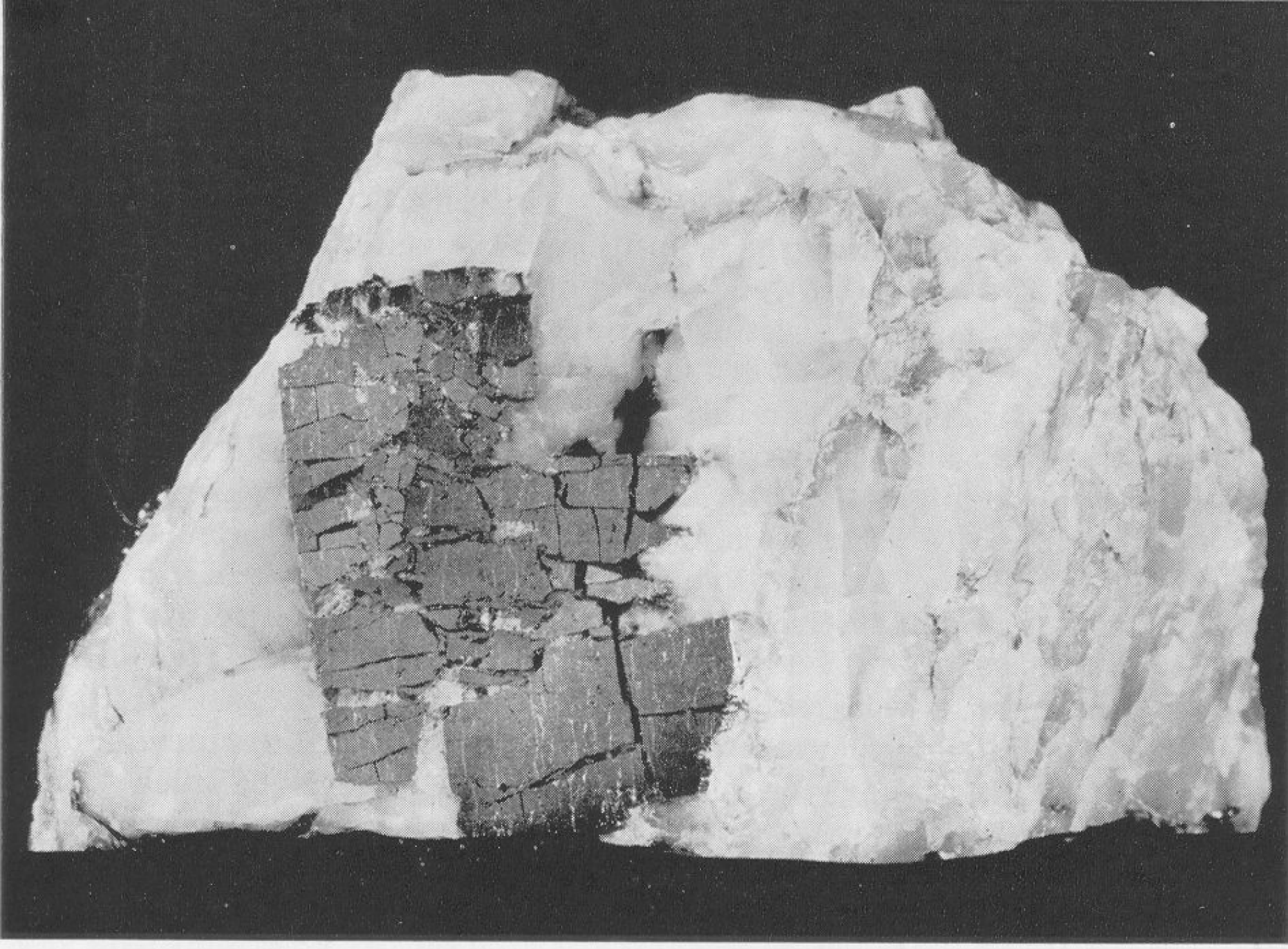
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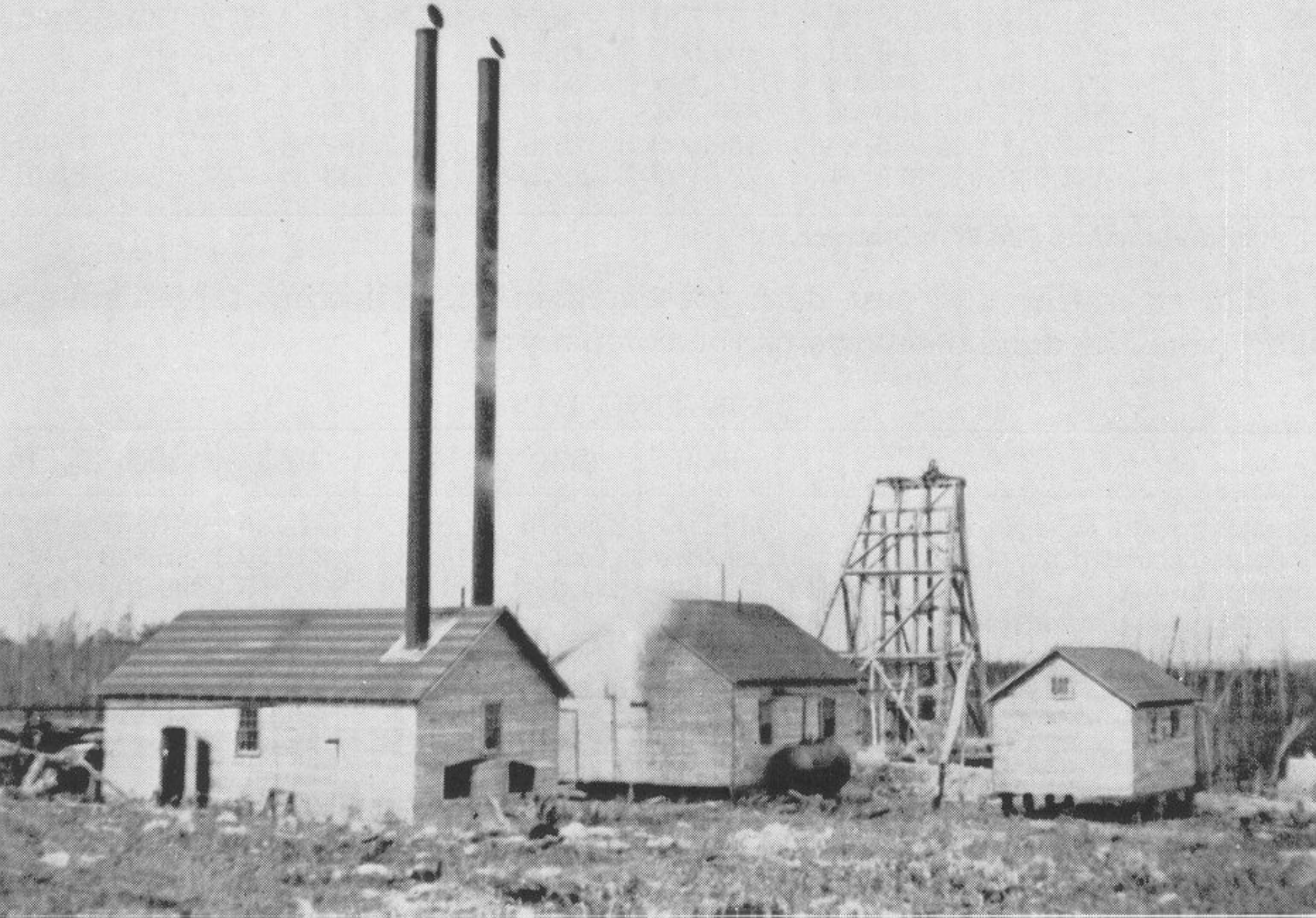


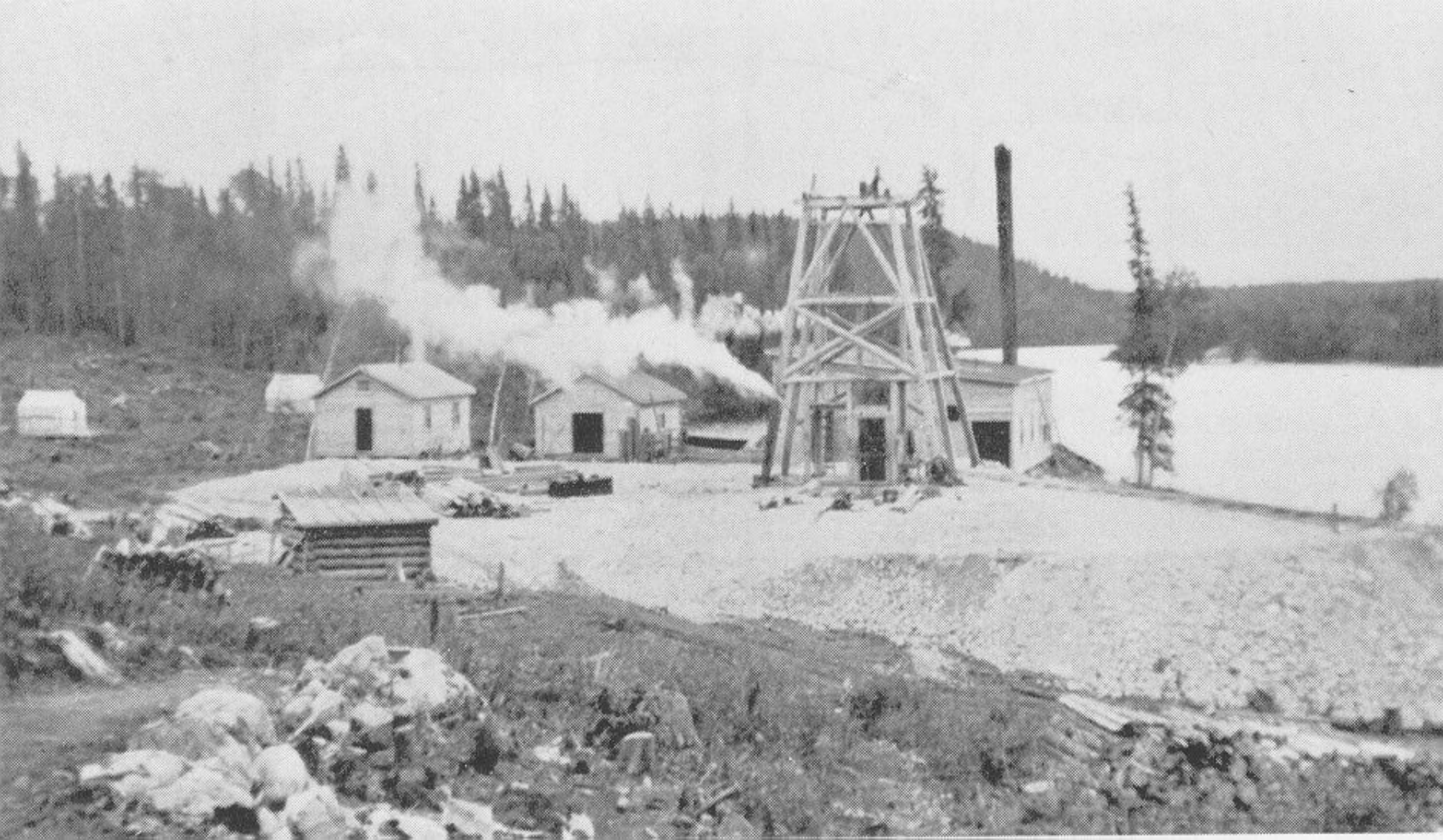


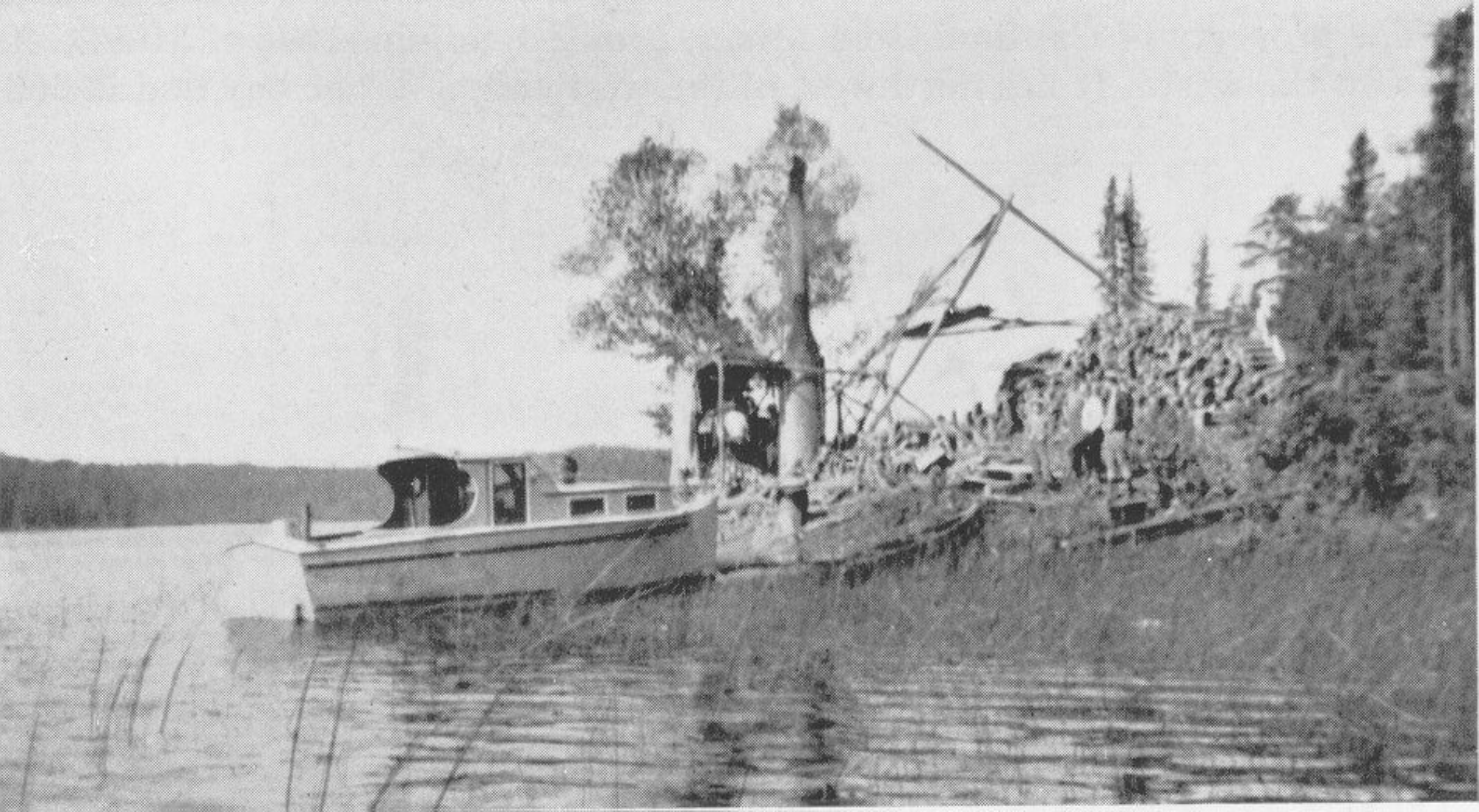


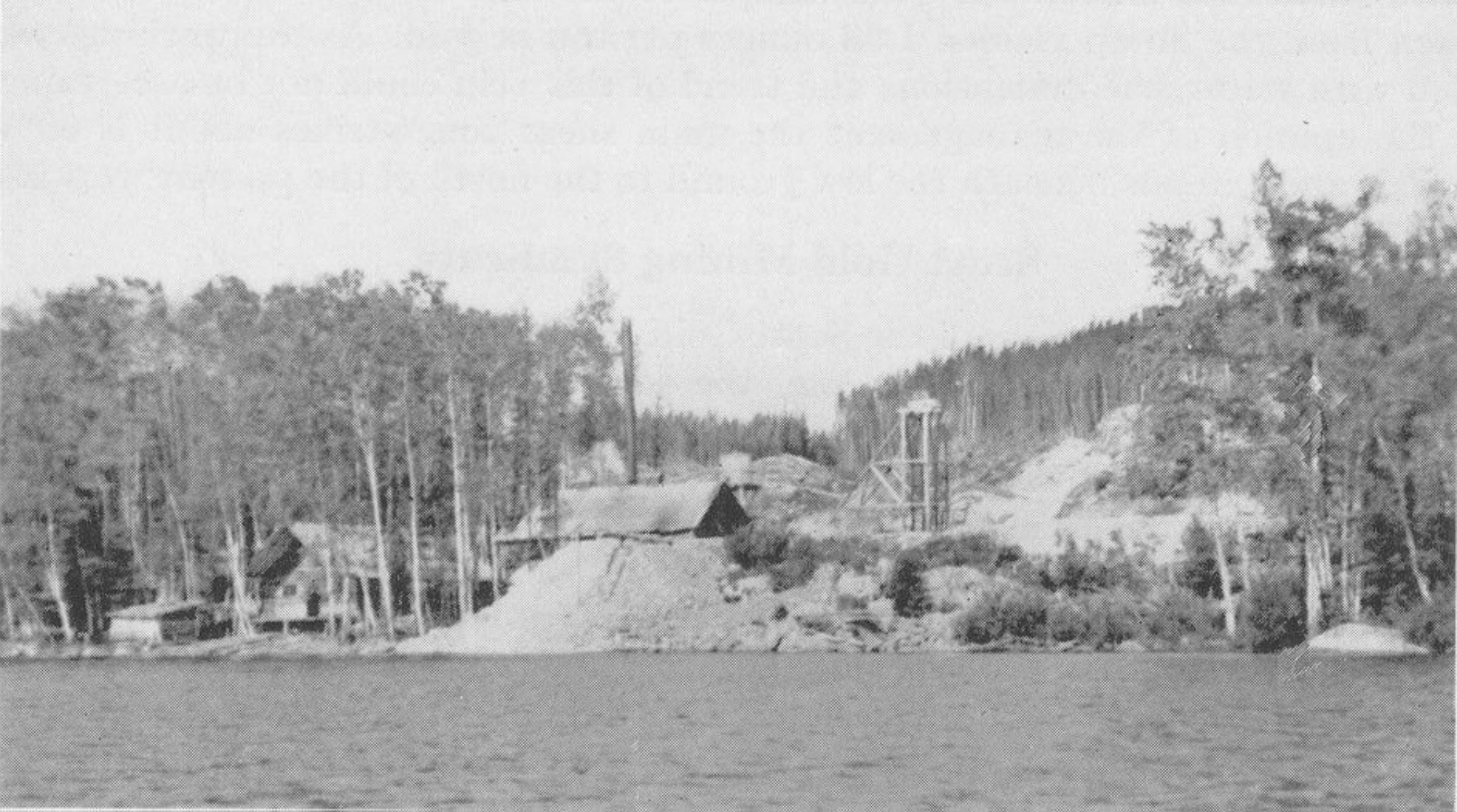


















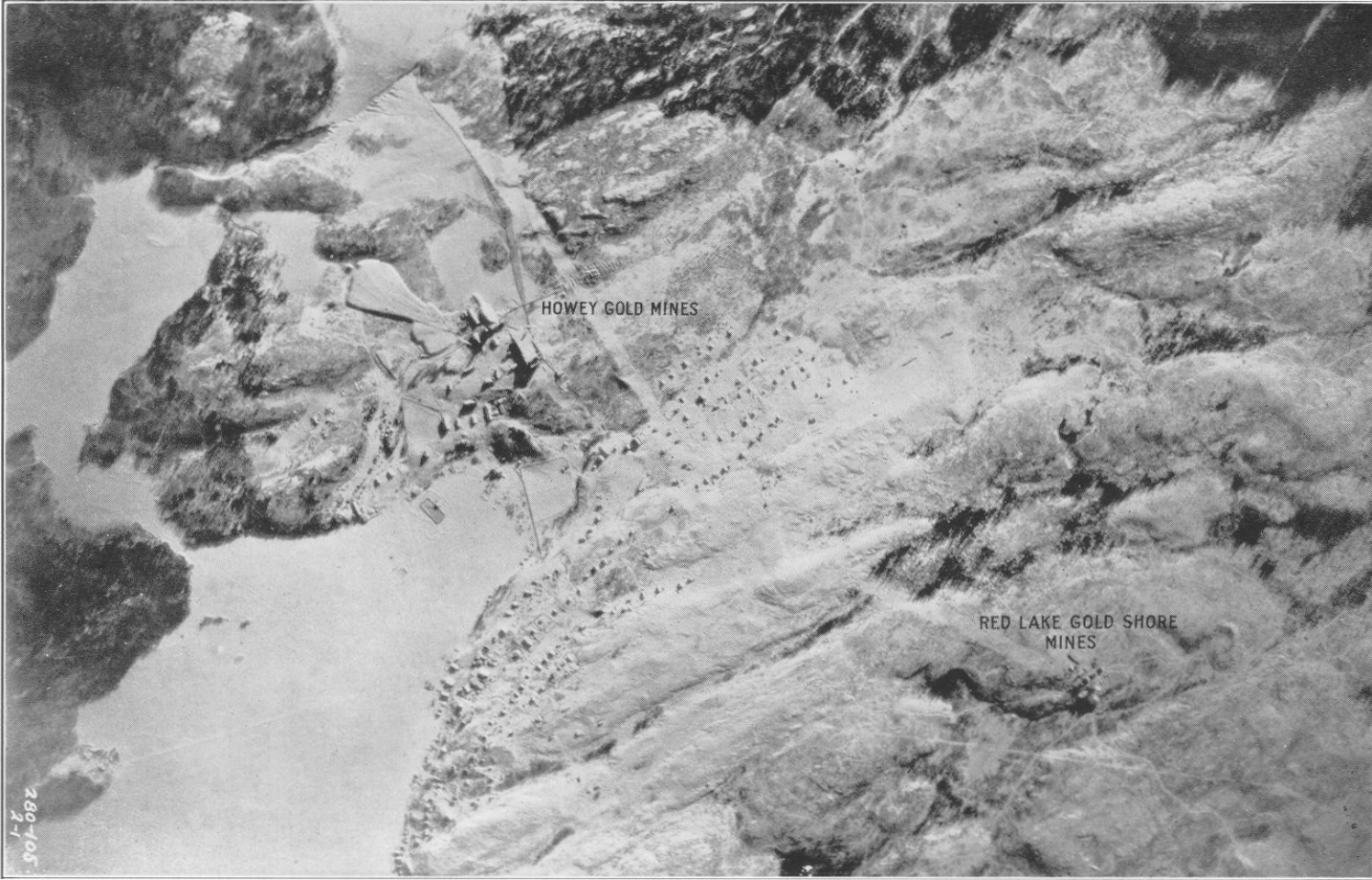











HOWEY GOLD MINES
RED LAKE GOLD SHORE
MINES
280-1-2

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLIV, PART VII, 1935

Geology of the Opeepeesway Lake Area, by H. C. Laird - - 1-30
Horwood Lake Area, by H. C. Laird - - - - - - - - 31-37
Recent Developments in the Swayze and West Shiningtree Areas, by H. C. Laird - - - - - - - - - - - - - 38-47
Part of Strathy Township, by W. S. Savage - - - - - - 48-56
Notes on Mongowin Township and Vicinity, by H. C. Rickaby - 57-61

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TABLE OF CONTENTS

Vol. XLIV, Part VII

GEOLOGY OF THE OPEEPEESWAY LAKE AREA

PAGE

Introduction 1
Acknowledgments 1
Means of Access 2
Previous Work 2
Bibliography 2
Topography and Drainage 3
Natural Resources 4
Timber 4
Fish and Game 5
Water Power 5
Agriculture 5
Mapping Methods 5
General Geology 5
Keewatin 6
Group A 7
Group B 9
Timiskamian 11
Ridout Series 11
Age and Relationships of the Ridout Series 15
Algoman 16
Granite, Granodiorite, Gneiss 17
Quartz Diorite, Diabase, Gabbro-Diorite 17
Porphyry and Lamprophyre 18
Matachewan 19
Pleistocene and Recent 19
Structural Features 20
Economic Geology 23
Iron 23
Gold 23
Northern Aerial Canada Golds, Limited 23
Ferland-Gauldie-Mogridge Claims 23
Woman River Gold Mines, Limited 25
Hermiston-Hammerstrom Claims 28
Maltby Claims 28
Jessop-O'Neill Claims 28
Carter Claims 29
Economic Possibilities of the Area 29

HORWOOD LAKE AREA

Introduction 31
Previous Work 31
Bibliography 31
General Geology 32
Keewatin 32
Algoman 32
Matachewan and Keweenawan 33
Pleistocene 33
Economic Geology 33
Description of Properties 34
G. A. Thorne 34
Moramo Gold Syndicate 35
Wm. Smith 36
Groundhog Gold Mines, Limited 36
Lefever-Anderson Claims 36
Cambach Syndicate 37
Other Properties 37

RECENT DEVELOPMENTS IN THE SWAYZE AND WEST SHININGTREE AREAS

PAGE

Swayze Area 38
Buffalo Canadian Gold Mines, Limited 38
Swayze-Huycke Gold Mines, Limited 38
Lee Gold Mines, Limited 39
Halcrow-Swayze Mines, Limited 39
West Shiningtree Area 39
Wasapika Section 39
Churchill Mining and Milling Company, Limited 40
Neville Canadian Gold Mines, Limited 40
Lake Caswell Mines, Limited 41
Bilmac Gold Mines, Limited 42
Properties in Adjacent Sections 43
Canyon Creek Gold Mines, Limited 43
Gosselin Gold Mines, Limited 45
Duncan J. McDonnell 46
Ace Exploration and Holding Company, Limited 46
Communication, Transportation, and Power 47

PART OF STRATHY TOWNSHIP

Introduction 48
Location 48
Topography 48
Previous Geological Work 49
Map 49
Acknowledgments 49
General Geology 49
Keewatin 50
Pre-Algoman (Haileyburian?) 51
Algoman 51
Granite 51
Quartz Porphyry 51
Keweenawan 52
Pleistocene and Recent 52
Economic Geology 52
Manitoba and Eastern Mines, Limited 52
Cuniptau Mines, Limited 54
Longlac Adair Mines, Limited 55
Strathy Basin Mines, Limited 55
Other Properties 56

NOTES ON MONGOWIN TOWNSHIP AND VICINITY

Introduction 57
Working Properties 57
McMillan Gold Mines, Limited 57
Bousquet Gold Mines, Limited 60
Fox Lake Gold Mines, Limited 60
Bob Tough Gold Mines, Limited 61
Other Properties 61

ILLUSTRATIONS

PAGE

Polished specimen of agglomerate from the west shore of the North arm of Opeepeesway lake 12
Exposure of boulder conglomerate of the Ridout series, Huffman lake 12
Cross-bedded greywacké of the Ridout series, west shore of the Northwest arm of Opeepeesway lake 14
Cross-bedding in greywacké of the Ridout series, indicating deltaic conditions of deposition, Opeepeesway lake 14
Polished specimen of mineralized Algoman (?) quartz diorite from the northern part of Mallard township 17
Cross-bedded greywacké, west shore of the Northwest arm of Opeepeesway lake 21
Sigmoidal drag fold in bedded greywacké, Opeepeesway lake 22
Main test pit, Moramo Gold Syndicate, Horwood Lake area 35
Aerial view of the property of Lee Gold Mines, Limited, Greenlaw township 38
View showing the power plant, headframe, and mill, Churchill Mining and Milling Company, Limited 40
Plant of Neville Canadian Gold Mines, Limited, Macmurchy township 40
Plant of Lake Caswell Mines, Limited, Macmurchy township 41
Main test pit exposing a high-grade gold-bearing quartz vein, Canyon Creek Gold Mines, Limited, Asquith township 45

SKETCH MAPS, PLANS, AND SECTION

PAGE

Key map showing the location of the Opeepeesway Lake area 1
Geological sketch map of the main showing, Ferland-Gauldie-Mogridge property, Mallard township 24
Geological sketch map of the claims of the Woman River Gold Mines, Limited, Mallard township 26
Geological sketch map of the main showing of the Woman River Gold Mines, Limited, Mallard township 27
Sketch map of a part of the Horwood Lake area showing the general geology and the location of the various properties *insert facing* 32
Plan of surface workings showing the geology and mineralized zones of the G. A. Thorne property, Horwood lake 34
Geological plan of the main showings on the property of the Moramo Gold Syndicate, Horwood Lake area *insert facing* 36
Plan of underground workings on the 240- and 500-foot levels, No. 1 shaft, Lake Caswell mine 42
Geological sketch map of a part of the property of Lake Caswell Mines *insert facing* 42
Plan of the open cut and vein system on surface projected to workings on the 60-foot level, No. 2 shaft, Lake Caswell mine 43
Geological sketch map of the property of Bilmac Gold Mines, Limited 44
Key map showing the position of Strathy township 48
Geological sketch map of part of Strathy township *insert facing* 50
Geological sketch map of the main showings on the property of Manitoba and Eastern Mines, Limited *insert facing* 52
Plan showing drag fold at the various levels, McMillan mine 58
Section through "C" ore body, McMillan mine 59
Composite plan of workings, Bousquet mine *insert facing* 60

COLOURED GEOLOGICAL MAP

(In pocket at back of report)

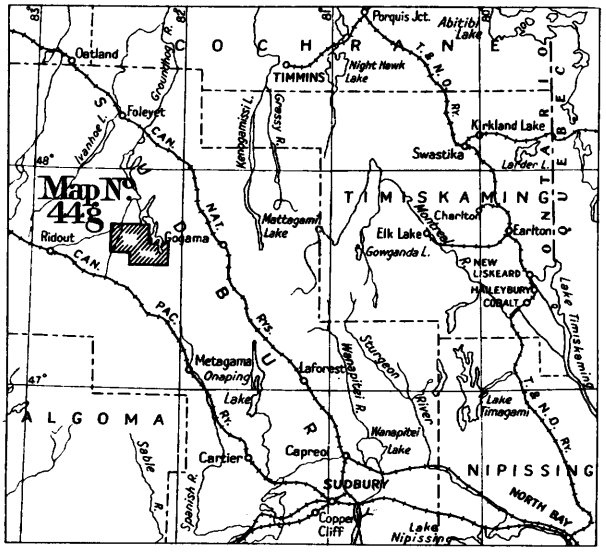
Map No. 44g—Opeepeesway Lake Area, District of Sudbury, Ontario. Scale, 1 mile to the inch.

Geology of the Opeepeesway Lake Area

By H. C. Laird

INTRODUCTION

The Opeepeesway Lake area includes the townships of Benton, Mallard, Osway, Huffman, and parts of Esther, Fingal, Arbutus, and Eric, in the district of Sudbury, about 100 miles northwest of the city of Sudbury. It lies between the Three Duck Lakes and Swayze areas, both of which have been prominent in the public eye on account of gold discoveries made between the years 1930 and 1933. In the summer of 1933, there was a mild staking rush into the central part of Mallard township as a result of a gold discovery on the Mogridge property. Unfavourable results here, as well as in the Swayze field to the west, have so



Key map showing the location of the Opeepeesway Lake area. Scale, 60 miles to the inch.

restrained the prospector that few visited this area during the past season. In spite of this reverse, the writer feels that this field still provides excellent opportunities for intelligently directed prospecting effort.

Acknowledgments

During the early parts of the field season assistance was rendered by John Bridger, Bruce Russell, and Constans Godefroy. Late in June Mr. Bridger tendered his resignation, and his place was taken by Jack Satterly. These gentlemen proved to be very capable assistants, and the writer is deeply indebted for the highly efficient manner in which they discharged their respective duties.

This opportunity is taken to acknowledge the many courtesies extended to the party by residents of Sultan, Brett Lake, and Horwood Lake. Special

thanks are due A. L. Morse, of Sultan, in connection with the handling of supplies and mail; to F. G. Huycke, Wm. McClintock, and Jack Wright, of the Swayze-Huycke Gold Mines, Limited, for the use of their camps on several occasions; to J. E. Lefever and C. S. Gifford, of Horwood Lake, for cordial hospitality extended to the party while visiting that section.

Means of Access

The area lies midway between the main lines of the Canadian Pacific and Canadian National railways, and is readily accessible from several points on either line. The choice of route is dependent largely on the nature of supplies and equipment to be handled. The Wakami river, which is reached by the Sultan-Swayze wagon road from Sultan station on the C.P.R., provides an excellent means of ingress to the area and involves a minimum of portaging. Until late in 1934 this route was probably the most expedient because there was a regular cartage service landing supplies at Wakami bridge, within one day's paddle of most of the area. With the suspension of this service, however, an alternative route from Groundhog River on the C.N.R., via Horwood lake and the Woman or the Rush river would seem more advantageous. Those taking this route may purchase supplies at Sudbury, Foleyet, or Tionaga. Shorter but more arduous and less travelled routes lead from Woman River and Biscotasing, on the C.P.R., or from Stackpool on the C.N.R. Airplane transportation at reasonable rates can be arranged by communicating with officials at Chapleau or Gogama.

Previous Work

During his reconnaissance survey in 1899, W. A. Parks travelled through Rice lake in the eastern part of this area.[1] His report is accompanied by a coloured geological map, which embraces the entire region and is the earliest on record. In 1904, C. K. Leith became interested in the possibilities of iron ore in the southern part of Huffman township. His studies led to further investigation for private interests in 1907. A magnetic survey was completed and a limited amount of surface development was performed. No further geological work was done until 1923, when Ellis Thomson began the systematic mapping of the Woman River and Ridout areas for the Geological Survey of Canada. This work was continued during the seasons of 1924, 1925, 1926, and concluded by R. C. Emmons in 1927. In 1929, the results of this investigation were published by the Geological Survey in a preliminary report with accompanying maps.[2] This information has been embodied in subsequent map-sheets: the Lake Huron Sheet, map No. 155A, the third edition of which was published by the Geological Survey of Canada in 1933; and the Kamiskotia-Ridout Area, map No. 1933a, published by the Ontario Department of Mines. Further relevant information may be found in reports by G. D. Furse, H. M. Bannerman, H. C. Rickaby, and the writer.

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[1] W. A. Parks, Ont. Bur. Mines, Vol. IX, 1900, p. 131.
[2] R. C. Emmons and Ellis Thomson, Geol. Surv. Can., Mem. 157, 1929.

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H. M. BANNERMAN, "Rush Lake Area, Sudbury District, Ontario," Geol. Surv. Can., Sum. Rept., pt. D, 1933, pp. 53, 59.
H. C. RICKABY, "Geology of the Swayze Gold Area," Ont. Dept. Mines, Vol. XLIII, pt. 3, 1934.

Topography and Drainage

The Opeepeesway Lake area lies in a region of very low relief, even lower than is common elsewhere in the pre-Cambrian shield. Essentially it consists of a low undulating plain, with a mean elevation of approximately 1,400 feet above sea-level and a gentle down slope toward the north. Muskeg areas occupy the depressions but, for the most part, these are neither widespread or extensive. Notable exceptions are the wide, open muskegs in the vicinity of the northwest arm of Opeepeesway lake and Ramsay creek in the northeast part of Fingal township. Hills rising as much as 100 feet above the general level are rare and form prominent landmarks on an otherwise even sky-line. This is particularly true in the townships of Benton, Esther, and Mallard. The highest hill in the area, with an elevation estimated at 150 feet, is situated in the central part of Benton township, about 2 miles north of the Wakami river. Less prominent elevations are found along the north boundary of Benton township, in the western and northeastern parts of Osway township, in Mallard township just west of Rae lake and Mallard lake,[1] and in the northern half of Arbutus township. Characteristic esker topography is well developed in all parts of the area, but more particularly in the northern halves of Osway and Esther townships. The eskers are narrow, elongated, sinuous ridges of sand, gravel, and boulders, having a general north-south trend. Although they rarely attain an elevation greater than 60 feet, these ridges are very persistent as to length, in many cases being more or less continuous for a mile or more.

In the northern halves of Benton and Esther townships a rather characteristic but unusual type of topography consists of low, undulating, irregularly shaped sandy knolls, rarely rising more than 25 feet above the lowest level, and in most cases much less than this. It is interesting to note that Bannerman[2] observed a similar topography in the central part of Heenan township, and suggested that these surface irregularities might be fossil sand dunes of wind-blown origin. The same thought suggested itself to the writer and his assistants.

The height-of-land between the Great Lakes and Hudson Bay watersheds passes through the southern part of Fingal and Arbutus townships, about 3 miles south of the south boundary of the map-sheet. The main streams flow north and form tributaries of the Groundhog River system. The western part of the area is drained by the Wakami and Woman rivers, and Cordes creek, and the eastern part is served by the basin of Opeepeesway lake and the Opeepeesway river.

In Benton township, the Wakami is a sizable river, carrying a considerable volume of water at all times of the year. It is wide and shallow, ranging from 100 to 200 feet in width; and its average depth is 3 or 4 feet. It is broken by two short rapids, both of which may be navigated by experienced canoemen. One mile west of the Benton-Mallard township line it joins the Woman river. From this point the latter continues east for 2 miles, then north through Mallard township toward Horwood lake. This part of the Woman river is a little wider than the Wakami river and also deeper. In Mallard township, it is broken by three waterfalls with a total drop of approximately 50 feet. Above its junction with the Wakami river, it ranges from 40 to 50 feet in width and from 4 to 8 feet in

[1]Mallard lake, which is not shown on the map, lies between Rae lake and Marion lake.
[2]H. M. Bannerman, "Rush Lake Area," Geol. Surv. Can., Sum. Rept., pt. D, 1933, p. 45.

depth, and follows a very sinuous course. Its banks are sandy and in the nature of ramparts built up in times of flood. About one-quarter of a mile south of the Benton-Esther township line, the Woman river is joined by the Cordes creek, at which point the latter is almost as wide as the former, and carries almost as much water. Reports indicate that the Cordes creek may be navigated by canoe as far as the centre of Esther township, but beyond this point canoe travel is difficult. Flowing into the Wakami river near the Benton-Garnet township line is Fawn creek, a very sinuous stream, ranging from 10 to 20 feet in width and from 3 to 10 feet in depth; it has a current of approximately 1 mile per hour. For the most part, it meanders through open alder swale and is navigable westward far into Garnet township.

Opeepeesway lake occupies an irregularly shaped basin in Osway and Huffman townships. It is a comparatively shallow body of water, rarely exceeding 20 to 25 feet in depth, except in the North arm. The Northwest arm is particularly shallow, a large part of it being filled almost to the surface with decaying vegetable debris. Flowing into the East arm of this lake are waters from the Arbutus-Potier Lakes system in Arbutus and Yeo townships, and from Little Rice lake in the central part of Huffman township. Ramsay creek, which has its source in several small lakes in the central part of Alcona township, flows into the south side of the main body of Opeepeesway lake. This stream ranges from 10 to 20 feet in width and carries a considerable volume of water. In Fingal township it meanders through an open alder swale for three miles or more, and in Osway township it is broken by four waterfalls with a total drop of approximately 50 feet in a distance of 1¼ miles. Opeepeesway lake drains northward by way of the Opeepeesway river, which joins the Woman river about 1½ miles beyond the limits of the map-sheet. For some distance north this river is really an extension of the lake, since in places it attains a width of 500 feet or more. North of the first portage it narrows somewhat but still averages 125 feet in width. On its course to the Woman river there are four rapids and three waterfalls with a combined descent of approximately 50 feet.

Natural Resources

Timber

The area is covered by a forest of mixed types, which, from the veiwpoint of the lumberman, would appear to be of little commercial value. However, a few small stands of red or Norway pine, confined largely to esker ridges in Osway and Mallard townships, might be utilized for preliminary mining development. White pine is conspicuous by its almost total absence. Much of the spruce and jackpine, particularly that in Benton and Mallard townships, may be regarded as a potential source of pulpwood. Cedars grow in the swampy places and along the main water courses, where they become very large, trunks 3 feet in diameter being not uncommon. Tamaracs, 40 feet in height, were observed in some of the open muskegs. The hardwoods are common and not specially confined to any given part of the area.

There have been no forest fires in this area for half a century, a fact which in itself is truly remarkable. During the construction of the Canadian Pacific railway, in 1885, a devastating fire, said to have originated near Chapleau, swept these townships, destroying a virgin forest of pine that would have been ready for harvesting at the present time. Small, isolated stands of red pine that escaped this conflagration may now be seen towering 30 to 40 feet above the forest of more recent growth.

Fish and Game

Except for pike, the waters of this area are not abundantly stocked with fish commonly found in Northern Ontario waters. Pickerel are rarely, if ever, taken, even in the larger lakes, but the common lake herring, *Leucicthys artedi*, may be netted in Opeepeesway lake.

Moose and deer are plentiful. Trapping is now said to be an unprofitable venture on account of the scarcity of fur-bearers, as well as the low price of the commodity. The beaver has been almost exterminated, but bear, mink, foxes, muskrats, and weasels were observed occasionally. The region about Opeepeesway lake is said to be the special habitat of the lynx, one of which was seen by a member of the party.

Partridge and grouse were notably scarce.

Water Power

There are no important sites suitable for the development of water power in economic quantities. The streams and lakes in this area, however, contribute large quantities of water to the Horwood Lake basin, which is now utilized by the Spruce Falls Pulp and Paper Company, of Kapuskasing, as a supply reservoir for their power development.

Agriculture

This area is not especially adapted to agricultural pursuits. It is believed, however, that, with proper drainage, large areas of sandy loam and clay are capable of producing many of the common field crops, particularly roots and other vegetables.

Mapping Methods

The accompanying map (No. 44g) is based on township surveys by the Ontario Department of Lands and Forests and on a micrometer survey of all the rivers and lakes along the main routes by Ellis Thomson in his compilation of the Woman River sheet. The writer made additional micrometer surveys of Camp lake, in the southeast part of Huffman township, and Fawn creek, in the western part of Benton township, as well as minor changes of the original survey. The geological interpretation is based on the systematic traversing of the whole area at half-mile intervals by standard pace-and-compass methods, traverses being tied to known points of the micrometer survey. Many small lakes not shown on previous maps have been located and rough sketches made.

In traversing this area, some attention was paid to the general topography, of which sketches and notes were made. In the hope that this type of information might be useful to the prospector, an attempt has been made to incorporate in the map as much of it as would seem consistent with usual map-making practice.

GENERAL GEOLOGY

The consolidated rocks in this area are pre-Cambrian in age. They are dominantly Keewatin volcanics and consist largely of lava flows, pyroclastics, and their metamorphic derivatives. Infolded in this Keewatin series are elongated belts of sedimentary rocks believed to be the equivalent of the Timiskaming series as defined in other parts of Northern Ontario. Intruding the above assemblage are various types of Algoman granite, porphyry, diorite, and diabase.

Overlying this pre-Cambrian basement complex, and separated from it by a time interval reckoned only in terms of millions of years, is an unconsolidated

mantle of sand, gravel, and other superficial deposits of the Pleistocene and Recent.

The following table indicates the probable stratigraphic sequence of rock formations in this area, the oldest being at the bottom:—

QUATERNARY	
RECENT:	Sand (beaches and river ramparts), peat, and lacustrine deposits.
PLEISTOCENE:	Sand, gravel, and loam deposits.
	Great unconformity
PRE-CAMBRIAN	
MATACHEWAN:	Porphyritic quartz diabase dikes (certain olivine-bearing diabase dikes may be of Keweenawan age).
	Intrusive contact
ALGOMAN:	Lamprophyre. Dikes and bosses of quartz porphyry, quartz-feldspar porphyry, and granite porphyry. Dikes and bosses of quartz diorite, diabase, gabbro-diorite. Batholithic masses of hornblende and biotite granite, with granodiorite and gneissic varieties.
	Intrusive contact
TIMISKAMIAN:[1] (Ridout Series)	Banded iron formation. Schistose conglomerate; greywacké; arkose; quartzite; argillite; slate.
	Erosional unconformity
KEEWATIN:	Poorly banded iron formation with pyrite replacements. Sediments: Greywacké and sericite schist. Volcanics of Group B: Predominantly "grey lavas," mainly andesite and basalt; light-grey tuff and agglomerate. Volcanics of Group A: Predominantly dark-green lavas, mainly highly altered andesite and basalt and their associated schists; basalt agglomerate; tuff and agglomerate.

Keewatin

Rocks believed to be of Keewatin age underlie a large part of this area. They are adjacent to and form a part of a broad region of Keewatin rocks lying to the north and west, in what may be referred to collectively as the Swayze-Horwood area. Together with the Ridout series of sediments, these rocks constitute a broad belt cutting diagonally across the area in a southeast direction, and tapering from a width of 11 miles in Esther and Mallard townships to 3½ miles at the east boundary of the sheet. The Ridout series occupies a medial position within this belt, and divides the Keewatin series into a north band and a south band, in subparallel arrangement. This division, however, has no special significance with respect to rock types, the general character and appearance of which are essentially the same in both bands. The whole belt is bordered on the north and south by widespread areas of batholithic granite and gneiss.

The Keewatin rocks consist mainly of intermediate to basic lavas, breccias and tuffs, and their related schists. For the most part, they are highly folded, strongly metamorphosed, dark-green rocks, to which the field term "greenstone" is commonly applied. In the western part of the area, however, the lavas and their related fragmental types are dominantly grey to greenish-grey in colour and show evidence of having been less metamorphosed than the greenstones just mentioned. So representative are these "grey lavas," by which name they will henceforth be designated in this report, that separation from the greenstones has been possible in mapping. Although the age relationships of these two lava

[1]This term is used in the time sense to represent a group of Timiskaming-like sedimentary rocks, the Ridout series.

types have not yet been clearly demonstrated, there would appear to be good reasons for suggesting that the grey lavas are younger than the greenstones, and overlie them stratigraphically. It should be emphasized, however, that the separation of these lavas into two groups is done not so much on the basis of possible differences in age, but rather for purely lithological reasons.

Group A

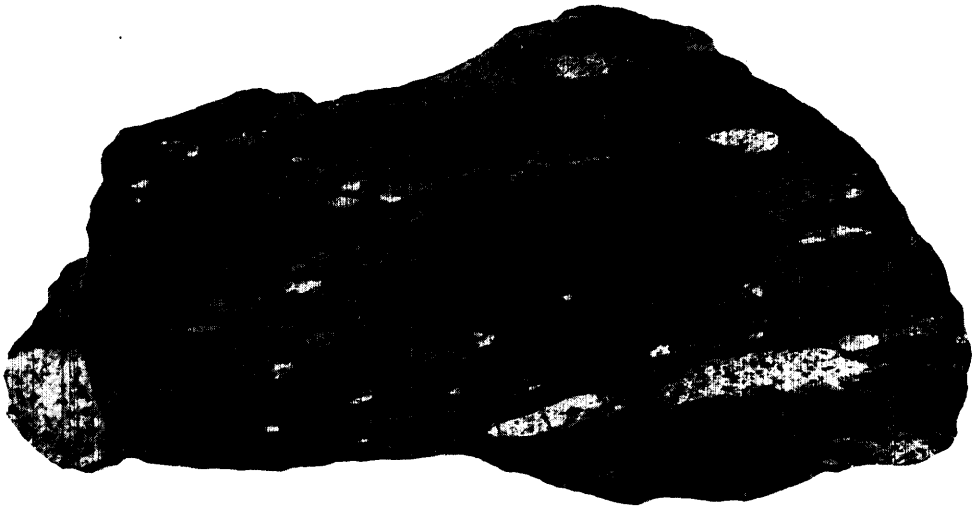
The rocks in this group constitute a schist complex, which has a wide distribution in Huffman and Osway townships and extends into Mallard township, the northeastern part of Esther township, and the southern part of Benton township. This complex is dominantly composed of greyish-green to dark-green highly altered lavas ranging in composition from acid andesite or dacite to basic andesite. Typical basalt is rare. Although these lavas are commonly massive or porphyritic types with a wide textural range, locally they have been converted into chlorite and carbonate schists by reason of their having been subjected to strong shearing in a general east-west direction. The central parts of thick lava flows usually display coarse textures, with a superficial appearance not unlike that of diorite or diabase, whereas their pillowed portions are generally fine-grained. Although slight variations occur, in general it may be said that the strike of the flows not only conforms with the strike of the belt as a whole, but shows a marked tendency toward parallelism with the Ridout series contact and with the bedding of the infolded Ridout sediments themselves. Superimposed on the flows is a regional schistosity, the strike of which is also parallel to the strike of the flows. The lavas have been tilted from a horizontal position to attitudes approaching the vertical.

The lavas in this area exhibit ellipsoidal or pillow structures, amygdaloidal cavities, scoriaceous surfaces, and brecciated or fragmental tops. These structures are particularly well developed in outcrops along the west shore of the North arm of Opeepeesway lake, where an orderly succession of flows occurs over a width of a mile or more. Cross-sections of individual flows commonly show a thick lower portion consisting of rather massive andesite, a medial pillowed andesite portion, and a top portion consisting of amygdaloidal fragmental material. As a rule the pillow structures are greatly stretched in the direction of the schistosity and exhibit small amygdaloidal cavities around their peripheries. Much of the fragmental material is of autoclastic origin, being the crust or partially consolidated flow top that has been brecciated by the further upwelling of the underlying liquid magma. Individual flows rarely exceed 100 feet in total thickness. Interbedded with the flows are narrow bands of pyroclastic materials including tuffs and agglomerates, both of which had their origin in the explosive activity accompanying vulcanism. In their material composition the pyroclastics strongly resemble the autoclastics, and this resemblance is further increased by the strong shearing to which both of these types have been subjected. In places, however, they may be distinguished by the occurrence of amygdules in the autoclastics and their total absence in the pyroclastics. The amygdules are almond-shaped cavities as much as an inch in length. Some of these are completely filled with sugary quartz or epidote; others are only partially filled with these materials. Quartz fillings are sugary, due to the granulation accompanying the shearing movements.

Considerable time was given to the study of the flows exposed on the west shore of the North arm of Opeepeesway lake in the hope that the establishment of their tops and bottoms would throw light on the structure of the whole north side of the Keewatin belt. Although a definite succession of flow tops was

recognized, it was never possible to say with any degree of certainty whether the tops faced north or south. This uncertainty was due not only to contradictory evidence and imperfection of the record at critical points, but also to the fact that flow contacts have been largely obliterated by shearing movements, as a result of which the delimitation of individual flows is made with difficulty.

A single outcrop of slightly sheared basalt agglomerate was observed on the west shore of the North arm of Opeepeesway lake a little less than a mile from its north end. It is a rather fine grained black rock containing many pale-green fragments and amygdaloidal structures. The fragments have been stretched, as a result of which the rock has a streaked appearance. They owe their distinctive colour to epidote alteration, which is seen in various stages of development. The amygdules, which are as much as half an inch in length, are lined with epidote, the remaining space in the cavity being filled with either quartz or calcite.



Polished specimen (five-sixths natural size) of agglomerate from the west shore of the North arm of Opeepeesway lake, Osway township.

Interbedded with the volcanics of this group are many narrow lenses of buff-coloured tuffaceous sediments and impure cherty quartzites, which, when unsheared, show a distinct banding indicative of their sedimentary origin. In many cases, these rocks are hard to separate from certain greyish-green schists of Group B, which they strongly resemble. Although rocks of this type are encountered everywhere throughout the volcanic belts, they were observed to be especially abundant in Mallard township, east of the Opeepeesway river, and in Osway township south and west of Opeepeesway lake.

Close to the contact with the broad granite areas, the greenstones have been strongly metamorphosed, resulting in a variety of contact rock types. This contact zone, which, as a rule, is about a quarter of a mile in width, usually shows an intensification of metamorphic effects toward the granite contact, but where granite underlies the greenstone at no great depth the same effects may be observed even far within the greenstone areas. Along the contact in Mallard township the lavas have been converted into quartz-hornblende schists, which in some places have a characteristic gneissic appearance if the quartz is an abundant constituent. In Huffman township, the lavas near the contact have

been converted into feldspathic hornblende schists and feldspathic amphibolites, the latter in many places being porphyritic. In addition to its metamorphic effects the granite itself commonly invades the adjacent schists in the form of narrow dikes and veinlets parallel to the foliation. The actual contact is seldom sharp, being marked rather by narrow bands of granite or feldspathic material and schist alternating in *lit par lit* fashion over widths usually not greater than 50 feet. Similar contact phases were likewise observed along the south contact in the townships of Arbutus, Fingal, Osway, and Esther.

Included in this group are localized bands of iron formation, the strike of which is parallel to the flows with which they are interbedded, and the dip close to the vertical. The most important of these bands is that in the southern part of Huffman township midway between Opeepeesway lake and Little Rush lake. Although outcrops are scarce, this band has been traced, with the aid of a dip needle, in a general east-west direction for a distance of 3 miles. Its continuity is broken south of Camp lake, but it appears again at about the same horizon in the extreme northeast corner of Arbutus township. The band is well exposed at the 6-chain portage on the Little Rush river, where it has a width of about 200 feet. In places, however, a dip-needle survey is reported to have indicated widths as great as 600 feet. For the most part it is a poorly banded type consisting of alternating layers of sugary or cherty quartz and limonite with a maximum thickness of 2 inches. Intercalated with these layers are narrow bands of schistose ferruginous argillite, weathered portions of which give rise to much limonitic material. Generally speaking, the magnetite content is negligible, but in places toward the west end of the band it is the source of strong magnetic attraction. Iron sulphides are not common constituents, but on Little Rush river, 8 chains southeast of the 6-chain portage, the band consists of laminated sugary quartz with irregular glassy quartz veinlets, which carry appreciable quantities of coarse pyrrhotite and cubes of pyrite as much as an eighth of an inch in diameter. This rock is magnetic.

Other outcrops of iron formation were observed in the following localities: On Ramsay creek, close to the south boundary of Osway township, a 4-foot band is exposed in a low outcrop. It consists largely of banded cherty quartz and pyrite. In Huffman township, on the portage between Little Rice and Rice lakes, a 15-foot band of cherty banded iron formation has been exposed by stripping operations. It is rusty-weathering and strongly magnetic. On the west shore of the Opeepeesway river, in the central part of Mallard township, a pyrite-carbonate type of iron formation was observed. It is a lens-shaped deposit in a quartz-sericite schist and consists largely of rusty-weathering pyrite and iron carbonate. Tiny lens-like masses of surgary quartz are present in the pyritized zones. The total width of the band, as exposed in a test-pit, is about 10 feet.

Group B

On the basis of a conspicuous lithological characteristic, namely colour, a large proportion of the Keewatin rocks in this area have been assigned to a second group called "Group B." This group is dominantly composed of the so-called "grey lavas" and their related pyroclastics. In other words, these rocks are dominantly light in colour and, as such, stand in marked contrast to the dark-coloured greenstones in Group A. They occur widely in Benton township, and extend into the townships of Esther, Mallard, and Osway. The lavas are massive, fine-grained types displaying many of the attributes of the flow rocks in Group A. They vary widely in shade from pearl-grey to greenish-grey and in many places show characteristic mottled effects. In the field they were readily

taken for rhyolite or trachyte, but subsequent microscopic and chemical determinations indicate that these rocks are fairly basic in composition, ranging from dacite, through andesite, to basalt. Although they have a much fresher appearance than the ordinary greenstones, thin sections under the microscope show that they are strongly altered. In many cases they are composed of little other than aggregates of alteration products consisting mainly of sericite and zoisite. Porphyritic varieties exhibiting small phenocrysts of white feldspar and quartz were observed in Benton township, mainly in outcrops along the Wakami river and in the northern part of the township.

In addition to the flow rocks this volcanic assemblage is characterized by the presence of large quantities of pyroclastic material, which is interbedded with the flows. As a rule the fragments are light-coloured, very fine grained, lenticular bodies having a maximum length of 6 inches and showing a definite orientation parallel to the strike of the flows.

Near the north boundary of Benton township, between mile-posts 3 and 4, a rather unusual type of lava was encountered. It is a massive, greyish-green, fine-grained type having a remarkably fresh appearance. A thin section of a specimen from an outcrop 24 chains south of the township line indicates that this rock is a basalt. Under the microscope it is seen to have a very finely crystalline groundmass of diabasic appearance and to consist of a fine felt of little laths of plagioclase feldspar (andesine), augite, epidote, chlorite, and small quantities of pyrite. An analysis of a specimen of the same type of rock from an outcrop on the township line, 20 chains east of the 3-mile post, showed a chemical composition as indicated below. Other analyses of basalt from various sources are shown for the sake of comparison.

ANALYSES OF BASALT

	No. 1	No. 2	No. 3	No. 4
	per cent.	per cent.	per cent.	per cent.
SiO_2	49.30	48.70	49.06	48.90
Al_2O_3	14.63	15.21	15.70	13.94
Fe_2O_3	2.63	4.28	5.38	5.59
FeO	9.10	8.35	6.37	8.63
CaO	11.00	11.11	8.95	9.05
MgO	6.51	3.76	6.17	6.39
Na_2O	.19	3.23	3.11	3.22
K_2O	.30	.59	1.52	1.03
TiO_2	.83	.....	1.36	1.71
P_2O_5	.14	.....	.45	.28
H_2O	3.07	.....	1.62	.73
CO_2	2.10	2.25	.....	.....
MnO	.....	.....	.31	.53
FeS_2	.34	.....	.....	.....
Total	100.14	.....	100	100
Specific gravity	3.031	.....	.....	.....

Specimen No. 1—Basalt, 20 chains east of the 3-mile post, north boundary of Benton township. Analysis by Provincial Assay Office, 1935.
Specimen No. 2—Basalt, Kirkland Lake, Ont.[1]
Specimen No. 3—Average of 198 analyses of basaltic rocks from world-wide sources.[2]
Specimen No. 4—Average of 20 analyses of basalt from Hawaii.[3]

[1]Ont. Dept. Mines, Vol. XXIX, pt. 4, 1920, p. 7.
[2]R. A. Daly, "Igneous Rocks and Their Origin," McGraw-Hill Book Co., New York, 1914, p. 27.
[3]Ibid, p. 34.

In this regard it is interesting to note that Bannerman[1] in his report on the adjacent area remarks on the fresh-looking basaltic rocks near the north boundary of Benton township as well as elsewhere in the Rush Lake area. From generalized considerations he was led to the belief that these lavas are the extrusive equivalents of the post-Algoman(?) gabbro-diorite types, and hence much younger than the Keewatin assemblage. Although there would appear to be considerable evidence in support of this interpretation, the writer, not being entirely convinced of its propriety, prefers to group these lavas with the Keewatin series, at least until such a time as a more detailed field and petrographic study establishes other affinities.

Iron formation is not abundant in the volcanics of Group B. What is widely known as the Woman River iron range crosses the north boundary of Benton township 26 chains east of the 4-mile post. At this point the range narrows to 20 feet in width, strikes N.67°W., and dips 70°N. It shows excellent banding, red jasper bands up to an inch in width alternating with narrower bands of dark cherty material. Although the range is non-magnetic at this point, other parts of the same range a short distance north in Heenan township are strongly magnetic. Another band of iron formation was encountered on the Woman river about 1¼ miles north of the 4-mile post on the south boundary of Benton township. It is exposed only at the water's edge for a width of 12 feet. It is poorly banded material striking N.60°W., dipping slightly south, and consisting mainly of grey chert and pyrite, the latter giving rise to much limonitic material.

Timiskamian

Ridout Series

The Opeepeesway Lake area is the type area of the Ridout series of sediments, which were named and first described here by Emmons and Thomson.[2] Subsequent mapping has extended this series both east and west in a belt stretching without a break from the Swayze area to the West Shiningtree and Tyrrell-Knight areas, a total distance of approximately 100 miles. This belt attains its greatest dimension in the main body of Opeepeesway lake, Osway township, where exposures may be observed over a width of 2¾ miles. In the northwest part of the same township the belt has been reduced to a width of 4 chains owing to what is believed to be localized structural derangements. It should be noted that previous maps of this area indicate the Ridout series as being much wider than is shown on the accompanying map. The writer, however, is convinced that the rocks as exposed on the North arm of Opeepeesway lake are predominantly volcanic in origin and hence may be more properly correlated with the Keewatin series.

The Ridout series is dominantly composed of conglomerate, greywacké, and arkose, but quartzite and argillite are prominent locally; one band of iron formation was observed. In no important detail do they differ from the same series as observed by the writer in other areas along the belt. Fine exposures may be observed on Huffman lake and Opeepeesway lake, as well as on the Woman and the Wakami rivers where they traverse this belt. As a result of strong shearing movements, which are believed to have accompanied their infolding, these rocks in many places have been rendered highly schistose, the direction of the schistosity being parallel to that of the original bedding planes.

[1]H. M. Bannerman, op. cit., pp. 49, 50, 65, 66.

[2]R.C. Emmons and Ellis Thomson, "Preliminary Report on Woman River and Ridout Map-Areas," Geol. Surv. Can., Mem. 157, 1929, pp. 7-15.

Although the strike of the beds varies somewhat from place to place, at any given point it shows a notable tendency to conform with the general trend of the whole belt at that point. For example, on the Wakami river and at the west end of the main body of Opeepeesway lake a strike of N.55°W. was recorded, this being the general trend of the belt between these points. On the south shore of the East arm of the same lake the beds strike approximately east-west, which is in conformity with the trend of the belt at that point. The whole series has been tilted from the horizontal to attitudes approaching the vertical. In places the folding has been so close that the dip of the beds change from north to south even in the same outcrop. A notable feature of the Ridout series is the intense alteration to which its members have been subjected, owing mainly



Exposure of boulder conglomerate of the Ridout series on a small island in Huffman lake, Huffman township.

to dynamic adjustments. Of all the various types, greywacké and arkose are especially prone to these processes, the former giving rise to chlorite-carbonate schist and the latter to kaolin-sericite-carbonate schist. In many cases the rocks are composed of little other than these alteration products, and were it not for their association these intensely altered types might readily be confused with the schists of the Keewatin series.

Infolded with the south band of the Keewatin series and parallel to the main band of the Ridout series is a subsidiary band of sedimentary rocks, which on account of their likeness to the rocks of the Ridout series are believed to be of the same age. The band has an average width of about a quarter of a mile and is discontinuous along the strike. It was observed in the northeastern part of Arbutus township and near the south boundary of Osway township, and is especially prominent in the southwestern part of Benton township. Certain outcrops of sediments in the central part of Huffman township just east of Little Rice lake suggest that another subsidiary band exists on the north side of the main band. These subsidiary bands are believed to be minor infolds on the north and south limbs of a broad synclinorium.

Prominent among the sedimentary types is conglomerate, which occurs in narrow bands both at and near the margins of the sedimentary belt and at recurring intervals within this belt. Excellent exposures were observed as follows: at Huffman lake in the eastern part of Huffman township; on the south shore of the East arm and the north shore of the main body of Opeepeesway lake; on the west boundary of Osway township just north of the 5-mile post; in the western part of Benton township where the band crosses the Wakami river; at a point where Fawn creek touches the west boundary of Benton township. The conglomerate contains a wide variety of pebbles and boulders, including granite, diorite, various types of Keewatin schist, gneiss, porphyry, banded iron formation, and quartz. Close examination will usually reveal all of these types in any given outcrop. In this connection it is interesting to note the results of a pebble count recorded by Emmons and Thomson.[1] On an outcrop of pebble conglomerate on the south shore of the East arm of Opeepeesway lake, an area of 4 square feet, gave the following count:—

	No. of pebbles
Granite	181
Schist	56
Iron formation	12
Diorite	6
Quartz	4

It will be observed that granite pebbles predominate in this particular outcrop, and for the most part this is true of the conglomerate everywhere. A notable exception is in outcrops in the northwestern part of Osway township where the pebbles of the conglomerate are almost exclusively iron formation. In places boulders as much as 2 feet in diameter were observed, but normally they are much smaller, ranging from 2 to 6 inches in diameter. The larger ones are almost invariably granitic in character. As a result of the strong shearing to which the conglomerate has been subjected the pebbles and boulders have in many places been stretched parallel to the schistosity. Granite types, especially the larger boulders, appear to have resisted this deformation rather well. In certain outcrops the schist boulders have been stretched into mere wisps, and in places the stretching and squeezing has been so intense that wisps of schist are wrapped half way round well-rounded granite boulders. The matrix of the conglomerate is predominantly greywacké, but arkose, quartzite, and argillite are prominent locally. In places where the pebbles and boulders are crowded together these materials merely fill the interstices, whereas in other places the matrix is well bedded and shows only an occasional pebble. In general this failure of pebbles is the only feature marking the passage from conglomerate to other sedimentary types, such as greywacké, arkose, and argillite.

Outcrops of greywacké conglomerate were observed on the Wakami river in Benton township, in the northwestern part of Osway township, and on the south shore of the East arm of Opeepeesway lake. Reddish arkose conglomerate is prominent along the north shore of the main body of Opeepeesway lake, and near the narrows joining the main body and the East arm of the lake. Feldspathic quartzite conglomerate occurs on the north shore of the main body of the same lake, and argillite conglomerate was observed in the same location just west of the entrance to the North arm.

Greywacké and arkose are the dominant rock types in the Ridout series. They show all gradations between the two types, the distinction between them

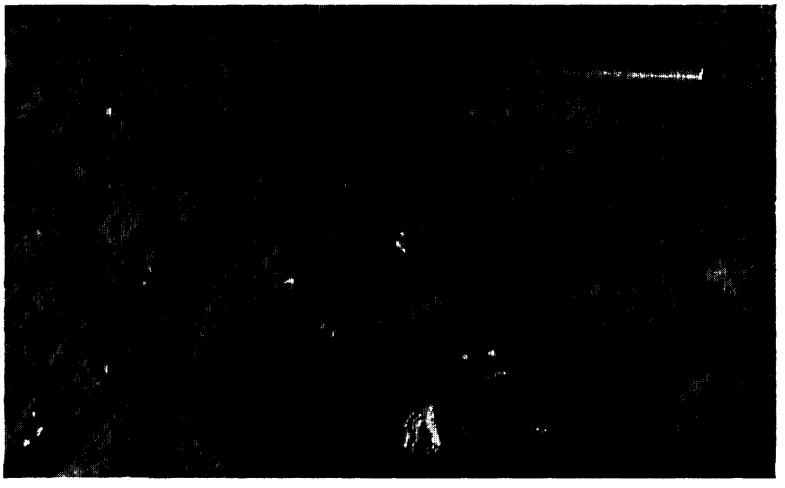
[1]Op. cit., p. 9.

being more or less an arbitrary one, based largely on colour. The light-coloured or reddish varieties are referred to arkose, thin sections of which under the microscope show many rounded to angular fragments of quartz, plaglioclase, and ortho-



Cross-bedded greywacké of the Ridout series, looking east along the strike, west shore of the Northwest arm of Opeepeesway lake, Osway township. Note the truncation of the bedding on the north side.

class in a fine-grained matrix of the same materials with the addition of sericite, chloritic hornblende, and carbonate. The dark-coloured varieties are highly altered greywackés, thin sections of which in many cases show little other than



Cross-bedding in greywacké of the Ridout series, indicating deltaic conditions of deposition, large island in the main body of Opeepeesway lake, northwest of the mouth of Ramsay creek, Osway township.

quartz and plagioclase in a felted mass of alteration products, including chlorite, epidote, carbonate, sericite, pyrite, and magnetite. In some thin sections muscovite was an abundant constituent. Hand specimens of the greywacké

commonly show much pale to deep-blue quartz in the form of tiny eyes ranging from minute particles up to blobs 2 mm. in diameter.

At the narrows between the main body and the East arm of Opeepeesway lake, and to the east and west of this point, fine outcrops of reddish arkose are exposed. This rock on account of its colour and massive appearance might readily be taken for a granitic type, but close examination will usually reveal the presence of greenstone fragments indicative of its clastic origin.

The arkose is essentially a massive rather than a bedded type, although in a few places rude bedding-planes were observed. In marked contrast is the greywacké, which, when undisturbed by shearing, shows not only the original bedding-planes remarkably well preserved, but also cross-bedded relationships, the latter being of considerable importance in structural determinations. Normal cross-bedding may be observed in outcrops of greywacké along the south shore of the East arm of Opeepeesway lake, and on a prominent point on the west shore of the Northwest arm of the same lake. In both localities truncation of the beds on the north side indicate that the tops of the beds face north. On the east side of the large island in the main body of Opeepeesway lake about three-quarters of a mile northwest of the mouth of Ramsay creek an outcrop of greywacké shows a very irregular type of cross-bedding and truncated relationships suggestive of deltaic conditions of deposition.

Locally throughout the Ridout series, greywacké members grade into narrow beds of highly crenulated, dark-green, strongly altered phyllitic schist, to which the term argillite seems especially applicable. This rock has a general appearance not unlike the chlorite-carbonate schist of the Keewatin series, with which it might readily be confused were it not for its association with sedimentary types. In places, where the argillite beds are not schistose, they are fairly well banded and have the general appearance of slaty beds. Typical slate, however, such as has been observed by the writer in the Ridout series farther east, does not occur here except in the form of narrow beds, ranging from 2 to 12 inches in width, intercalated with the other sediments.

Narrow beds of impure feldspathic varieties of reddish to greyish quartzite were noted in the eastern part of Huffman township. In most cases it was found that rocks of this nature, having the general appearance of quartzite, might be more properly referred to as arkose. In any case typical quartzite is not a prominent member of the Ridout series in this area.

Banded iron formation was observed within the sedimentary series in the western part of Benton township. It outcrops on the east shore of the Wakami river, where in low water it is exposed over a width of 150 feet. From this point it was traced eastward for about 300 feet, beyond which it is drift-covered. It strikes N.47°W. and dips 85°N. It consists of bands of red jasper with a maximum width of half an inch, alternating with bands of smoky-coloured cryptocrystalline chert of about the same width. The bands contain no magnetite; hence the rock is non-magnetic. A little pyrite occurs in places.

Age and Relationships of the Ridout Series

Early geological work in this area by Emmons and Thomson[1] led to the conclusion that the Ridout series is Keewatin in age, being underlain by an older series of Keewatin volcanics to the south, and overlain by a similar but younger series of Keewatin volcanics to the north. The writer sought in vain to obtain first-hand field evidence to substantiate this conclusion, but the only result was a strengthening of the theory that the Ridout series was deposited in the Timis-

[1]Op. cit., pp. 4, 7.

kamian period of sedimentation and that this series of sediments was subsequently infolded with the Keewatin volcanics.

If the Ridout series as a whole is considered, there would appear to be strong presumptive evidence that it should be assigned to the Timiskamian rather than to the Keewatin. In the first place the Ridout series consists almost entirely of clastic sediments, a feature that argues strongly against its being included in the Keewatin group, which is dominantly volcanic. Moreover, the Ridout series, which has been traced in a continuous belt for nearly 100 miles, is comparable in extent with similar elongated sedimentary belts in the Porcupine, Kirkland Lake–Rouyn, and Sudbury areas, all of which have been assigned to the Timiskamian period of sedimentation. Even more significant in this regard is the probability that the Ridout series belt extends far to the east, even to the point of establishing a continuity with the type area of Timiskaming rocks as exposed on Lake Timiskaming. The occurrence of many square miles of the overlying Cobalt series in the intervening area, however, precludes forever the possibility of definitely proving a stratigraphic relationship with rocks known to be of Timiskamian age. Nevertheless, it has long been the opinion of the writer that all of the sedimentary belts named above belong to one period of deposition, namely the Timiskamian, and that their infolding with the Keewatin rocks must be ascribed to one and the same period of pre-Cambrian orogeny.

In the area under consideration the Ridout series possesses certain lithological attributes that have long been regarded as typical of Timiskamian rocks, namely good banding and vertical attitudes of the beds. Although these features alone would not necessarily divorce the sediments from the Keewatin series there is the added feature of unconformable relationships between the two series. Wherever Timiskamian rocks have been studied such a relationship has been recognized, whether it be erosional, structural, or both. That an erosional unconformity exists here is indicated by the fact that conglomerate bands lying in the position of a basal conglomerate, i.e. at or close to the bottom of the sedimentary series, enclose fragments of jasper, iron formation, and schist, all of which were derived from the subjacent Keewatin series. Furthermore, this basal conglomerate, as a rule, contains many well-rounded pebbles and boulders of granite, which have been transported from some distant granite terrane, a process that probably involved a reasonably long period of time in which erosion was dominant.

The actual contact between the sediments and volcanics was seldom observed, but the limits were frequently fixed within 100 feet, this interval being marked by a drift-filled depression. The consistency of this observation makes it likely that this feature may be attributed to fault strikes along the contact rather than to accident. The soft material in this faulted zone was, no doubt, easily weathered and gouged out, the resulting depression being subsequently filled with drift. Although, as a rule, the contact is fairly sharp, especially along the south side of Opeepeesway lake, there are places along the north contact where the volcanics appear to grade upward into sedimentary materials, all within the space of a few hundred feet. Under these conditions the sediments were observed to be either greywacké or argillite types.

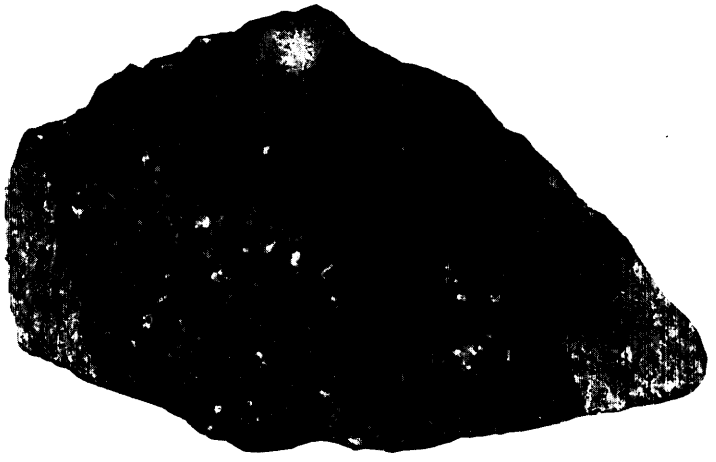
Algoman

Various types of intrusive rocks believed to be of Algoman age occur in this area. Batholithic masses border the Keewatin belts, and small stocks and dikes occur within the Keewatin and Tamiskamian areas.

Granite, Granodiorite, Gneiss

Typical granite predominates at some little distance from the Keewatin contact. In general, it is a fairly massive, medium-grained, pink to greyish hornblende-biotite variety. In many places, however, these femic constituents fail and the granite is a leucocratic type, i.e. one dominantly composed of light-coloured minerals, mainly quartz and feldspars.

Contact metamorphic effects of the intrusive granite are visible not only on the Keewatin side of the contact, as noted in a previous section, but are commonly reflected within the granite itself. This results in the development of hornblende, which is usually a prominent constituent of the granite for a quarter of a mile or more away from the actual contact. Beyond this contact zone, biotite resumes its rôle as one of the main femic constituents. Another contact effect is the development of gneissic structure, which does not usually extend more than 300 to 400 feet away from the actual contact. The foliation of the gneiss is always parallel to the contact.



Polished specimen (natural size) of mineralized Algoman(?) quartz diorite from the northern part of Mallard township.

Sharp contacts between the batholithic granite and the Keewatin greenstone are not common, but one instance was observed on the west shore of the north end of Little Rush lake. On the opposite shore, but faulted 19 chains farther south, the contact is a broad type consisting of an injected Keewatin zone and a basic hornblende granite extending 5 chains or more to the south. It would appear that in the process of faulting at this point there was considerable vertical as well as horizontal displacement and that the sharp contact on the west shore is a deep-seated type, whereas that on the east shore is a high-level type.

No areas of typical granodiorite were observed, but many of the contact types of granite noted above might be placed in this category.

Quartz Diorite, Diabase, Gabbro-Diorite

Dikes and irregularly shaped bodies of basic rocks varying in composition from quartz diorite through diabase to gabbro-diorite are common in this area, being particularly abundant in the townships of Benton and Mallard. Where intrusive relationships with the Keewatin lavas have not been established, correlation is often uncertain owing to the fact that these basic intrusives in

places strongly resemble coarse phases of the basic lavas. They may be distinguished from the latter, however, by their massive, fresh appearance and their more or less granitoid texture.

These rocks are normally dark-coloured and of medium grain, and they show a wide variation in texture and composition. In places plagioclase feldspar predominates over the ferromagnesian constituents to such an extent that the rock has more the appearance of a granodiorite. Textural changes take place abruptly, the rock being diabasic at one point and granitoid at another only a few inches away. A thin section of a fine-grained gabbro-diorite type from the northern part of Mallard township showed it to consist of hornblende, plagioclase, augite, quartz, epidote, zoisite, and an abundance of pyrite.

That these basic rocks are definitely younger than the Keewatin series is indicated by certain clear-cut intrusive relationships observed on the Opeepeesway river near the north boundary of Mallard township. Beyond this point, however, their age relationships are somewhat debatable on account of the fragmentary nature of the evidence. Had it not been for Bannerman's important observation[1] near the outlet of Sakatawi (Rush) lake, Marion township, the writer would have been inclined to assign this group of rocks to the Haileyburian period of intrusion, i.e. pre-Algoman. Bannerman observed a diorite-diabase phase of the basic intrusives definitely intruding a gneissic phase of the batholithic granite. This evidence, together with observations by the writer in the northeastern part of Mallard township where small bosses of gabbro-diorite and diabase occur far out in the areas of batholithic granite, leads to the conclusion that these basic intrusives are mainly post-batholithic granite in age. In the northern part of Mallard township, and elsewhere, the basic intrusives have themselves been intruded by narrow dikes of quartz-feldspar porphyry, to which reference is made below. If these porphyry dikes were intruded late in the Algoman period the age of the basic intrusives is more or less fixed as Algoman, being post-batholithic but pre-porphyry.

A dike of quartz diorite, somewhat older-looking and more altered than the ordinary types in this group, occurs in the southern part of Huffman township. It definitely intrudes the Keewatin, but beyond this its age relationships are unknown. If its lithological appearance is any criterion it might more properly be assigned to the Haileyburian period.

Porphyry and Lamprophyre

Dikes of quartz porphyry and feldspar porphyry ranging from 1 to 60 feet in width occur widely within the greenstone and sediments. Most of the dikes in the sediments have been intruded parallel to the bedding, and in many instances have been sheared and altered almost as much as the enclosing sediments. This feature is especially true of the dikes in the vicinity of Opeepeesway lake where porphyry is frequently hard to distinguish from arkose, especially when the intrusive contacts are not exposed. A thin section of a greyish quartz-feldspar porphyry on the trail between Opeepeesway lake and Huffman lake, Huffman township, exhibited many crushed phenocrysts of quartz, plagioclase, and orthoclase in a fine-grained matrix of the same materials with the addition of pyrite and large quantities of alteration products in the form of sericite and carbonate.

Dikes and lens-shaped bosses of greyish to reddish porphyry, with a much fresher appearance than that mentioned above, were frequently encountered in

[1]H. M. Bannerman, op. cit., p. 67.

the northern halves of Benton and Mallard townships. At the showing of the Woman River Gold Syndicate, on the Woman river, Mallard township, two ages of porphyry were recognized, namely an older carbonated and somewhat schistose quartz-feldspar porphyry and a younger quartz porphyry with prominent phenocrysts of glassy quartz with a maximum diameter of a quarter of an inch. These types were observed elsewhere in this general vicinity. What is thought to be the largest single mass of quartz-feldspar porphyry (older type) in this area is that occurring on the north side of the Woman river on both sides of the boundary between Benton and Mallard townships. Although the determination of the extent of this mass is difficult on account of the small and scattered nature of the outcrops, its limits are believed to be as indicated on the accompanying map.

A few mica lamprophyre dikes were observed, but they are not common in this area. One of the best examples occurs on the east shore of the Woman river, 3½ miles north of the 4-mile post on the south boundary of Benton township. This dike is about 10 feet wide and intrudes schistose volcanics parallel to the foliation. It is a dull-reddish granitoid rock consisting of orthoclase, flakes of biotite, interlacing networks of chloritic films, and small inclusions of the enclosing rock.

Matachewan

Diabase dikes invading all the other rocks of the pre-Cambrian assemblage are abundantly represented in this area. They trend in a general north-south direction, the deviation from which is seldom more than 45 degrees. A dike 350 feet wide was encountered in the northeastern part of Arbutus township, but this width is unusual, most of the dikes ranging in width from a few inches up to 60 feet. Both olivine and quartz varieties of diabase were recognized, but they have not been separated in mapping. The olivine type weathers to a rusty-brown colour, and in places weathering processes have gone far in bringing about the complete disintegration of the solid rock. In addition to the main constituents, namely plagioclase, pyroxene, and olivine, the olivine type carries magnetite, which in some cases is present in such quantities as to cause strong magnetic attraction. Quartz diabase is much more common than the olivine type. It weathers to a dark-green colour, has a fairly fresh appearance, and frequently exhibits a characteristic porphyritic texture with waxy-looking, yellowish-green phenocrysts, in places up to several inches in diameter. This material, known as huronite, is an aggregate of alteration products after plagioclase feldspar.

The age of these diabase dikes is open to question. But, since most of them have lithological attributes peculiar to diabase of Matachewan age as established in areas to the east, they have all been assigned to the Matachewan period of diabase intrusion. It must be admitted, however, that the olivine-bearing variety may, on lithological grounds, be assigned to the Keweenawan period, although no proof has been observed in this area.

Pleistocene and Recent

The Pleistocene deposits consist of a relatively thin mantle of unconsolidated materials, mainly sand, gravel, and sandy loam. The advancing ice-sheet in Pleistocene time gouged and polished the underlying pre-Cambrian rocks, evidence of which is seen in the glacial striae, flutings, *roche moutonnées*, and chatter marks, such as characterize the present surface of the rocks. The striae indicate that the ice moved between S.26°W. and due south. Succeeding recessions and advances of the ice front greatly modified the early topography by the dumping of vast quantities of glacio-fluvial debris, thus giving rise to a character-

istic glacial topography in the form of ground moraines, outwash and pitted plain, esker ridges, and kettle lakes.

Eskers are confined more or less to the southeastern part of the area, being particularly well developed in Osway township. They are abrupt, sinuous ridges of unsorted sand and gravel, which commonly attain an elevation of 60 feet. In many instances these ridges are so abrupt that the material on the flanks rests at the angle of repose. The crests are commonly strewn with a train of boulders, and in many places they are so narrow that there is only room for a game trail.

Deposits of the Recent consist largely of peat and lacustrine organic deposits. Locally, however, the Pleistocene drift has been reworked by the agencies of erosion, and redistributed in the form of sand beaches and river ramparts. The probability of fossil sand dunes in the northern halves of Benton and Esther townships has already been noted under the heading of "Topography."

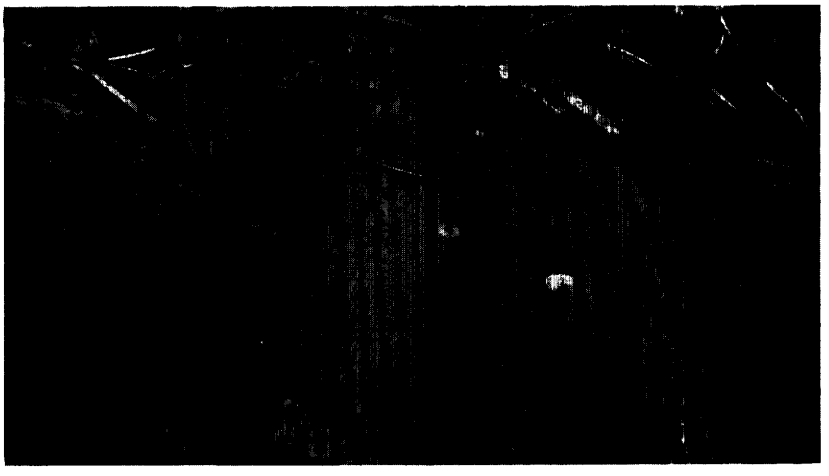
Structural Features

The consolidated rocks in this area have been subjected to intense deformation by folding, shearing, and faulting, all of which have contributed to the formation of various schists and a general complexity of structure. That negligible deformation of the volcanics took place prior to the deposition of the sedimentary series is indicated by the lack of a structural discordance between the two series. Subsequent to the deposition of the Ridout series, however, both series were closely folded into a broad synclinorium, the axis of which follows the trend of the sedimentary belt, that is northwest-southeast. The reason for this folding is not known for certain, but many have attributed it to the pressure exerted by invading masses of Algoman granite. Although the compressional forces attending this folding undoubtedly caused some shearing movements within the volcanics and sediments, there is reason to believe that much of the shearing, particularly that in the sediments, was due to subsequent east-west regional movements of an independent nature.

The area has been strongly faulted in a general north-south direction. As a rule, evidence of this faulting is found not in the topography, as is commonly the case in pre-Cambrian areas, but rather in a close study of the continuity of rock formations along the strike. This is particularly true of the sedimentary band, since a displacement of any part of it either horizontally or vertically is readily apparent. Between the northeast corner of Osway township and the Woman river, the Ridout series belt is somewhat deranged by a complicated system of faults. In Osway township the broad sedimentary belt gives place abruptly to narrow ribbon-like belts of conglomerate, which persist westward into the township of Benton, where the belt abruptly widens again. This part of the Ridout series belt is believed to be a segment that has been elevated relative to the adjacent parts of the belt and separated from them by faults; that is, the structure is a truncated horst. If this is admitted, the narrow belts of conglomerate represent all that remains of minor infolds of basal conglomerate occurring in the lowest parts of the trough of the original syncline. In most cases, the field evidence was such that the faults shown on the accompanying map have been fairly well located; in certain cases, however, the location of faults must be viewed with a liberal interpretation owing to the scarcity of outcrops. The age of this major faulting is definitely post-Algoman, since the same faults that intersect the Keewatin-Timiskamian belt extend far out into the Algoman granite areas, as exemplified in the case of the fault in Little Rush lake, Arbutus

township. Minor adjustment faults are important locally throughout the area. Strike faults undoubtedly occur at or close to the boundary between the Keewatin series and the Ridout series, and elsewhere within the belts. Their presence, however, is difficult to establish owing to the schistose nature of the rocks.

All the available evidence seems to point to the conclusion that the Keewatin-Ridout series belt has been folded into a major syncline or synclinorium. This evidence is most convincing at various places along the south side of the belt, where cross-bedded relationships and differential movements in the beds have been studied. Excellent cross-bedded greywacké was observed on the south shore of the East arm of Opeepeesway lake about three-quarters of a mile from the east end, and again on the west shore of the Northwest arm of the same lake about 1 mile from the north end. In both places the *laminae* of the cross-beds

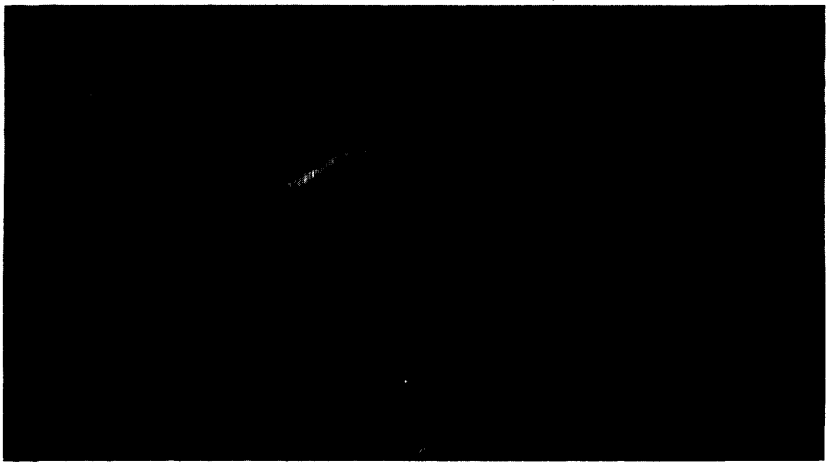


Cross-bedded greywacké, looking west along the strike, west shore of the Northwest arm of Opeepeesway lake, Osway township. The truncation of the beds on the north side and the tangential arrangement on the south side indicate that the beds face north.

are truncated abruptly on the north side, thus indicating that the tops of these beds face north. Corroborative evidence was obtained midway along the south shore of Camp lake, in the southwest corner of Huffman township, where an outcrop of Keewatin banded tuff shows excellent drag folds and related fracture cleavage, both of which indicate that the outcrop lies on the south limb of a syncline with the tops of the beds facing north. Here and elsewhere along the south side of the belt the beds dip at high angles to the south, so that they must necessarily be slightly overturned. Unfortunately the north side of the belt provides little in the way of tangible evidence one way or the other, as far as structure is concerned. In two places on the west shore of the North arm of Opeepeesway lake, near the narrows to the main body of the lake, cross-bedding and fracture cleavage in slaty tuffs seem to indicate that the tops of the beds face south; but on the whole the structures are poor and are not considered as conclusive evidence. It was hoped that the identification of tops and bottoms of individual flows along the west shore of the North arm of Opeepeesway lake would give a clue toward solving the structure, but close examination revealed little from this source. The main difficulty arises from the impossibility of definitely establishing flow contacts on account of the highly schistose nature

of the rocks. Toward the extreme north end of the North arm of Opeepeesway lake the lavas show excellent pillow structure, and in places their disposition indicates that the flows face south. In addition to the above lines of evidence is the occurrence of fairly thick conglomerate members in the position of a basal conglomerate at both the north and south contact of the Ridout series. This circumstance, together with the evidence that the tops of the beds face north along the southern side of the belt, argues strongly that the major structure is a syncline.

The Ridout series syncline is not a simple fold but is characterized by numerous close minor or secondary folds on the flanks and in the trough of the major structure. Evidence of this is shown not only by the occurrence of conglomerate members far within the main belt of sediments, but by the location of



Sigmoidal drag fold in bedded greywacké, looking east, small island in Opeepeesway lake one mile north of the mouth of Ramsay creek, Osway township. The hammer rests on the synclinal part of the fold, the anticlinal part being to the upper right; the pitch is 45°E.

subsidiary sedimentary belts on either side of the main belt. The latter are believed to be abnormally deep secondary synclinal remnants related to the flanks of the major structure, but subsequently separated from it by erosion.

The pitch of the minor drag folds along the south side of the sedimentary belt indicates that the pitch of the whole structure is steeply east. On a small island in the main body of Opeepeesway lake, about 1 mile north of the mouth of Ramsay creek, beds of greywacké have been thrown into sigmoidal folds with a remarkable degree of symmetry. In one case the axis of the fold strikes N.74°W. and the pitch of both the anticlinal and synclinal portions is 45°E. If this pitch, which may be regarded as steep, is representative of the whole structure, then cross-folds are to be expected. That cross-folding did take place, even to the point of breaking, is suggested by the uplifted segment of the Ridout series to which reference has been made above.

In that portion of the Rush Lake area adjacent to the townships of Benton and Mallard, Bannerman[1] found evidence of a synclinal structure plunging east-southeast. If there is such a structure, then the structure of the Keewatin area in the northern part of Benton and Mallard townships is obviously anticlinal.

[1]Op. cit., pp. 59, 60.

ECONOMIC GEOLOGY

Economic interest in this area dates back to the beginning of the century, when the bands of iron formation in the townships of Huffman and Osway were investigated as a possible source of iron ore. In later years the area has been prospected intermittently for gold, but beyond the sinking of a few test pits little serious development has been undertaken. In the summer of 1933, however, the discovery of gold-bearing schist in the central part of Mallard township led to a mild rush of prospectors to this area, as a result of which more than 100 claims were staked. As yet no deposits of economic importance have been disclosed, and during the writer's sojourn in the field prospecting and development operations were at a standstill.

Iron

In 1907, C. K. Leith investigated the band of iron formation in the southern part of Huffman township for private interests. In addition to making a dip-needle survey of the whole band, a considerable amount of stripping and test-pitting was done, mainly on the portage where the band crosses the Little Rush river. On this portage one old shaft, now filled with water, was sunk to a depth of about 20 feet. Further work was done on a similar band in the southern part of Osway township. In both cases the iron formation was found to be lean, its iron content being much too low for economic purposes.

Gold

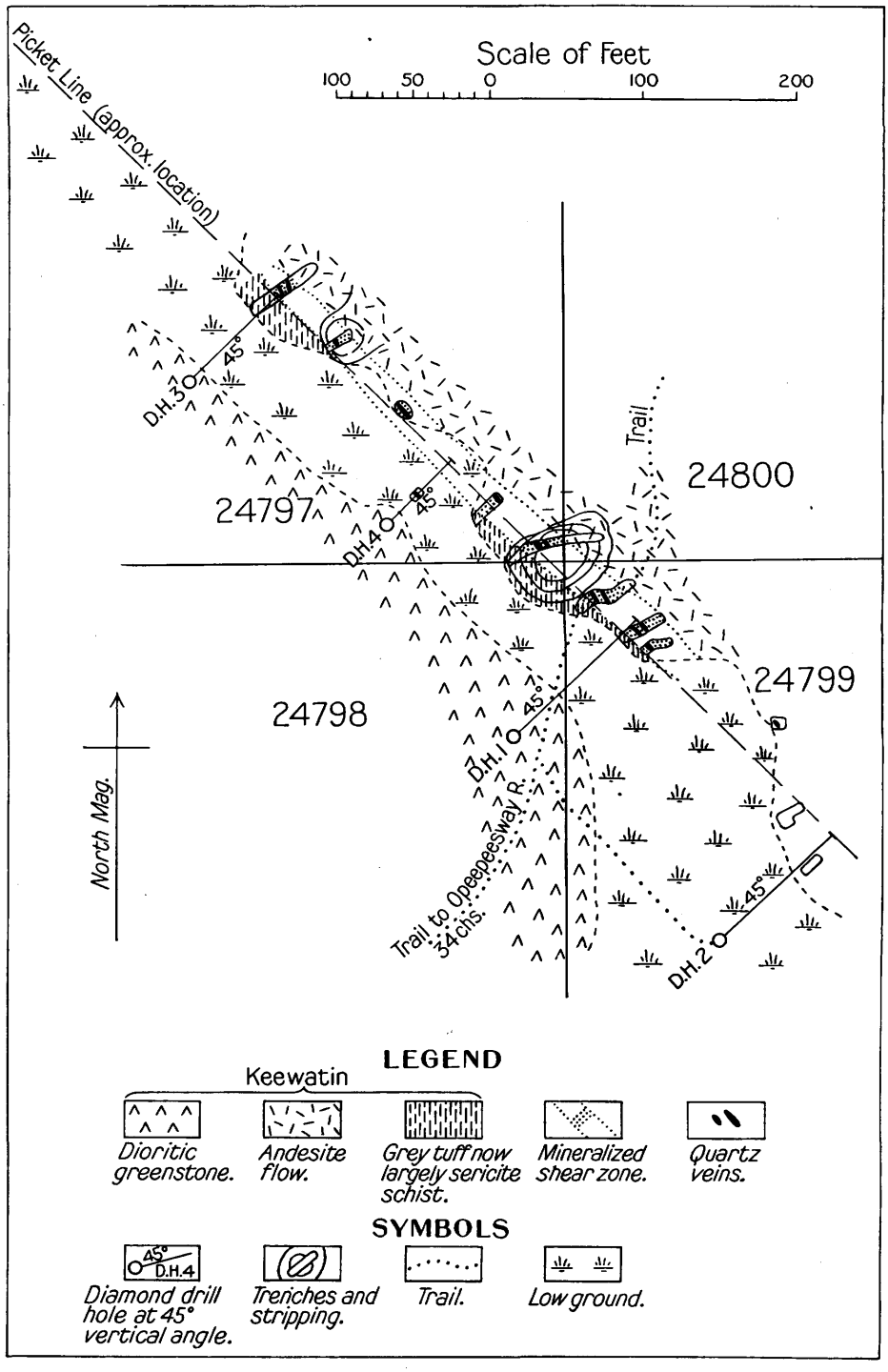
Nothern Aerial Canada Golds, Limited

In 1928, this company, which at that time was known as the Northern Aerial Minerals Exploration, Limited, held a group of 8 claims in the northeast corner of Esther township, on which a discovery of gold had been made. The showings may be reached most conveniently from the extreme north end of the Northwest arm of Opeepeesway lake by an excellent trail about 170 chains in length. They are located on a low bluff on the east side of a small creek. The main showing occurs in a rusty-weathering, heavily carbonated zone in schistose quartz diorite. This zone trends in an east-west direction and has a width of about 40 feet, as exposed in several north-south trenches. In one of these trenches a 10-foot test pit was sunk on an irregular quartz lens, which strikes N.10°W. and dips 45°W. The lens has a maximum width of about 3 feet at the test pit but tapers out rapidly on either side, the total length being probably less than 30 feet. The quartz is coarse and glassy and is heavily mineralized with pyrite and arsenopyrite. A grab sample with massive arsenopyrite yielded 0.63 ounces gold and 3.46 ounces silver per ton. About 100 feet south of the main showing a trench and test pit exposes another heavily carbonated shear zone, but no quartz veins were observed. No further work has been done either at the main showing or elsewhere on the group.

This group of claims, which was allowed to lapse in 1933, is now held by George Tough and Frank L. Johnson, who contemplate further surface exploration.

Ferland-Gauldie-Mogridge Claims

Recent interest in Mallard township has been centred about a gold discovery made by W. McLeod in July, 1933. It was this discovery that precipitated the rush to Mallard township in the fall of the same year. The discovery lies at the southeast corner of claim S.24,797, being centrally located in a group of 18 claims



Sketch map showing the location of the main shear zone, trenches, diamond-drill holes, and general geology in the vicinity of the main showing, Ferland-Gauldie-Mogridge property, Mallard township.

in the central part of Mallard township, just east of the Opeepeesway river. These claims were staked and, until a short time ago, held jointly by J. H. Gauldie, L. Mogridge, W. Mogridge, and E. Ferland.

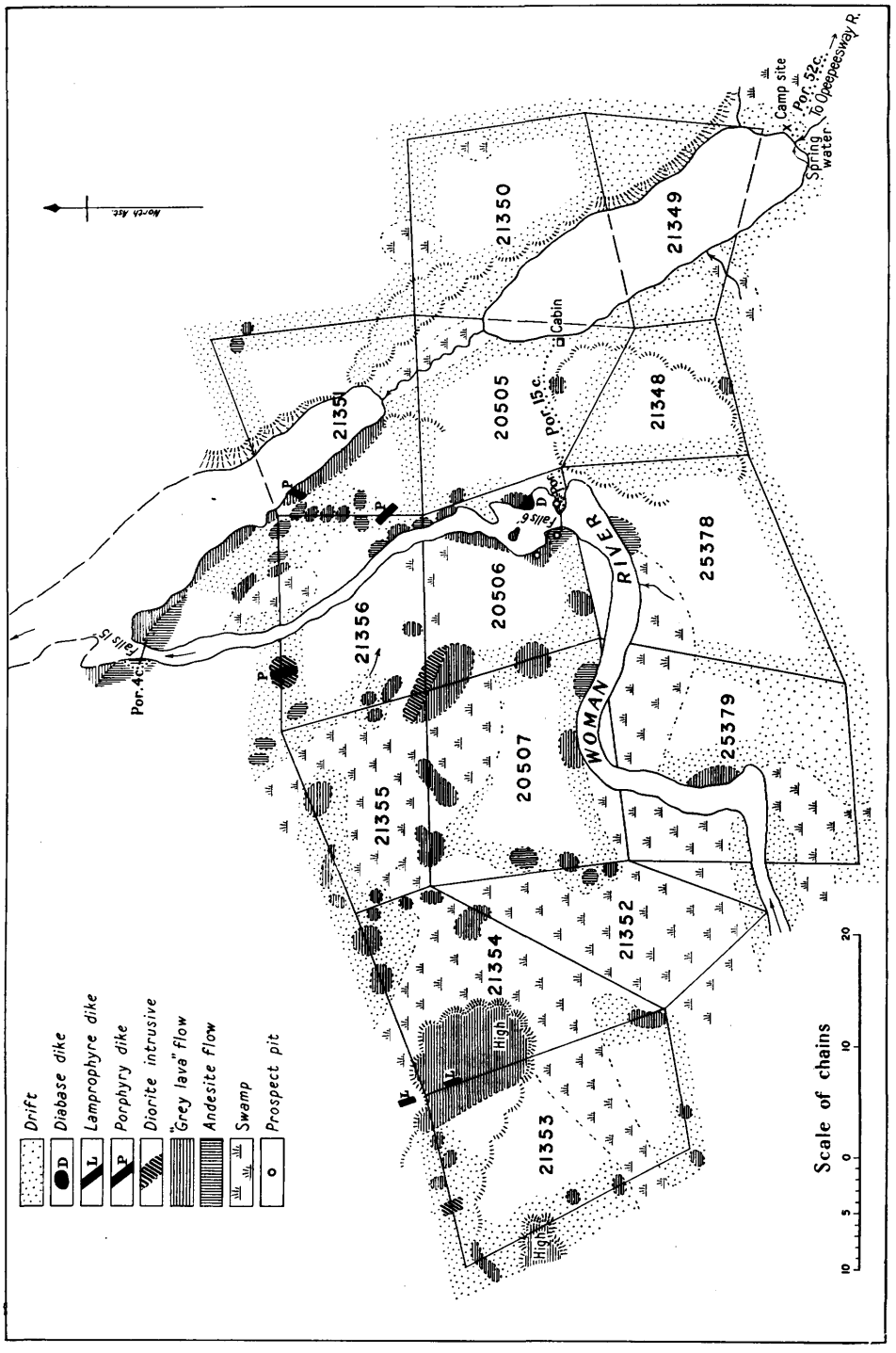
The main showing is reached by a trail, 34 chains in length, leading east from a point a few chains south of the 25-chain portage on the Opeepeesway river. It consists of a rusty-weathering shear zone lying between andesite flow rocks on the north and a narrow band of light-coloured bedded tuff on the south. Stripping and cross-trenching have exposed this zone for a length of about 450 feet and a width ranging from 15 to 30 feet. It strikes N.45°W. and dips 63°S.W., according to the logs obtained from diamond-drill holes. The schist is silicified and carbonated and contains an abundance of fine sulphides, including pyrite and a little chalcopyrite, over practically the whole width. In places, however, there is a notable concentration of these sulphides, especially pyrite. A few irregular lenses of quartz as much as 4 inches in width are scattered throughout the schist, but for the most part vein quartz occurs in negligible quantities. No visible gold was seen, but some is reported to have been obtained by panning in some of the pits.

In September, 1933, the N. A. Timmins Corporation took an option on the group and proceeded to diamond-drill the main showing. In all, 4 holes were drilled with a total footage of 502 feet. The best results were obtained in No. 1 location, where one 10-foot section yielded an average of 0.11 ounces in gold per ton. Selected grab samples of well-mineralized schist from the surface yielded from 0.01 to 0.11 ounces gold per ton, and from 1.45 to 4.85 ounces silver per ton. The option was dropped, and no further work was done on the property in 1934.

Woman River Gold Mines, Limited

The Woman River Gold Mines, Limited, formerly the Woman River Gold Syndicate, holds a group of 14 surveyed (1933) claims in the northwestern part of Mallard township. The group was staked in May, 1931, as a result of the discovery of gold values in a rusty shear zone at the upper falls on the Woman river. The main showing occurs in the southeast corner of claim S.20,506 on the east side of the falls. It consists of a carbonated chlorite-sericite shear zone in pillowed "grey lava" (andesite), with which are associated narrow stringers and lenses of quartz and small intrusive masses of porphyry. Two ages of porphyry were recognized, namely an older carbonated quartz-feldspar porphyry and a younger quartz porphyry, the latter being characterized by large phenocrysts of glassy quartz. Adjacent to the shear zone on the north is a 15-foot band of a rather unusual type of dark-green schistose rock characterized by numerous tiny quartz eyes and light-brown flecks of a material which, under the microscope, was seen to be leucoxene, the alteration product of ilmenite. Other minerals in a thin section of this rock were quartz, orthoclase, chlorite, carbonate, sericite, and ilmenite. This band is probably a highly altered dacite flow.

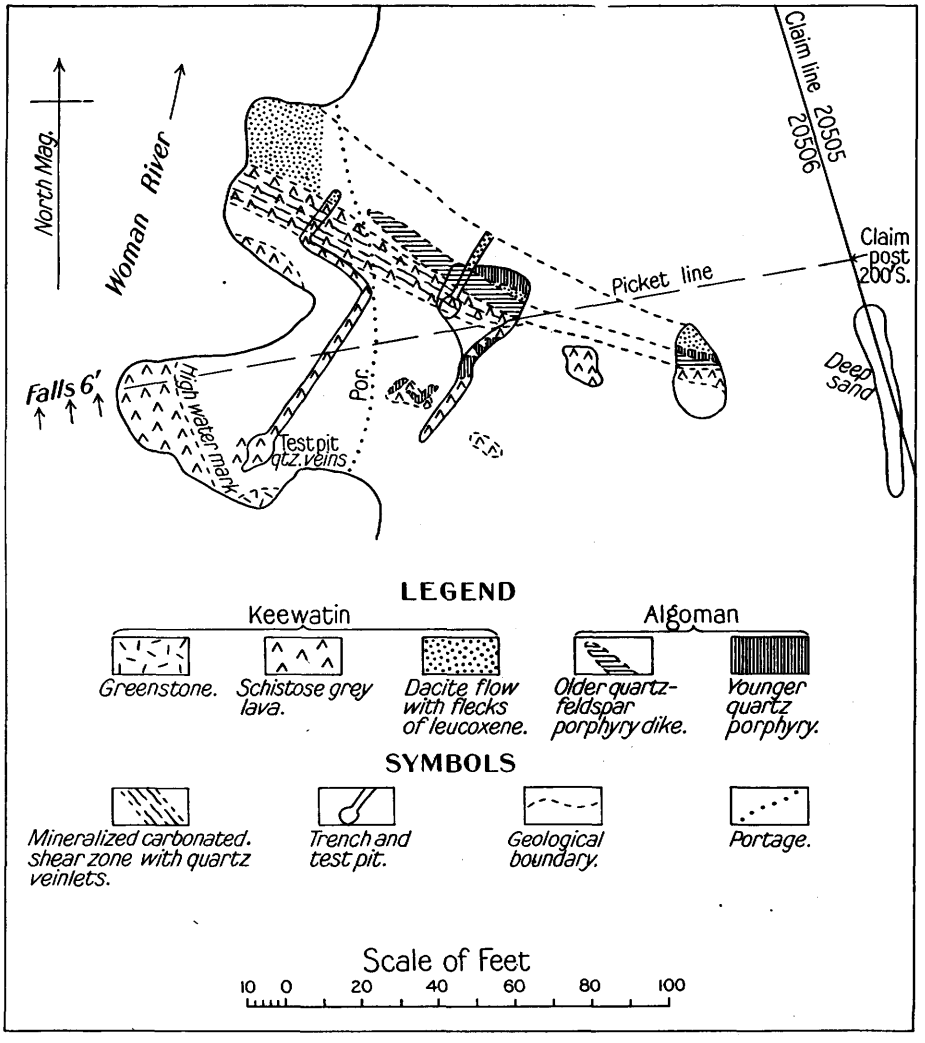
A series of test pits and shallow trenches exposes the shear zone for a length of 140 feet and an average width of 10 feet. It strikes N.68°W. and has a vertical dip. The schist contains numerous tiny stringers of carbonate, which both follow and traverse the planes of foliation. In places quartz vein material up to 3 feet in width occurs, but as a rule it is rather indistinct owing to the intense silicification of the enclosing schist. The quartz is grey to milky-white in colour and carries minute quantities of pyrite, which occurs mainly in fractures and slip planes along with sericite, chlorite, and rock film. In a pit close to the water's edge the schist seems to consist of 50 per cent. quartz and carbonate and contains



Geological sketch map of the claims of the Woman River Gold Mines, Limited, Mallard township.

small quantities of sulphides, mainly pyrite and chalcopyrite. Channel samples of this material are reported to have yielded low gold values.

What is thought to be the westward continuation of the main carbonated shear zone has been uncovered approximately 400 feet west on the west shore of the river. A 10-foot test pit exposes highly sheared olive to pale greyish-green carbonated "grey lava," striking N.55°W. and dipping 85°N. Cutting across



Sketch map showing the general geology and surface development at the main showing of the Woman River Gold Mines, Limited, at the upper falls on the Woman river, Mallard township.

the strike is a lenticular dike of shattered, slightly carbonated quartz-feldspar porphyry similar to that seen at the main showing. Between this point and the falls the rapid alternation of "grey lava" with typical andesitic greenstone seems to indicate an intercalation of these flow types.

About 50 feet south of the main shear zone and quite close to the brink of the waterfall, a 4-foot test pit exposes two irregularly shaped quartz lenses, one

of which attains a width of 3 feet. The quartz is white, sugary, and in part an amethystine variety carrying moderate quantities of pyrite and a little chalcopyrite. Carbonate is abundant, and tourmaline occurs sparingly in some parts of the vein matter. A selected grab sample from this pit yielded 0.19 ounces in gold per ton.

Late in 1934, surface exploration of this group was resumed under the direction of Peter B. Morris. At the time of the writer's visit interesting mineralization was being encountered in a prospect pit on the west side of the falls. Low gold values are said to have been obtained here. According to officials of the company further surface exploration is contemplated.

Hermiston-Hammerstrom Claims

In 1933, P. A. Hermiston and Wm. Hammerstrom discovered a mineralized shear zone on their group of claims in Mallard township, adjoining the Ferland-Gauldie-Mogridge group on the west and about half a mile west of the main showing on the latter group. H. C. Rickaby[1] describes the showing as follows:—

> Near the east side of claim S.24,851 a mineralized zone is exposed in two trenches 80 feet apart. The strike of the schist is S.45°E. The mineralization occurs over a width of 15 feet, with lenses of quartz and a considerable amount of pyrite. In the southeast trench a dike of felsite 10 feet wide cuts the greenstone parallel to the schistosity. Two grab samples of the pyritized schist from this find assayed 0.21 and 0.28 ounces per ton in gold.

No further work was done on these claims during the field season of 1934.

Maltby Claims

In 1933, interesting mineralization was discovered in Mallard township about 1¼ miles southeast of the Ferland-Gauldie-Mogridge showing. The discovery is reached by a trail, about 100 chains in length, leading east from a point on the Opeepeesway river, 28 chains south of the 25-chain portage. The showing, which occurs near the middle of claim S.25,069, consists of a narrow quartz vein, ranging from a mere stringer to a vein 15 inches in width, cutting highly schistose tuffaceous greenstone. The vein strikes N.37°W. and dips slightly south, whereas the schist strikes N.60°W. and dips 72°S. Although the outcrop has been stripped for 150 feet along the strike, with deep cross-trenches and test pits at either end, the vein itself has only been traced for about 25 feet. The quartz has a rather glassy appearance and is sparsely mineralized with pyrite, chalcopyrite, ankerite, and a little tourmaline. A selected grab sample yielded negligible gold values and a trace of silver. On the whole the showing did not look impressive.

Jessop-O'Neill Claims

Early in 1933, J. Jessop and C. E. O'Neill staked a group of 16 claims in the western part of Huffman township, on which several showings have been uncovered. The main showing, located in the extreme northeast corner of claim S.23,961, is reached by a trail leading from the camp at the Opeepeesway Lake narrows, a distance of about 21 chains. It consists of a sort of stockwork of narrow mineralized quartz stringers in a much fractured reddish arkose. The mineralization consists of pyrite, chalcopyrite, malachite, specularite, and reddish calcite, none of which occur abundantly. No gold values were obtained here. A trail striking east, then north, leads to another showing toward the north end of the group, where specimens of a galena-chalcopyrite type of mineralization were obtained. In the northeast part of claim S.23,964 stripping operations

[1]Ont. Dept. Mines, Vol. XLIII, pt. 3, 1934, p. 36.

have exposed several 2-inch quartz stringers in a carbonated arkose. The quartz carries a little chalcopyrite and tourmaline.

Carter Claims

Early in 1933, P. C. Carter staked a group of 9 claims tied to the south boundary of Garnet township at the 3-mile post. The claims may be reached either from Sultan via an old lumber road and a trail following the west and north boundary lines of Fawn township, or by traversing south from Garnet lake in the central part of Garnet township.

The main showing occurs on the west side of a narrow 3-chain rapids on Fawn creek, near the north line of claim S.24,364, less than a quarter of a mile north of the township line. It consists of a strongly magnetic band of Keewatin iron formation, which has been injected by glassy white quartz veins over a width of 18 feet. For 6 feet next to the creek, the rock is practically all quartz, the remaining 12 feet consisting of numerous quartz stringers parallel to the banding of the iron formation. The band strikes N.30°W. and dips as much as 70°S.W. Magnetite bands ranging from paper-thin up to 2 inches in width alternate with fine-grained, pale-green chloritic material. The mineralization, which consists mainly of cubes and splashes of pyrite, is confined largely to the magnetite bands, the main quartz vein being practically barren of mineral. In places, however, the quartz has been brecciated and contains inclusions of country rock; it shows a little pyrite, chalcopyrite, and calcite with vuggy quartz. The main quartz vein, which is exposed for 50 feet in length on the west side of the rapids, is picked up again on the east side, where it has been exposed for a length of 60 feet and a width of 4 feet. This portion of the vein carries a little pyrite and iron carbonate. The quartz veins are probably genetically related to a small boss of syenite, outcrops of which were seen on the west side of Fawn creek between the showing and the township line. Other narrow quartz veins occur in outcrops of diorite on the township line just east of Fawn creek and also in the northeast corner of claim S.24,362, but no important mineralization has been disclosed.

Selected grab samples from the main showing yielded no gold values but traces of silver. On the whole the showing is not impressive, and no further work was done on the property in 1934.

Economic Possibilities of the Area

Although no gold deposits of economic value have thus far been disclosed, the writer does not believe that the limited amount of prospecting that has taken place in parts of the area has by any means exhausted the possibilities of finding a deposit of commercial importance. This conclusion is based not only on the general geological relationships but on the occurrence of significant mineralization in different parts of the area.

Geological experience in the great gold belts of Ontario and Quebec has shown that elongated belts of structurally disturbed Keewatin greenstones with infolded Timiskamian sediments and Algoman intrusives are the most favourable areas in which to search for gold deposits. In general, the Opeepeesway Lake area possesses these geological conditions. The apparent lack of small masses of porphyry of the type usually observed in close relationship with gold-bearing quartz veins should not be taken too seriously by those who may look at the accompanying map from the viewpoint of prospecting in this area. Not that porphyry intrusives are unimportant, but there is reason to believe that porphyry masses underlie the greenstones and sediments at probably no very great depth.

This assumption is based on the occurrence of many porphyry dikes and the strong alteration of country rocks in many parts of the area. What may prove to be as important as, or even more than the probable presence of underlying porphyry is the widespread occurrence of intrusive masses of mineralized quartz diorite, especially in the western part of the area. If the quartz diorite is the basic counterpart of the porphyry, as seems quite probable, then there seems no good reason why it should not be regarded in the same light as the porphyry as far as any genetic relationship with gold-bearing quartz veins is concerned. The validity of this reasoning remains to be proved by prospecting in and close to these bodies of quartz diorite.

In addition to the geological considerations there are certain physical factors that make this area attractive to the prospector. Excellent water routes make any part of it readily accessible by canoe with a minimum of portaging. Outcrops are abundant, and in few places is the drift thick enough to make surface exploration tedious or expensive. The forest is largely of second growth; and underbrush and brulé areas, both of which frequently make traversing in the bush not only difficult but dangerous, are practically absent.

Horwood Lake Area

By H. C. Laird

INTRODUCTION

While engaged in mapping the Opeepeesway Lake area in the summer of 1934, the writer was instructed to visit Horwood lake, where gold discoveries have recently been made. This lake lies in an area consisting of 144 square miles of unsurveyed territory 12 miles north of the Opeepeesway Lake area and about 14 miles southeast of Foleyet, a divisional point on the Canadian National railway approximately 150 miles northwest of Sudbury. It is readily accessible from either Groundhog River crossing or Tionaga on the C.N.R. From the south excellent canoe routes lead into the area via the Swayze, Woman, and Rush rivers.

The area was visited early in July and again in September. Although only a few days were available for the geological examination, sufficient information was gathered from which to construct the accompanying map, which shows the general geology, the location of the main showings, and the approximate position of the main groups of claims on which work was done during the past season. The general geology, as indicated on this map, is based largely on information gathered by H. M. Bannerman in 1928 and incorporated in the Rush Lake sheet.[1]

Previous Work

The earliest record of geological investigation in this area is that by W. A. Parks, who traversed Horwood lake on his way to Flying Post[2] in 1899. It is of interest to note that along with his oft-quoted prediction of the Porcupine gold camp is the statement[3] that "the south arm of Matagaming lake and the river above [Rush river] shows traces of gold, and a prospect might prove successful in that region." In this connection it should be pointed out that in later years the name Matagaming[4] lake was changed to Horwood lake in order to conform with the rulings of the Geographic Board of Canada.

A report[5] and geological map[6] by T. L. Tanton, published in 1916, includes the Horwood Lake section. In 1923, H. M. Bannerman made a geological survey of this section for his report on and map of the Rush Lake area.[7] For an excellent account of the main physiographic features and natural resources of this area the reader is referred to Bannerman's report. Other references to the Horwood Lake area may be found in the publications listed below.

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W. A. PARKS, "Niven's Base Line, 1899," Ont. Bur. Mines, Vol. IX, 1900, pp. 132, 141, 142.
W. G. MILLER, "Mines of Northwestern Ontario," Ont. Bur. Mines, Vol. XII, 1903, p. 106.
T. W. GIBSON, "Statistical Review," Ont. Bur. Mines, Vol. XIX, pt. 1, 1910, p. 10.

[1]Map No. 290A, Geol. Surv. Can., 1933.

[2]An important trading post, in the early days of the Hudson's Bay Company, at Groundhog lake on the main travelled route between Biscotasing on the C.N.R. and Moose Factory.

[3]W. A. Parks, "Niven's Base Line, 1899," Ont. Bur. Mines, Vol IX, 1900, p. 141.

[4]An Indian word meaning "Branch in the Lake."

[5]Geol. Surv. Can., Sum. Rept., 1916, p. 181.

[6]Geol. Surv. Can., Pub. No. 1697, 1916.

[7]H. M. Bannerman, "Rush Lake Area," Geol. Surv. Can., Sum. Rept., pt. D, 1933, pp. 38-82.

T. L. TANTON, "Reconnaissance along Canadian Northern Railway between Gogama and Oba, Sudbury and Algoma Districts, Ontario," Geol. Surv. Can., Sum. Rept., 1916, p. 181. Preliminary map of the "Explored Routes in a Belt Traversed by the Canadian Northern Ontario Railway between Gogama and Missonga," Geol. Surv. Can., Pub. No. 1697, 1916.
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"Rush Lake Area, Sudbury District, Ontario," Geol. Surv. Can., Sum. Rept., pt. D, 1933, pp. 38-82.
"Rush Lake Sheet," Geol. Surv. Can., map No. 290A, 1933.
G. D. FURSE, "Geology of the Swayze Area," Ont. Dept. Mines, Vol. XLI, pt. 3, 1932, pp. 36-39, 43.

GENERAL GEOLOGY

Keewatin

The oldest rocks in this area are Keewatin in age and consist largely of a varied assemblage of volcanic types dominantly andesitic in composition. Rocks of this type occur in the vicinity of all the main showings and are known to be of widespread occurrence. In places they are strongly sheared, but for the most part they are rather massive types retaining their original flow characteristics, such as pillow, amygdaloidal, and vesicular structures. In this respect they stand in marked contrast to the strongly sheared Keewatin rocks in townships lying to the south and in the Opeepeesway Lake area. Acid volcanic types do not seem to be abundantly represented, the only example observed being a rhyolite fragmental on the east shore of Horwood lake, half a mile north of the north boundary of Dale township.

In places localized bands of tuffaceous sediments are interbedded with the flows. Bannerman[1] identified an extensive band of this material occurring on either side of the Northeast arm of Horwood lake. He describes outcrops on the south shore as "well-bedded quartz-actinolite and hornblende schists," and on the north shore as "micaceous and chloritic quartzites, chloritic and sericitic tuffs, and some fairly coarse agglomerate." What may be a part of the same band was also noted by him north of the 24-chain portage on the Swayze river. It has been suggested that this band is the continuation of the Swayze series of sediments lying to the southwest. Having seen both in the field, however, the writer cannot concur in this suggestion, but rather deems it more probable that the Horwood Lake series is a local development within the Keewatin volcanics.

Algoman

The volcanic series has been invaded by various types of acid and basic rocks, believed to be Algoman in age.

Widespread areas of batholithic biotite granite and granodiorite occur west of the Swayze river and east of Great Pike lake. In the northwestern part of Dale township is a stock of granitic rock showing marked differentiation, being a gneissic diorite at the margins and reddish and porphyritic toward the centre. This body has an area 2 by 2¾ miles and is well exposed in almost vertical cliffs along the shores of Horwood lake. A somewhat detailed petrographic study of this stock by Bannerman[2] establishes it as mainly a syenodiorite. Furthermore, a close field study of the distribution of acidic and mafic material led Bannerman to the conclusion that this stock plunged to the north or northeast. From an economic viewpoint some importance may be attached to this observation in that there may be a genetic relationship with the acid porphyry dikes and gold-

[1]H. M. Bannerman, op. cit., p. 50.
[2]Ibid, pp. 63, 64.

bearing quartz veins occurring in great profusion in the area between the Swayze river and Great Pike lake. If this is true it would seem probable that all three granitic masses noted above unite at no great depth.

Dikes of granite and porphyry are abundant within the confines of the accompanying map-sheet, but only the few that were observed in close association with the main showings have been indicated. They range in width from a few inches to 75 feet or more and have a general east to northeast trend. They have a wide range in composition and general appearance, and consist largely of greyish gneissic granite, granite porphyry, waxy green quartz porphyry and grey to reddish feldspar porphyry. Feldspar porphyry dikes are especially abundant on the Landry-Taylor group of claims lying between the Swayze river and Horwood lake.

In addition to the acid intrusives, the volcanic series has been invaded by dikes, sills, and bosses of basic gabbroid rocks varying in composition from quartz diorite, through diorite, to gabbro or diabase. They are dark-green, coarse- to fine-grained massive rocks with a fairly fresh appearance, although thin sections show that they are strongly altered. In every respect they are similar to the Algoman basic intrusives in the Opeepeesway Lake area and elsewhere in the Rush Lake area, and are believed to be of the same age, i.e. post-batholithic granite but pre-porphyry.

Matachewan and Keweenawan

Diabase dikes ranging from a few inches up to 60 feet in width are common. They trend in a general north-south direction and are in many instances traceable for a mile or more. One of the largest and most persistent of these dikes is an olivine type which cuts across Horwood peninsula in a general northeast direction. In places it is nearly 600 feet in width. What is believed to be the same dike has been observed at intervals between the Swayze river and the main body of Horwood lake. This dike is probably Keweenawan in age, whereas the smaller north-south-trending porphyritic types are Matachewan in age.

Pleistocene

Unconsolidated sand and gravel deposits of glacial origin cover much of the area, but outcrops are nevertheless plentiful. At some of the showings trenching operations have necessarily been abandoned on account of the deep drift.

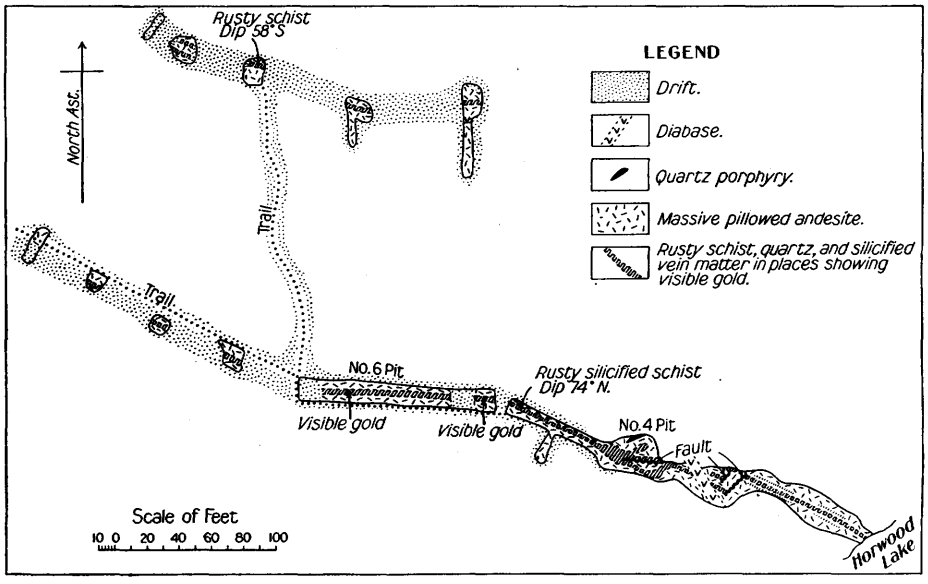
ECONOMIC GEOLOGY

The occurrence of gold-bearing quartz veins in this area was known as early as 1909. Since that time certain sections have been staked and restaked, but no intensive prospecting seems to have been done until very recently. A small staking rush took place in 1918, as a result of which the Jessop discovery was made on the east shore of the main body of Horwood lake. Some years later the Nipissing Mining Company, Limited, had an option on this property, which at that time was known as the Jessop-Seery group. While engaged in testing the main showing on the shore of Horwood lake, the operators were interrupted by the action of the Spruce Falls Pulp and Paper Company, who, seeking a greater reservoir of water, constructed a dam on the Groundhog river. As a result the water level was raised several feet, and the Jessop showing was flooded.

Later in the fall of 1933, prospectors working northeast from Swayze found visible gold just east of the 24-chain portage on the Swayze river. This was

the signal for another small rush, which resulted in the staking of more than 300 claims centred largely about the junction of the South and Northeast arms of Horwood lake. Visible gold has been disclosed on four different groups of claims, in some cases in spectacular quantities. Operations to date have been confined largely to surface exploration.

The geological conditions in this area are such as to warrant a further intensive search for gold-bearing quartz veins. It is essentially an area of Keewatin greenstones, into which have been intruded many dikes and sills of quartz diorite, quartz porphyry, and feldspar porphyry. The geological structure is not known and would be difficult to determine owing to the apparent absence of any extensive area of sedimentary rocks.



Plan of surface workings showing the geology and mineralized zones of the G. A. Thorne property, Horwood lake.

Description of Properties

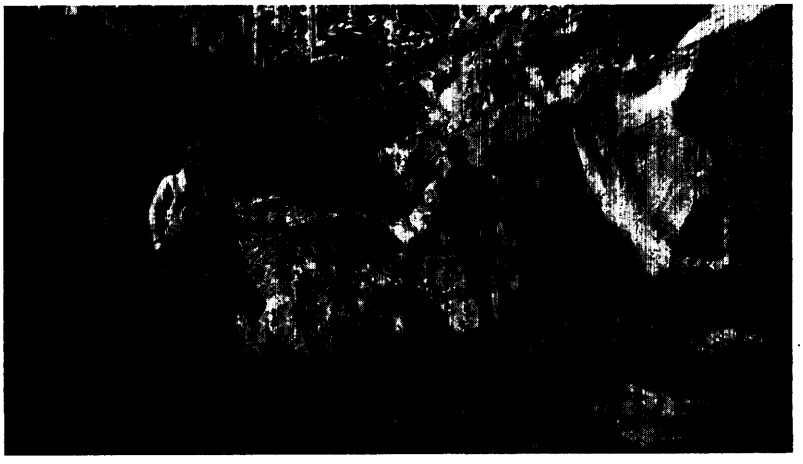
G. A. Thorne

The Thorne interests hold two groups of claims, the Swayze River group (12 claims) and the Horwood Peninsula group (10 claims). The former is located east of the 24-chain portage on the Swayze river and directly north of the 3-mile post on the north boundary of Newton township. Five men were engaged in surface development when the property was visited in July. The country rock is mainly greenstone, which has been extensively intruded by feldspar porphyry dikes and bosses of quartz diorite. In all, 14 different quartz leads have been uncovered, 6 of which show visible gold.

The main showing occurs on the east slope of a prominent north-south ridge on claim S.24,974. In two of the test pits here, visible gold occurs in spectacular quantities. The greenstone has been thrown into well-defined folds, probably as the result of the pressure exerted by the intruding diorite masses, and a bedded appearance has developed. Narrow quartz stringers carrying visible gold and some pyrite follow the bedding-planes but occur mainly on the

flanks of the folds. It follows that the veins dip at low angles to the north and to the south and that they are erratic in their occurrence.

Late in July the crew was withdrawn from the Swayze River property, and all effort was being concentrated on the Horwood Peninsula group when the property was visited in September. The main showing on this group occurs at the northwest corner of claim S.25,369. It consists of a moderately mineralized "break" striking N.70°W. and dipping 70°N., which is traceable from the lake level over a high hill, a total distance of approximately 450 feet. It varies somewhat in width, but the average is probably less than 3 feet. It is mainly a rusty silicified zone carrying moderate quantities of fine-grained sulphides. Of the 10 test pits sunk, the best results have been obtained in Nos. 4 and 6, where the zone attains a width of 4½ feet and carries considerable quantities of fine-grained pyrrhotite, chalcopyrite, and visible gold; this section is about 100



Main test pit (No. 6), Moramo Gold Syndicate, Horwood Lake area.

feet in length. Quartz lenses occur at various places along the zone, but the mineralization does not appear to be associated with them. The country rock is a massive pillowed andesite intruded by a few tongues of porphyry. On the south shore of the lake directly opposite the showing a mass of quartz porphyry is exposed.

Although the results of a systematic sampling are not known to the writer it is understood that they were sufficiently encouraging to warrant further exploration by diamond-drilling.

Some work has been done on a rusty shear zone parallel to the main break and 200 feet north of it. Thus far the results have not been encouraging.

Moramo Gold Syndicate

The Moramo Gold Syndicate holds a group of 12 claims on the west side of the South arm of Horwood lake, just north of the north boundary of Dale township. A shear zone, which in places attains a width of 66 feet, has been traced in a northeast direction for more than 1,000 feet. Within this zone are several stockworks of quartz veins carrying moderate quantities of pyrite, pyrrhotite, and chalcopyrite. For the most part the veins follow the shearing and dip 60°N. The country rock immediately bordering the vein matter is

strongly carbonated greenstone, but farther out massive pillowed andesites predominate.

During the summer of 1934 a crew of five men, under the direction of C. S. Gifford, was engaged in opening up this mineralized zone, in preparation for a thorough sampling. A considerable amount of cross-trenching and test-pitting was performed. The results of this sampling are not known to the writer, but Mr. Gifford reports that preliminary sampling in test pit No. 6 showed gold values as high as 0.33 ounces per ton over a channel width of 6 feet. Elsewhere the values are said to be lower.

Wm. Smith

The Smith group consists of 26 claims on the east side of Horwood lake near the junction of the South and Northeast arms. In October, 1933, Wm. Smith discovered a massive quartz vein in pillowed andesite on the shore of the lake on what is now claim S.25,339. It strikes N.83°E. and dips 45°N. It has an average width of 30 inches and has been exposed for about 60 feet. To the west it passes into the lake and eastward it is heavily drift-covered. The quartz is a dark smoky variety containing tourmaline and moderate quantities of pyrite, sphalerite, galena, and chalcopyrite, and some visible gold. Channel samples are reported to have yielded 0.75 ounces gold per ton over vein width.

Although little or no work was done on this property during the summer of 1934, holes have already been spotted for a campaign of diamond-drilling to be conducted in the near future.

Groundhog Gold Mines, Limited

Early in 1934, Groundhog Gold Mines, Limited, was incorporated to take over the Jessop-Seery property, reference to which has already been made. At present, the group consists of 12 surveyed claims on the east shore of Horwood lake, opposite the outlet of the Swayze river.

Old records show that encouraging results were obtained by the Nipissing Mining Company, Limited, in their development of the main showing on this property some years ago. The vein matter, which is reported to be of high grade, was stripped for a length of 96 feet and had an average width of nearly 2 feet. For several years this showing has been under several feet of lake water.

In midsummer, it was reported that this company on confirmation of commercial gold values on surface, planned an extensive programme of diamond-drilling and underground development. Early in September, 1934, a crew of 6 men were engaged in completing assessment work necessary to hold additional claims recently staked; but when the property was visited later in the month, there was no one on the ground, plans apparently having been delayed.

Lefever-Anderson Claims

During the field season of 1934 a crew of 6 men were engaged in surface exploration on a group of 10 claims located on the west side of the South arm of Horwood lake. This work was conducted under the supervision of J. E. Lefever and D. Anderson.

An irregular system of narrow quartz stringers in sheared andesite has been uncovered near the middle of the south line of claim S.25,395. The quartz contains many greenstone inclusions, and is only moderately mineralized with pyrite and chalcopyrite; gold is said to have been obtained by panning at one place. Other quartz veins on the property have not responded particularly well to development.

Apart from the negative results already obtained, the general geology of the group is, nevertheless, interesting from the prospector's viewpoint, since several intrusive porphyries have been uncovered. Further work, however, will be seriously handicapped by the extensive overburden.

Cambach Syndicate

The Cambach Syndicate holds a group of 24 claims on the east side of the South arm of Horwood lake, tied to the north boundary of Dale township. Six of these claims were staked in September, 1932, and the remainder in September, 1933, by J. R. Campbell and Eugene Bachmann.

The main showing occurs near the middle of claim S.22,549 a few chains north of the township line. It is reached by a good trail 72 chains in length leading from the south side of a bay of Horwood lake. Stripping and trenching operations have exposed no less than six parallel rusty-weathering shear zones in a more or less schistose pillowed andesite over a width of 300 feet and a length of 450 feet. The individual shear zones range from 4 to 20 feet in width and strike approximately east-west. Between the shear zones light-weathering dikes of quartz-feldspar porphyry ranging from a few inches to 20 feet in width intrude the greenstone parallel to the schistosity. The shear zones themselves are cut by an intricate system of narrow veinlets of glassy quartz and rusty-weathering carbonate (ankerite). The quartz contains a moderate quantity of sulphides, mainly pyrite and chalcopyrite. The enclosing schist contains an abundance of pyrite cubes, and ankerite occurs abundantly along the shear planes.

Samples taken from the surface are reported by Mr. Campbell to have yielded encouraging gold values, so much so that, early in 1934, a diamond-drill was engaged to probe the showing at shallow depths. The results of this drilling are said to have been inconclusive, owing largely to a faulted condition encountered at depth. No further work was done at the property in 1934.

Other Properties

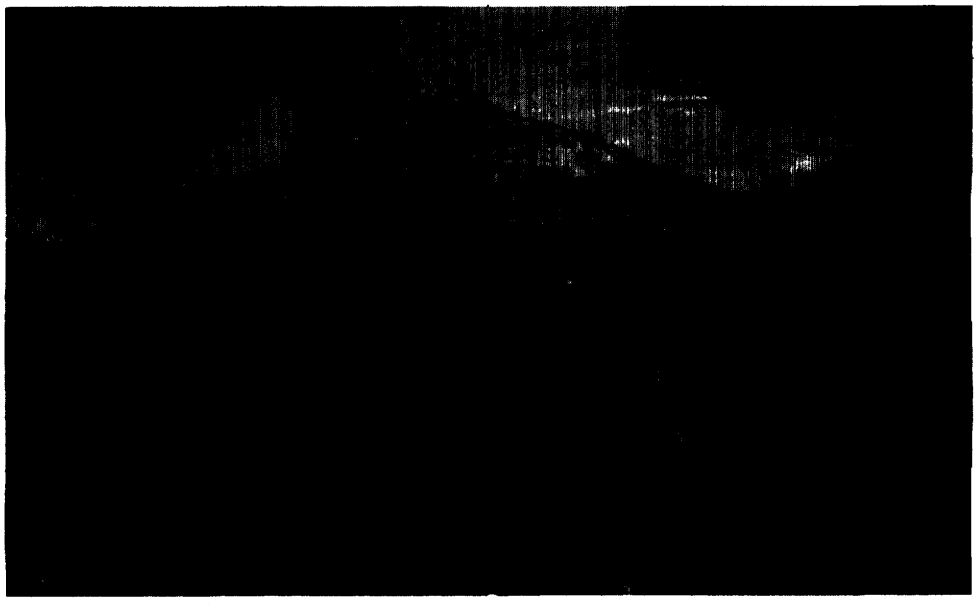
Although no important discoveries were made during the summer of 1934, assessment work was performed on the Landry-Taylor, J. C. Dunn, and C. E. O'Neill properties.

Recent Developments in the Swayze and West Shiningtree Areas

By H. C. Laird

SWAYZE AREA

No discoveries of special importance were made in the Swayze area in 1934. The abandonment of the Kenty Gold Mines operation in midsummer proved to be a decidedly discouraging factor to the few prospectors and operators who had planned further exploration work on their properties.



Aerial view of the property of Lee Gold Mines, Limited, Greenlaw township, June, 1934.

Buffalo Canadian Gold Mines, Limited

In May and June, 1934, Buffalo Canadian Gold Mines, Limited, carried on an extensive diamond-drilling campaign at the main showing on their Cree Lake property, Swayze township. The results of this drilling are reported to have been inconclusive and operations ceased early in July.

Swayze-Huycke Gold Mines, Limited

Swayze-Huycke Gold Mines, Limited, maintained a crew of 15 men on their group of 6 surveyed (1933) claims at Allen lake, Cunningham township, throughout the summer of 1934. The crew was engaged largely in underground development. The property was equipped with an excellent set of camps and a complete mining plant, including a Diesel power unit. A shaft was sunk to a depth of 125 feet, where about 250 feet of lateral work was performed. The encouraging gold values that are reported to have been obtained on surface and

in one short diamond-drill hole near the shore of Allen lake were not encountered underground. Operations were suspended in September, 1934.

Lee Gold Mines, Limited

During 1934, Lee Gold Mines, Limited, was engaged in underground development of their property at Lee lake, Greenlaw township. A shaft was sunk to a depth of 250 feet and considerable lateral work was performed on levels established at 125 and 250 feet. The mineralized shear zone, as exposed on surface, is reported to have been intersected on both levels. Disappointing gold values, however, together with a faulting problem led to the suspension of operations in January, 1935.

Halcrow-Swayze Mines, Limited

Development at the property of the Halcrow-Swayze Mines, Limited, in Halcrow township, proceeded steadily during 1934. It consisted mainly of surface exploration, underground development, diamond-drilling, and the operation of a 25-ton test mill, all of which was carried on under the direction of Horace Strong.

The testing of the three main veins as exposed on the surface are reported to have given the following results:—

Vein	Length	Width	Gold content
	feet	inches	ounces per ton
No. 1	100	16	0.235
No. 2	900	84	.120
No. 4	30	12	.857

A shaft was sunk on No. 2 vein to a depth of 371 feet, with levels at 200 and 354 feet and a sublevel at 270 feet. Most of the underground development has had to do with No. 2 vein at the 200-foot level, where it has been drifted on for a length of 1,138 feet and shows widths ranging from 4 to 7 feet. On the bottom level No. 2 vein was opened for a length of 200 feet and showed an average width of 4 feet. Diamond-drill intersections below the bottom level indicate the continuity of No. 2 vein, as well as low gold values to a depth of 500 feet.

Mr. Strong, president of the company, estimates in No. 2 vein 82,500 tons of ore above the 200-foot level, with a grade of 0.11 ounces gold per ton, and a further 45,000 tons of the same grade ore between this and the bottom level. By a process of selective mining it is stated that 35,000 tons of ore with a grade of 0.171 ounces per ton could be extracted down to the 354-foot level.

WEST SHININGTREE AREA

Wasapika Section

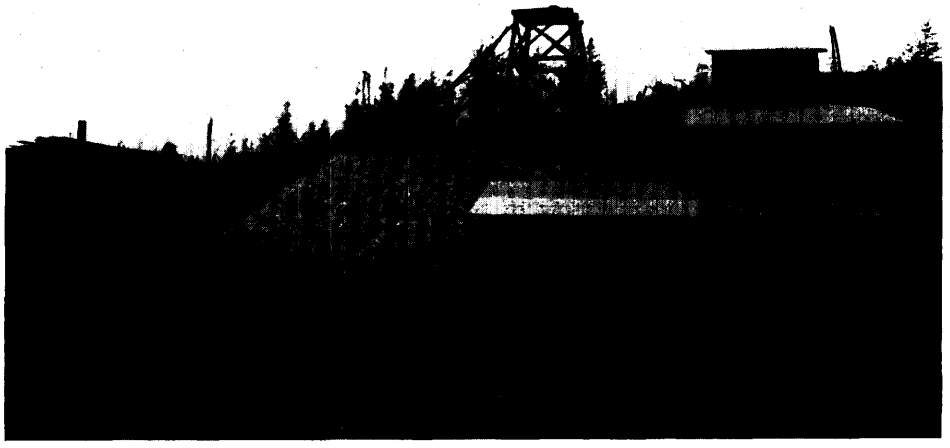
In October, 1934, a short visit was paid to the West Shiningtree gold area, to which attention is once again being directed on account of recent company reorganizations and the promise of further surface and underground development on some of the properties.

The writer wishes to take this opportunity to thank Frank Milne and other officials of Neville Canadian Gold Mines, Limited, for cordial hospitality extended to the writer and his assistant while visiting this section.

The following is a brief account of the more recent developments in the Wasapika section of this camp.

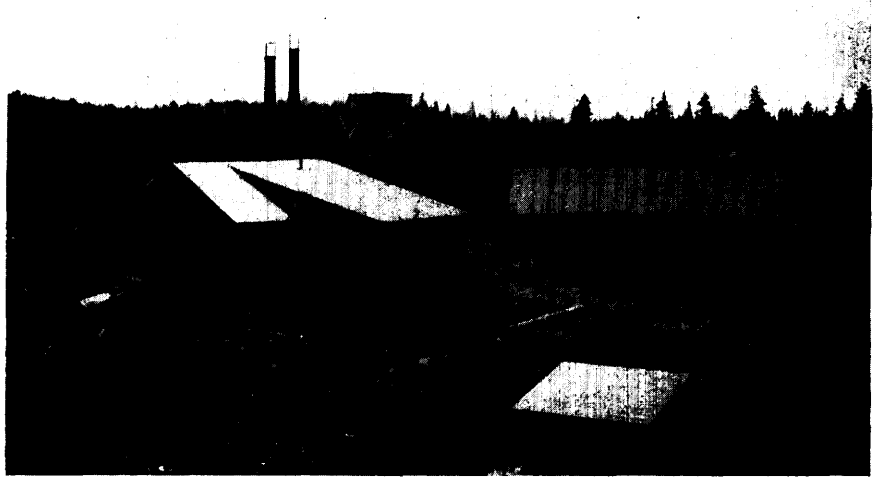
Churchill Mining and Milling Company, Limited

In May, 1934, a contract was let by the Churchill Mining and Milling Company to sink the old 40-foot shaft to a depth of 110 feet. This work was completed early in October. Early in 1934, the property was equipped with a



View showing the power plant (left), headframe (centre), and mill (right), Churchill Mining and Milling Company, Limited, October, 1934.

10-ton Straub mill, which was operated intermittently throughout the summer months. On October 10, the mill was closed down, and no work was being done when the property was visited a week later. Lack of funds is said to have been responsible for the suspension of operations.



Plant of Neville Canadian Gold Mines, Limited, Macmurchy township, October, 1934. The headframe had not been erected when the photograph was taken.

Neville Canadian Gold Mines, Limited

Early in 1934 a new company, known as Neville Canadian Gold Mines, Limited, was organized to take over the assets and obligations of Ribble Mines, Limited, consisting of a group of 8 leased claims in the townships of Macmurchy

and Churchill. This property was formerly (1932) owned by the Wasapika Consolidated Mines, Limited, and was originally (1920) known as the Wasapika Gold Mines, Limited.

Previous work centred about the famous Ribble vein, which has already been developed by a 2-compartment shaft to a depth of 300 feet and a limited amount of lateral work on the 100-, 200-, and 300-foot levels. According to company estimates, previous data indicate 37,000 tons of 0.37-ounce ore already blocked out above the 3rd level. Further estimates by officials indicate that the old dump contains from 7,000 to 10,000 tons of ore, averaging 0.39 ounces gold per ton. It is reported that the new interests plan to prosecute a vigorous campaign of underground development, which will include further lateral work on the levels already established as well as sinking to deeper horizons.

Operations were resumed in August, 1934, under the direction of Frank Milne, resident mine superintendent. Fourteen men have been engaged in



Plant of Lake Caswell Mines, Limited, Macmurchy township, October, 1934.

clearing the ground and putting the steam plant, buildings, and other equipment in first-class condition in preparation for dewatering the shaft.

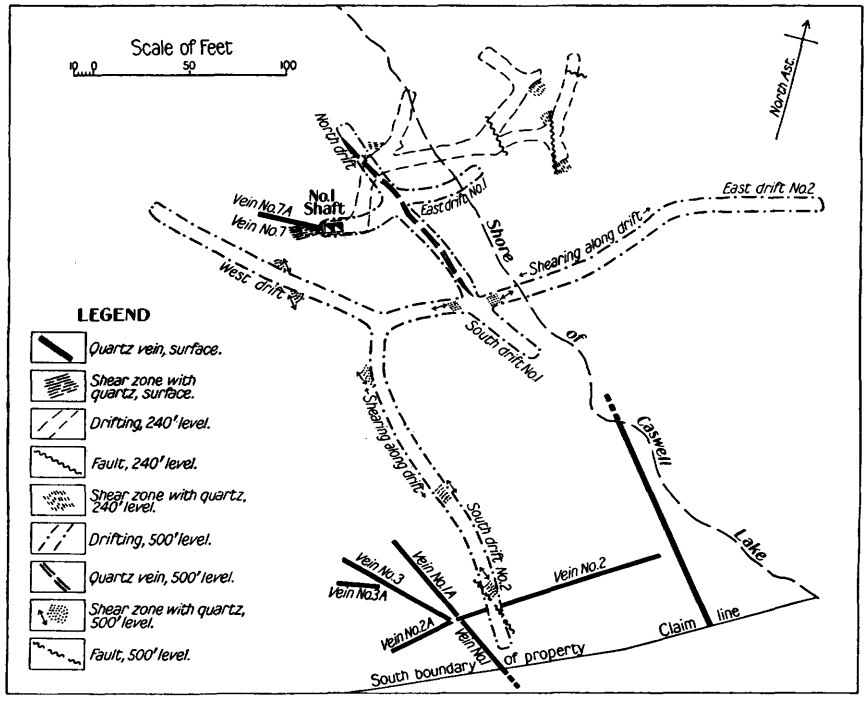
Lake Caswell Mines, Limited

Lake Caswell Mines, Limited, is a recent reorganization of Burvan Gold Mines, Limited. The property consists of 4 leased claims in Macmurchy township adjoining the Neville Canadian group on the east. It was originally owned by West Tree Mines, Limited, which in 1926 turned it over to the Canadian Champion Reef Mining Company, Limited. On the dissolution of this company early in 1933, the property was acquired by Burvan Gold Mines, Limited.

Early in July, 1934, a crew of 14 men, under the direction of Thomas Bullock, was engaged in putting the old mining plant and other equipment in condition for further underground development. When the property was visited in October, No. 1 shaft was being kept dry while the results of sampling of the underground workings by Paul M. Hedley were awaited. In the meantime, an aggressive programme of surface exploration was being conducted, with the result that several new quartz leads have already been uncovered. In all, 40 quartz veins ranging from mere stringers to 2 feet in width, have been located,

many of which, however, will doubtless prove to be duplications. The majority of the veins show only moderate mineralization, but in places spectacular high-grade gold specimens have been obtained.

Previous operators at this property had sunk two shafts and completed considerable drifting on the various levels. No. 1 shaft, on the west shore of Caswell lake, is 500 feet in depth, with levels at 240 and 500 feet. To date 300 feet of lateral development has been performed on the 240-foot level and 800 feet on the bottom level. No. 2 shaft, on the east side of the same lake, has been sunk to a depth of 60 feet with 178 feet of drifting on this level.



Plan of underground workings on the 240- and 500-foot levels, No. 1 shaft, Lake Caswell mine, Macmurchy township, December, 1934. (A compilation from plans submitted by company officials.)

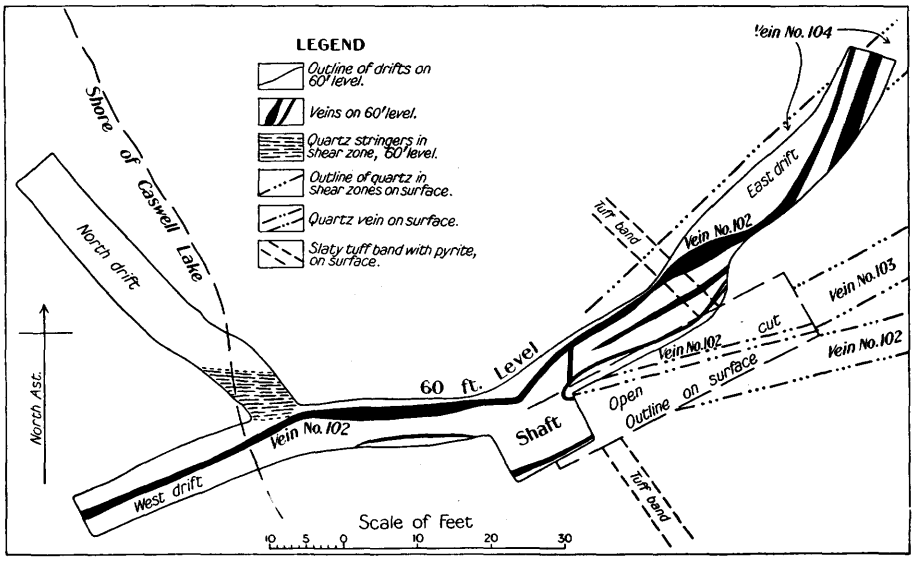
Early in 1935, work was proceeding in an endeavour to correlate surface and underground showings and to follow favourable indications obtained in 3,300 feet of diamond-drilling done by the previous operators in 1925. It is understood that some difficulty was being experienced in drilling on account of faulting problems and the occurrence underground of many veins and shear zones not apparent on surface.

Although encouraging gold values have been obtained both on surface and in the underground workings, no sizable ore shoots have as yet been encountered. The results thus far obtained, however, are considered favourable, and further intensive development is planned.

Bilmac Gold Mines, Limited

Bilmac Gold Mines, Limited, which was incorporated on September 11, 1934, is an amalgamation of four groups of claims in Macmurchy township adjoining the Lake Caswell property on the east. The holdings of the new

company consist of two claims that were owned by the White Rock Mining Company, Limited; one claim formerly held by Atlas Gold Mines, Limited; one claim of the Wm. McVittie Estate; and two claims formerly owned by Harvey Kirkland Mines, Limited. Considerable development work has already been done on each of these groups. Underground work at the White Rock property in the winter of 1933 carried the main shaft to a depth of 175 feet, where 560 feet of drifting was done. A level was also established at a depth of 65 feet, where some drifting and stoping operations were carried on. The original shaft on the property was sunk to a depth of 65 feet at a point 180 feet northwest of what is now the main shaft. On the Atlas property a shaft was originally sunk to a depth of 87 feet; this shaft is only 860 feet east of the White Rock shaft.



Plan of the open cut and vein system on surface projected to workings on the 60-foot level, No. 2 shaft, Lake Caswell mine, Macmurchy township, December, 1934. (From plans submitted by company officials.)

Operations were just getting well under way when the property was visited late in 1934. The old plant and equipment at the White Rock property were being overhauled and preparations were being made to dewater the main shaft, where it is planned to concentrate on further underground development. This work is under the direction of James E. Grant and Sydney Brown.

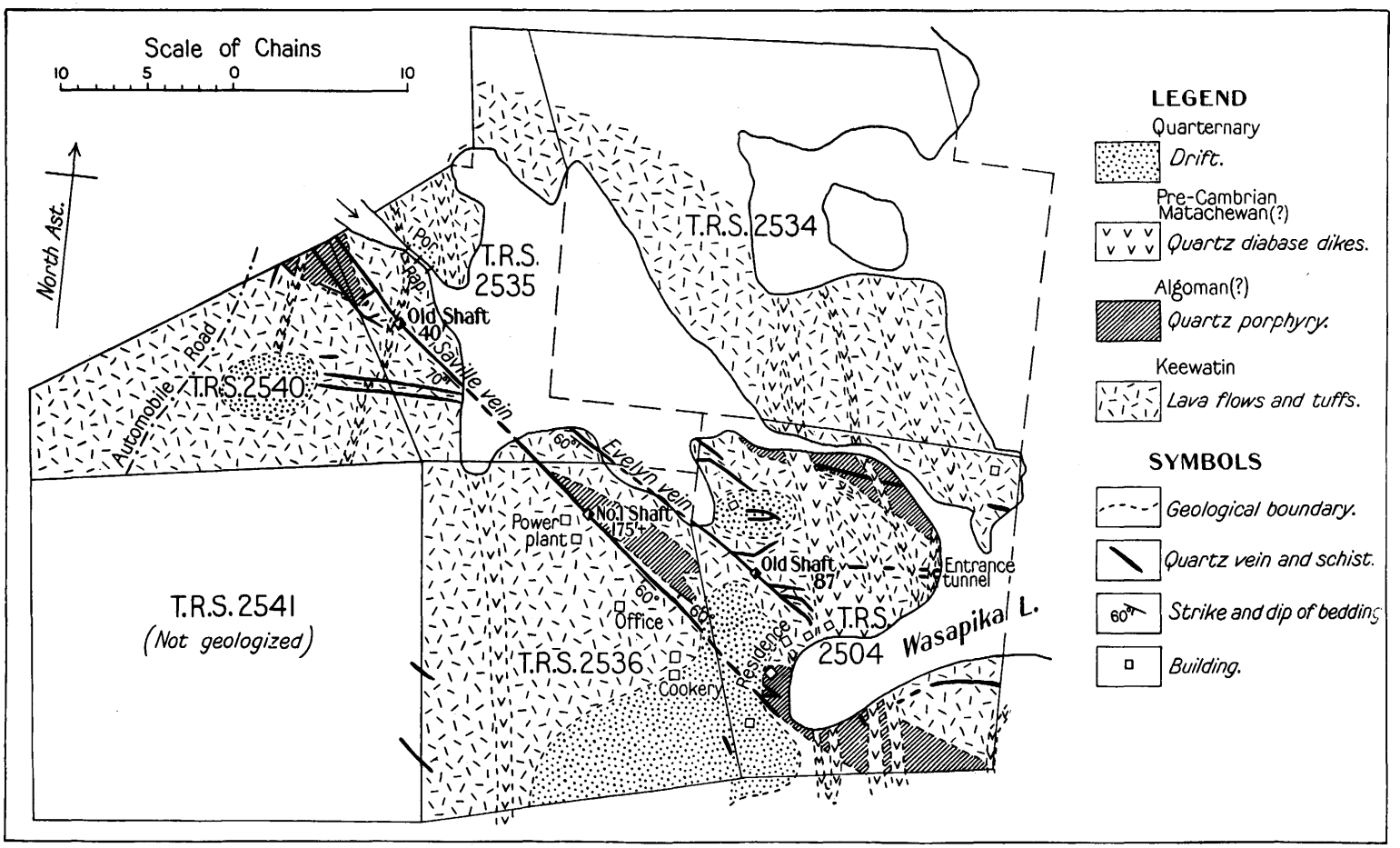
Encouraging results obtained from underground sampling are said to be responsible for a programme of deeper underground development initiated early in 1935. To this end the main shaft is being deepened to 425 feet and new levels are being established at 300 and 425 feet.

Properties in Adjacent Sections

Canyon Creek Gold Mines, Limited

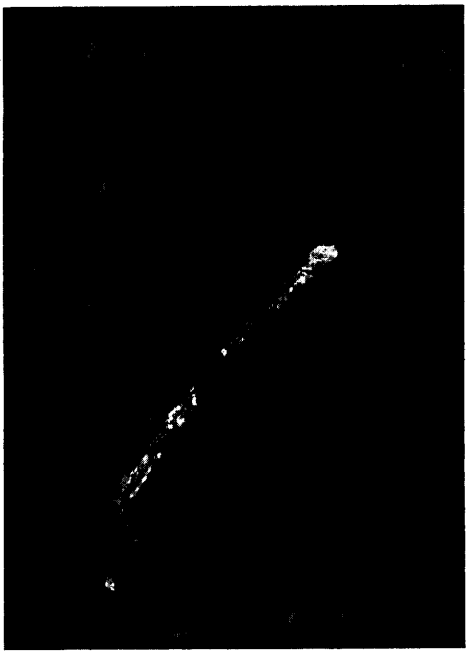
A group of 11 claims, 2 of which are surveyed, is held by the Canyon Creek Gold Mines, Limited, successors to Canyon Creek Mining Syndicate. The claims are located in the central part of Asquith township, about a mile southwest of Shiningtree village.[1]

[1]See map No. 43c, "Makwa-Churchill Area," Ont. Dept. Mines, Vol. XLIII, pt. 3, 1934.



Sketch map showing general geology and vein system on the property of Bilmac Gold Mines, Limited, Macmurchy township.

Considerable interest is attached to the recent discovery of spectacular high-grade gold specimens in a quartz vein located in the northeastern part of claim T.R.S. 6,699. Although the vein is indicated by stripping and trenching at intervals for nearly 500 feet, the main section on which deep test pits have been sunk is exposed for only 200 feet. It is strong where it dips into low ground at the east but feathers out toward the west. It ranges from 3 to 12 inches in width, strikes N.62°W., and dips approximately 45°S. The quartz is strongly fractured parallel to the strike, the fractures containing much dark graphitic and sericitic material. In certain sections of the vein, especially where it is well



Main test pit exposing a high-grade gold-bearing quartz vein, Canyon Creek Gold Mines, Limited, Asquith township, October, 1934.

fractured, the quartz is abundantly mineralized with pyrite, pyrrhotite, chalcopyrite, galena, and sphalerite, and shows visible gold. Other narrow quartz stringers, also reported to carry gold values, lead off into the country rock almost at right angles to the main leader. The wall rock is a highly altered and contorted Keewatin type believed to be a recrystallized andesite. A few feet south of the showing the andesite is intruded by a dike of quartz-feldspar porphyry several feet in width.

When the property was visited in October, 1934, a small crew of men under the direction of E. B. James was engaged in stripping operations in an attempt to pick up the westward extension of the main quartz leader.

Gosselin Gold Mines, Limited

Late in 1934, it was announced that Buffalo interests were taking over the property of Gosselin Gold Mines, Limited, with a view to exploring further the interesting surface showings that were located several years ago. The property consists of a group of 5 surveyed mining claims lying partly in Churchill township

and partly in Asquith township, about 1½ miles north of Shiningtree village. The location and general geology of the group is indicated on the Makwa-Churchill map.[1]

The gold showings on this property are associated with veins and irregular masses of quartz of unusual size and extent. Although the work of previous operators is said to have indicated that the gold is rather erratic and disseminated in its occurrence, the geological conditions are such that the showings might well be re-investigated, especially in view of the high price of gold obtaining at the present time.

For a detailed account of the geology of this group reference should be made to a report[2] by P. E. Hopkins.

Duncan J. McDonnell

Duncan J. McDonnell holds a group of 9 claims in the vicinity of Sams lake and Houston lake, in the northern part of Macmurchy township. Three of these claims were surveyed in 1926.

Considerable surface work has been done at the main showing, which occurs on the north side of the Montreal river midway between the above-mentioned lakes. The showing consists of a narrow quartz vein, which has been exposed by stripping and in test pits for a length of about 450 feet. It crosses the boundary between claims T.R.S. 4,569 and 4,570, about 3 chains north of the south side of these claims. The vein strikes east-west and dips slightly south. For about 200 feet at the west end of the exposure the vein traverses a laminated slate, which strikes N.82°E. and dips 78°S. East of this section the vein passes from slate into a rusty-weathering somewhat carbonated arkose, which is interbedded with narrow bands of fine-grained conglomerate with tiny fragments of black cherty material. Toward the west, the vein consists of a main quartz leader ranging from 6 to 8 inches in width, as well as narrow quartz stringers impregnating the wall rocks for 3 or 4 feet. Where the main quartz leader enters the arkose it tends to break up into a sort of stockwork with quartz stringers exposed irregularly over several feet. Four test pits have been sunk at intervals on this vein, the deepest being about 8 feet. A narrow porphyry dike cuts the sediments, which parallel the vein only a few feet south of it.

For the most part the quartz is rather sparsely mineralized with pyrite and chalcopyrite. In places, it contains bleached fragments of the arkosic wall rock, which gives it the appearance of a vein breccia. Mr. McDonnell reports that low gold values were obtained from the most easterly pit.

In October, 1933, the main showing was diamond-drilled, two 60-degree holes being sunk, one to a depth of 363 feet, the other to 505 feet. Although the vein was intersected, the mineralization in the core was negligible. No further work was done on the property in 1934.

Ace Exploration and Holding Company, Limited

The Ace Exploration and Holding Company, Limited, was incorporated early in 1934. It holds 52 claims in 4 groups in the southern part of Cabot township between Claw lake and Mattagami lake. One of these groups, consisting of 13 claims, was formerly held by Porcupine-Kirkland Gold Mines, Limited. During the field season of 1934 a crew of men, under the direction of B. R. Shortt, was engaged in surface exploration mainly in the vicinity of Lucid lake. No discoveries of importance have been reported.

[1]Map No. 43c, Ont. Dept. Mines, Vol. XLIII, pt. 3, 1934.

[2]P. E. Hopkins, "West Shiningtree Gold Area," Ont. Dept. Mines, Vol. XXIX, pt. 3, 1920, pp. 51, 52.

Communication, Transportation, and Power

The West Shiningtree area is beset by none of the difficulties that frequently retard development in the newer sections of the north country. For many years the operating properties named above have been served by telephonic communication and an excellent motor road from Westree station on the C.N.R., 60 miles north of Sudbury. In the summer of 1934, this road was being put in still better condition as part of the relief project of the Ontario Government. At the same time, a new section was being extended northeast toward Tyrrell township. When this road is completed it will be possible to motor from Westree to Gowganda. Construction of this northern highway is being superintended by Mortimer Moore, of Shiningtree.

At present, it is understood that the leading operators in this area are carrying on negotiations with the Ontario Hydro-Electric Power Commission with a view to obtaining an adequate supply of electric power for further deep development. In this regard no particular difficulty is anticipated, owing to the fact that the main transmission line from Abitibi Canyon to Sudbury passes only 11 miles west of this camp.

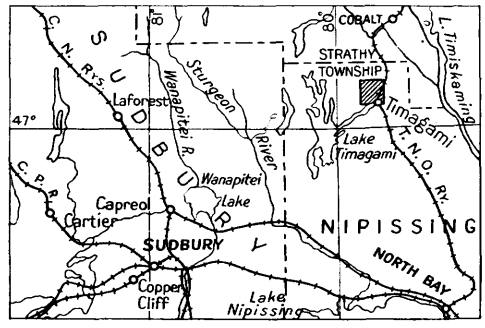
Part of Strathy Township

By W. S. Savage

INTRODUCTION

During the latter part of the field season of 1934 the writer conducted a geological survey of a part of Strathy township, district of Nipissing, including several properties on which development work was in progress.

This area, situated to the south of Kanichee (Cedar) and Net lakes, has been long known to contain deposits of nickel-bearing sulphides and auriferous arsenopyrite, and several properties have been worked at intervals for over thirty years. The advance in the value of gold reawakened interest in the area. Old properties were revived, and active prospecting and staking of claims have taken place during the past year.



Key map showing the position of Strathy township. Scale, 50 miles to the inch.

Location

The township of Strathy is located in the Timagami Provincial Forest. Easy access to the area is provided by the Temiskaming and Northern Ontario Railway from Timagami and Goward stations, and by the Ferguson highway. Both the railway and the highway cut across the township in a general north and south direction near the east boundary.

Topography

The region possesses the usual flat topography characteristic of the pre-Cambrian in general and, while rugged in detail, is lacking in outstanding physiographic landmarks. The most noticeable elevation is a ridge of sheared quartz porphyry extending across claims T.R.T.4,426, 4,427, and 4,413 in a northeast southwest direction. The intrusive mass of serpentinized diabase and peridotite, which forms an oval on and south of claim T.R.3,187, is essentially a low dome rising above the neighbouring Keewatin rocks. Most of the area mapped is covered with a mantle of glacial drift and is heavily timbered. Rock outcrops are relatively scarce and in many cases are masked by the debris from recent lumbering operations.

The area is drained by several small streams into Kanichee and Net lakes, which act as gathering basins for most of the water flowing into the Matabitchuan river.

Previous Geological Work

The earliest record of geological work in this area is to be found in the "Report on the Geology and Natural Resources of the Area Included by the Nipissing and Temiskaming Map-Sheets"[1] by A. E. Barlow, published in 1899, in which he describes the rocks observed along the principal canoe routes.

A. P. Coleman[2] made a trip through this area in 1899 and examined several properties in the neighbourhood of Net lake, having entered the region by way of the Matabitchuan river from Lake Timiskaming.

The geology of an area including Kanichee and Net lakes was mapped by C. W. Knight in 1920 in connection with his report on "Windy Lake and Other Nickel Areas."[3]

The report by E. W. Todd on the "Anima-Nipissing Lake Area,"[4] published in 1926, includes the general geology of Strathy township and mentions several mineral occurrences of possible economic importance.

Map

On the geological sketch map that accompanies this report, the extent of the different rock formations is shown on the scale of 25 chains to the inch. All surveyed mining claims are accurately located. The geology was mapped by pace traverses over the surveyed claim-lines, and in the unsurveyed areas by pace-and-compass traverses, spaced about one-quarter of a mile apart, between known groups of surveyed claims.

Acknowledgments

The writer wishes to express his appreciation of the courteous treatment and hospitality accorded by the officials of the various mining companies and by prospectors in the field. In the preparation of this report he is particularly indebted to the officials of the Manitoba and Eastern Mines, Limited, and the Cuniptau Mines, Limited, who generously placed at his disposal all available information and maps dealing with the surface and underground exploration of their properties. Thanks are also due to the staff of the Department of Mines for suggestions and assistance in connection with the preparation of this report and geological map.

GENERAL GEOLOGY

The consolidated rocks in the area are all of pre-Cambrian age. In the following table the various formations are classified according to their age relationships, the oldest being at the bottom:—

[1]A. E. Barlow, Geol. Surv. Can., Vol. X, 1897, pt. 1.
[2]A. P. Coleman, Ont. Bur. Mines, Vol. IX, 1900, pp. 172, 173.
[3]C. W. Knight, Ont. Dept. Mines, Vol. XXIX, pt. 1, 1920, pp. 207-219.
[4]E. W. Todd, Ont. Dept. Mines, Vol. XXXV, pt. 3, 1926, pp. 79-104.

QUATERNARY	
RECENT and PLEISTOCENE:	Swamp and glacial deposits (boulder clays, sand, and gravel).
	Great unconformity
PRE-CAMBRIAN	
KEWEENAWAN:	Olivine diabase dikes.
	Intrusive contact
ALGOMAN:	Massive pink granite. Quartz porphyry.
	Intrusive contact
PRE-ALGOMAN: (Haileyburian?)	Diabase, peridotite, serpentine.
	Intrusive contact
KEEWATIN:	Altered basic volcanics, amygdaloidal lavas, spherulitic pillow lavas, acid volcanics, pyroclastics. Banded iron formation.

Keewatin

A belt of greenstone extending in a general east and west direction occupies the greater part of Strathy township. The most prevalent type of rock in the area examined consists of green basic lavas. These altered basaltic flows are generally massive, but contain narrow schistose zones of shearing, where the presence of rusty oxidation products is indicative of sulphide mineralization. Amygdaloidal textures were observed in several places, particularly on claims T.R. 3,187, T.R.T. 1,623, T.R. 3,484, and T.R.T. 4,524. A fine exposure of spherulitic pillow structure can be seen on a small island in Arsenic lake near the east boundary of claim T.R.T. 4,524. This flow top outcrops again in the deep bay to the west. Another flow top distinguished by spherulitic pillow structure was traced from the Ferguson highway in a westerly direction across the north half of claim W.D. 598. In both instances the strike of the flows as indicated by the pillow structure was S.70°W. The bun shape of the pillows and their persistent orientation would appear to indicate that the tops of the flows faced south, but confirmatory evidence was not observed elsewhere in the area. A flow breccia which outcrops on the east line of claim W.S. 14 was observed again 1,500 feet to the west, the strike as before being S.70°W.

A peculiar type of porphyritic greenstone is exposed on the south shore of Kanichee lake and occupies the northeast corner of claim E.B. 22. This rock has a groundmass of dark chloritic material and contains many white-weathering phenocrysts of feldspar, which contrast sharply with the dark groundmass. The phenocrysts appear to be irregularly distributed throughout the rock in bands which strikes approximately N.10°E. These bands have no definite boundaries and grade imperceptibly into a typical fine-grained greenstone and back again into the porphyritic type. A similar occurrence is found northwest of Kanichee lake, where some of the white feldspar masses with irregular rounded borders are as much as 2½ inches in diameter; these have been described in greater detail by E. W. Todd, who observed the same gradual transition and describes it as follows:[1]—

> The dark chloritic groundmass shows in places an igneous structure suggestive of diabase, and the general appearance of the rock is similar to the material composing some of the porphyritic dikes of the Matachewan series. However, no definite boundaries suggestive of a dike could be found; instead, a gradual transition occurs, by diminution in the number of phenocrysts, from the porphyritic type to a basic volcanic rock showing pillow structure.

[1]E. W. Todd, op. cit., p. 87.

Pyroclastic rocks, both fragmental and tuffaceous, and acid volcanics, were observed in several places; but it was not feasible, on account of the nature of the overburden, to attempt to delineate these occurrences and separate them on the map from the prevailing more basic Keewatin rocks.

A band of iron formation at least 50 feet wide strikes approximately S.55°W. across the centre of claim W.D. 409. A similar band with the same strike can be seen on claim W.D. 340 on the east shore of the lake and has been exposed by stripping on claim T.R.T.4,444, where it shows a width of 80 feet. South of the lake on claim T.R.T.4,445, a narrow band of iron formation has been traced for 1,000 feet in a direction approximately S.75°W. In each case the iron formation consists of vertical narrow bands of magnetite and cherty quartz with considerable sulphide mineralization.

Pre-Algoman (Haileyburian?)

The Keewatin rocks of this area appear to be underlain by a batholith of diabasic composition. Masses of this basic rock dome up through the greenstones, and outcrop in many places. The oval-shaped mass of serpentinized diabase and peridotite, occurring on and south of claim T.R. 3,187 is the most important from an economic standpoint because of the occurrence of nickel ore associated with it. C. W. Knight describes this exposure as follows:[1]—

> This intrusion may be called serpentine rock, although it passes into a diabase. It is fine to medium in grain. Thin sections examined under the microscope show that some of it, at any rate, is an altered peridotite; the outlines of the original olivine crystals are readily recognized, now altered to serpentine. A little calcite or dolomite, or some similar carbonate, is present. Thin sections also show that in places much of the rock is made up of fibrous hornblende. The serpentine rock is somewhat similar to that at the Alexo mine near Porcupine.

Another important occurrence of intrusive rock belonging to this series occupies the eastern half of claim W.S.13. Here there is no evidence of serpentinization, the rock being a fine- to medium-grained green diabase, intrusive into the Keewatin flows and cut by the Algoman granite to the northeast. The main vein on the property of Manitoba and Eastern Mines parallels the western periphery of this mass of diabase, and it is probable that the fracturing in the greenstones, which permitted the incoming of later mineralizing solutions, may have been caused, in part at least, by the intrusion of the diabase.

Algoman

Granite

The Algoman series is represented by the granite mass that intrudes the Keewatin greenstones and pre-Algoman diabase in the extreme northeast corner of the area. This rock is typical massive, medium- to coarse-grained, pink granite, in which hornblende appears to be prevailing ferromagnesium mineral.

Quartz Porphyry

A large mass of quartz porphyry and quartz porphyry schist strikes in a northeast-southwest direction across the western half of the area. The shearing appears to have been more intense along the northwest side of this intrusive mass, where the rock is light-coloured and consists chiefly of sheared feldspar. In places, however, more or less rounded phenocrysts of quartz can be observed. The more massive portion of the intrusive is a grey quartz porphyry, which

[1]C. W. Knight, op. cit., p. 210.

according to C. W. Knight[1] resembles the grey porphyries of Porcupine and elsewhere. Narrow dikes of light-coloured felsitic material cut the greenstones in many places, and are especially numerous on the claims that lie in the northwest part of the area. Some of these dikes, which are usually schistose and, according to Todd,[2] are older in appearance than the granite dikes found cutting the margins of the Keewatin, show phenocrysts of quartz and in general closely resemble the felsitic rock in the more intensely sheared portion of the main quartz porphyry mass.

These acid intrusive rocks have been tentatively classed with the Algoman, but no correlation was possible which would determine whether they are of the same age as the Algoman granite to the northeast or are connected with some earlier intrusive.

Keweenawan

The youngest rocks in the area occur as narrow vertical dikes of olivine diabase, which cut across the Keewatin greenstones and the pre-Algoman serpentine and diabase and range from a few feet to not more than 200 feet in width. The olivine diabase dikes are particularly subject to the influence of weathering and generally have a rusty decomposed appearance. These dikes as a rule strike N.70°W. and are very persistent. The dike cutting across claim T.R. 3,187 is an exception to the general rule and strikes in a northeasterly direction, which is characteristic of similar dikes in the Matabitchuan area. Where this dike intrudes the serpentine mass it is a typically weathered, medium-grained olivine diabase, but in the northeast half of the claim where it cuts acid volcanic rocks, it is a finer-grained and fresher-looking rock.

Outside the area examined by the writer, E. W. Todd[3] found dikes of this type intruding all the other rocks of the region, and for that reason these dikes have been classified as Keweenawan.

Pleistocene and Recent

Glacial striae, boulder clay, and eskers of sand and gravel mark the advance and retreat of the ice-sheet in Pleistocene time. The orientation of the sand and gravel ridges and striae show the movement of the ice to have been approximately due south.

Swamp of Recent origin covers the greater part of several claims in the west and centre of the area.

ECONOMIC GEOLOGY

Claims have been staked throughout the area for gold, copper-nickel, and minerals of the platinum group. At the time the area was visited, underground development work was in progress at two properties.

Manitoba and Eastern Mines, Limited

The property of Manitoba and Eastern Mines, Limited, consists of 16 surveyed claims, and one held under license of occupation No. 2,177, which surround and include Arsenic lake. The mine buildings and plant are situated about a quarter of a mile west of the Ferguson highway, approximately 2 miles north of the town of Timagami.

[1]C. W. Knight, op. cit., p. 210.
[2]E. W. Todd, op. cit., p. 90.
[3]Ibid, p. 94.

The predominating rocks are Keewatin greenstones and the intrusive mass of pre-Algoman diabase, already mentioned on claims W.S.13 and W.D.598, which may have had a bearing on the loci of ore deposition. Three showings considered to be of economic importance occur on this property. All three have been worked in the past and are reported to have shown gold values of consequence.

The No. 1 showing is located at the east end of Arsenic lake on claim W.S.13. The vein zone on this showing appears to strike approximately N.14°W. and dips westward at an angle between 50 and 60 degrees. It is made up of much fractured quartz and silicified greenstone, well mineralized with iron pyrites, arsenopyrite, and chalcopyrite.

The No. 2 showing, formerly known as the "Little Dan," is located near the southeast corner of Arsenic lake on claim No. W.S.14. Vein material from this showing appears to consist of quartz and siliceous lava carrying a considerable amount of massive sulphides, in which arsenopyrite is the predominating mineral. Old assay plans show the shaft to be approximately 56 feet in depth, and about 90 feet of drifting and crosscutting are indicated. Gold values (at $20.67) are shown, which range from 40 cents to $84.80. Vein widths are shown to range from 0.45 feet to over 4 feet. Minor faulting is in evidence.

No. 3 showing is located on claim W.D.598, approximately 1,500 feet southwest of No. 1 showing. More mineralization can be seen on the surface at this showing than is evident at No. 1. Arsenopyrite is again the chief sulphide, accompanied by iron pyrites and chalcopyrite. Assay plans of previous operations show that a 55-degree inclined shaft was put down and a level established at 50 feet, from which 50 feet of drifting and crosscutting were done. Gold values (at $20.67) were shown to range from 40 cents to $12.00, and vein widths from 1 to 5 feet were indicated.

Present operations have been confined to the No. 1 showing, which was tested by 11 diamond-drill holes in the spring of 1934. The diamond-drilling results were considered encouraging and of sufficient importance to warrant considerable underground work. A mineralized vein zone at least 300 feet long, containing ore of commercial grade over mineable widths, was indicated to a depth of 300 feet.

A complete mining plant believed to be capable of adequately taking care of the preliminary underground exploration work on the No. 1 showing is in operation. A two-compartment shaft was sunk to the south of the area drilled, and levels have been established at 200 and 300 feet. The vein zone was intersected in the shaft at 190 feet, where it was 3 to 4 feet wide with a dip of approximately 70°W. A drift is being carried north and south in this zone on the 200-foot level.

The sulphide mineralization is chiefly arsenopyrite with some pyrite and chalcopyrite. There is a considerable amount of quartz present in this section of the vein zone. Irregular intrusions of quartz porphyry, which do not outcrop at the surface, were encountered in the shaft and on both levels. A crosscut carried to the west on the 300-foot level intersected the vein zone 40 feet west of the shaft, where another drift is being carried to the north and south.

No new work has been undertaken as yet on showings Nos. 2 and 3. The management is of the opinion that this work can be carried out to better advantage when a more general knowledge is acquired from the underground workings on the No. 1 showing.

Operations at this property, which were financed by Bobjo Mines, Limited, were suspended in February, 1935. The amount of ore indicated by the develop-

ment was considered to be insufficient in volume or two low in value to be profitable under the terms of the option.

The underground work included over 1,800 feet of drifting and crosscutting on two levels at 200 and 300 feet. Some 3,000 feet of drilling was done on the surface, and a number of holes were drilled from underground. According to the information supplied by the management three ore shoots were indicated as follows: on the 300-foot level, one shoot averaging 0.23 ounces over a width of 4.17 feet for a length of 205 feet; on the 200-foot level, two shoots, one averaging 0.274 ounces over a width of 2.9 feet for a length of 81 feet, and another 0.33 ounces over a width of 3.1 feet for a length of 52 feet.

In February, 1936, operations were resumed on this property under the direction of J. G. MacGregor; further diamond-drilling was being done, and plans were being made to carry on further underground exploration.

Cuniptau Mines, Limited

The Cuniptau property consists of a large block of claims located in the northwest half of Strathy township. The main workings and shaft are located on claim T.R. 3,187. The northern part of this claim is underlain by basic and acid Keewatin lavas. The former exhibit amygdaloidal texture. A mass of serpentinized diabase and peridotite which intrudes the Keewatin rocks occupies the southern two-thirds of the claim and extends for approximately half a mile to the south. It is oval in outline except for a small projection to the northwest. An olivine diabase dike of Keweenawan age strikes across the claim in a northeast-southwest direction.

The mineral deposits occur in the northwest projection of the main serpentinized diabase and peridotite mass on claims T.R.3,187 and 1,623. The greater part of the mineralized zone is on claim T.R. 3,187. This zone has a thin coating of rust, is shattered, and in places contains disseminated pyrite and chalcopyrite. Cutting the rusty zone are very small lenses or veins of calcite carrying these minerals together with pyrrhotite and pentlandite. They are narrow and irregular and range from a fraction of an inch to 12 inches in width. Analyses show the presence of copper, nickel, gold, silver, and platinum metals. The combined values in some cases are reported to give high values over widths of a few inches.

Shaft-sinking operations were renewed in the old two-compartment shaft on the main north-south shear zone, and stations were established at 100 and 225 feet. A vein which strikes north and south and dips approximately 80°W. extends from the surface to a depth of 42 feet in the shaft, where it is cut off by a nearly flat calcite vein, which represents a fault. The movement below the fault appears to have been to the east. The vein ranges from 10 to 20 inches in width and consists largely of pyrrhotite and some chalcopyrite.

A drift on the 100-foot level has followed a vein zone in a general norh-south direction for some 200 feet. This vein zone contains lenses of massive sulphides, chiefly pyrrhotite and chalcopyrite, with some pentlandite, and these range from a few inches to 4 feet in width. The dip varies from 30 to 40 degrees east. On this level two crosscuts to the east passed through about 20 feet of fine-grained serpentine followed by a zone of disseminated sulphides, which ranges from 40 to 70 feet in width. The north drift also passed through 36 feet of similar mineralization.

Diamond-drilling from the surface and the 100-foot level indicates several lenses of massive sulphides and two or more larger zones of disseminated mineral-

ization. The development work on the 225-foot level had not advanced beyond the cutting of the station at the time the property was visited.

An up-to-date mining plant has been installed, and a good road, 2¾ miles in length, is nearing completion, which will give easy access to the property from Goward station. A small blast furnace was set up on the property early in 1935 and operated for about a month. Operations were suspended, however, owing to the fact that the matte produced was too low in grade.

Longlac Adair Mines, Limited

A block of eleven claims held by Longlac Adair Mines, Limited, adjoins the Manitoba and Eastern property to the southwest. Two claims where development work is in progress are included in the area mapped.

A rusty-weathering band of cherty iron formation 5 feet wide, which has been traced for 1,000 feet by trenching and test-pitting, strikes approximately S.75°W. across the north half of claims T.R.T. 4,444 and 4,445. The iron formation stands vertical and consists of closely interbanded cherty quartz, dense magnetite, and massive sulphides. The latter consist chiefly of iron pyrites with some arsenopyrite, which appear to have replaced bands of green chloritic material. Flat-lying quartz and calcite stringers dipping west can be seen cutting the iron formation. The country rock is basic Keewatin lavas.

In pit No. 3 a rusty shear zone containing a quartz vein 1 foot wide cuts across the iron formation in a direction N.20°E. with a dip of 60°E. The quartz vein is heavily mineralized with pyrite, arsenopyrite, and some chalcopyrite.

At the west end, the 5-foot band of iron formation is separated from another band of iron formation to the north by 30 feet of greenstone. This band of iron formation is 80 feet wide and is similarly mineralized. It strikes S.55°W. and appears to be a continuation of the band that outcrops across the lake to the northeast.

Samples taken from several of the pits and the quartz vein are reported to have given encouraging values in gold. At the time the property was visited development work was still confined to surface exploration.

Strathy Basin Mines, Limited

The property of Strathy Basin Mines, Limited, consists of a block of twenty claims, lying in the north half of Strathy township. These claims are being carefully prospected, and several rusty fractured zones in Keewatin rocks have been uncovered showing good sulphide mineralization.

In the north half of claim E.B. 22, near the east boundary, a trench 200 feet long, striking N.70°W. in porphyritic greenstone, exposes two narrow northward-trending felsite dikes and a fractured zone containing about 8 feet of heavy sulphide mineralization. This zone contains pyrrhotite and chalcopyrite and some irregular stringers of quartz and calcite.

Another similarly mineralized zone has been uncovered near the centre of claim T.R.T.4,449, which lies outside the mapped area. The mineralization was found where a felsite dike striking N.10°E. contacts with Keewatin greenstone to the east.

Several test pits have been put down on these zones of sulphide mineralization, and gold values are reported.

Other Properties

Several properties where the work had not progressed beyond the prospecting stages were visited.

On the block of claims held by W. E. Hurd, which lie to the west of the area mapped, several rusty zones of sulphide mineralization in fractured Keewatin greenstones have been exposed. In the northeast corner of claim T.R.T.4,318, where a narrow quartz stringer cuts diabase, native gold was visible, accompanied by pyrite and chalcopyrite mineralization.

On the Jackson-McNab property, which lies to the northwest, a pit in diabase on claim T.R.T.4,577 exposes a fracture zone striking southwest and dipping 40°N.W. This zone contains quartz and calcite stringers and disseminated sulphide mineralization, which consists chiefly of pyrrhotite. Grab samples taken from this pit are reported to have given high values in gold.

Notes on Mongowin Township and Vicinity

By H. C. Rickaby

Introduction

During the summer of 1934 the writer spent a short time in the townships of Mongowin and McKinnon and in township 11 on the north shore of Lake Huron, southwest of the city of Sudbury. At that time there was considerable gold-mining activity in this area. Underground operations were being carried on at the McMillan mine in Mongowin township and at the Bousquet mine in township 11, and surface prospecting was being done on several other properties.

The area is reached by a good motor road running from Espanola on the Sudbury–Sault Ste. Marie highway to Little Current. The main features of the geology of the region have been described by E. S. Moore.[1] The geological formations consist of Serpent quartzite of the Bruce series and sediments of the Cobalt series, including conglomerate, slate, greywacké, quartzite, and limestone. These sediments form bands striking east and west and are intruded by Nipissing diabase, granite, and dikes of olivine diabase.

The gold occurs in quartz veins, mainly in the sediments but usually in association with dikes or sills of Nipissing diabase. The veins carry appreciable gold values and show considerable mineralization by pyrite and arsenopyrite with some pyrrhotite and other sulphides. Visible gold is present in only moderate amount, but grab samples of the quartz with arsenopyrite or pyrite show high values in gold.

Working Properties

McMillan Gold Mines, Limited

The property of McMillan Gold Mines, Limited, is situated on the north shore of House lake near its west end and is reached by a 3-mile motor road from the Espanola–Little Current highway. The mine has been operated at intervals since 1926. During the summer of 1934 a mill capable of treating 150 tons per day was erected and continued in operation until December 26, 1935, when it was closed down owing to lack of ore. Milling was commenced in the latter part of 1934, and the production for 1934 and 1935 was as follows:—

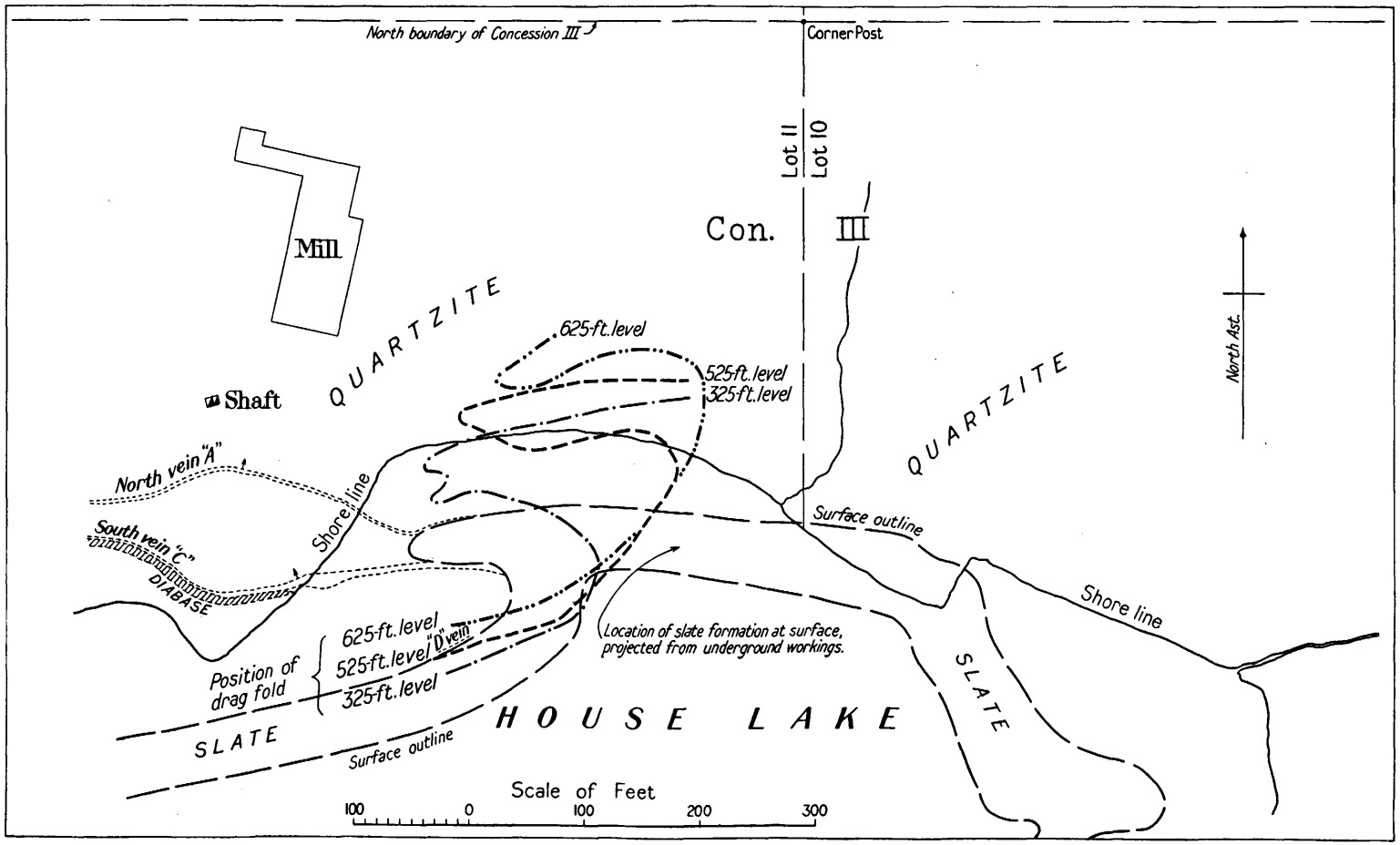
	Tons milled	Production
		ounces
1934	12,313	1,959.39
1935[2]	40,224	7,422

The surface and much of the underground geology is described in the report by E. S. Moore.[3] The veins occur in rocks of the Cobalt series, which here consist of quartzite and argillite. These sediments are intruded by dikes and

[1]E. S. Moore, "Ore Deposits near the North Shore of Lake Huron," Ont. Dept. Mines, Vol. XXXVIII, pt. 7, 1929.

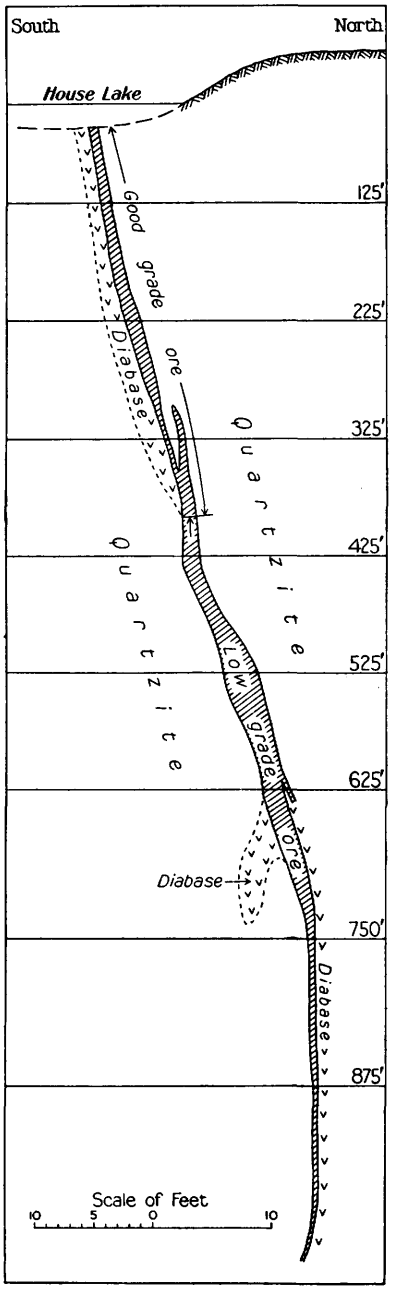
[2]Preliminary estimate.

[3]Ibid, pp. 39-46.



Plan showing drag fold at the various levels, McMillan mine.

sills of Nipissing diabase. A dike of olivine diabase cuts across the formation in a northwest-southeast direction near the centre of House lake. Southeast



Section through "C" ore body, McMillan mine.

of the shaft there is a U-shaped fold in the sediments. The axis of the fold strikes slightly north of east and dips steeply (about 65 degrees) to the east.

The veins are associated with the folding and lie along the contacts between quartzite and argillite and between quartzite and diabase. The widths of the veins are not usually over 5 or 6 feet but show local bulges up to 25 feet. Sections of the vein quartz are heavily mineralized with pyrite, arsenopyrite, and pyrrhotite, and the gold values are confined to these sections.

The main ore shoot occurring on No. 1 vein showed a length of approximately 300 feet down to the 325-foot level but pinched out above the 425-foot level. Other small shoots of ore were encountered down to the lowest level at 850 feet, but the tonnage resulting from these was small.

Bousquet Gold Mines, Limited

The property of Bousquet Gold Mines, Limited, is situated near the centre of township 11 at the east end of Charlton lake. The showing, which occurs near the north side of claim No. 54,782, consists of a quartz vein lying along the contact between diabase and quartzite of the Cobalt series, with the diabase on the north side. The vein strikes almost due east and west and stands nearly vertical. It is traceable on the surface for 120 feet west and 300 feet east of the shaft, showing widths up to 4 feet. West of the shaft a distance of 150 feet the diabase appears to be displaced to the southeast, probably owing to a fault, and the shear zone in which the vein occurs passes into the diabase.

At the time the property was visited in July, 1934, a shaft had been sunk to 160 feet and drifting done on the 150-foot horizon. The vein was visible most of the way down the manway, showing widths from 18 inches to 42 inches. On the 150-foot level the vein showed good widths for a length of 45 feet west of the shaft. Beyond this point it passes into the diabase, where it is represented by narrow stringers of quartz without much mineralization. To the east the vein had been followed for 340 feet, at which point the quartz appeared to pinch out. The quartz is mineralized with pyrite and arsenopyrite, and grab samples of this material showed high values in gold.

The shaft was later deepened to 450 feet and lateral work done on the 300- and 450-foot levels. The vein on the 300-foot level showed a length of 315 feet with widths somewhat narrower than on the 300-foot level. On the 450-foot level the vein was narrow and below commercial grade. From the surface down to the 450-foot level the ore had an apparent rake of about 60°E. in conformity with the plane of the fault. On this level diamond-drilling into the diabase north of the shaft indicated a strong quartz vein lying along the shear zone in the diabase. The quartz in the diabase was drifted on and is reported to have shown values[1] of $6.00 across a width of 5½ feet.

The management estimate ore to the amount of 21,000 tons averaging $18.50 per ton above the 300-foot level. A mill capable of treating 50 tons per day is under construction at present.

Fox Lake Gold Mines, Limited

The property of Fox Lake Gold Mines, Limited, which is controlled by the Northern Securities Company of London, Ont., consists of a group of nine claims forming part of lots 5 and 6, concession IV of Mongowin township. The country rock consists mainly of quartzite, both Serpent quartzite and quartzite of Cobalt age being represented. These are intruded by diabase dikes. Within the Cobalt series there is a brecciated zone replaced by carbonates and quartz carrying some sulphide mineralization. The zone is irregular in shape, showing widths up to 25 feet and a length of 200 feet. Oxidation of the carbonates has

[1]The values reported for this property are all calculated on gold at $35.00 per ounce.

produced a rusty capping of honey-combed material with a thickness of 20 feet or more. At the time the property was visited some pits had been sunk in this gossan, but in only one instance had the pits got below the oxidized material. Grab samples of the quartz and carbonates with some sulphides from this pit showed low values in gold. There appeared to be some enrichment of gold values in the oxidized zone, and at the time the property was visited some of this oxidized material was being treated in a sluice-box to concentrate the gold, which was in a very fine state.

During 1935 a 35-ton mill is reported to have been erected and operated for a short time.

Bob Tough Gold Mines, Limited

Bob Tough Gold Mines, Limited, controls a group of claims in lots 4, 5, and 6, concession III of McKinnon township. The country rock consists of sediments of the Bruce and Cobalt series intruded by diabase dikes. Two showings have been uncovered on the north shore of Evangeline (Moose) lake. The west showing consists of a shear zone in quartzite containing quartz stringers with some pyrite. Four diamond-drill holes were put down on this vein, and one of these is reported to have shown fair values in gold. The east showing lies on the north shore near the centre of the lake and consists of a quartz vein in an east-west shear zone, with some pyrite and arsenopyrite. Three diamond-drill holes were sunk on this vein, and one of the holes is reported to have shown some gold values. A shaft has been sunk on the east showing to a depth of 150 feet and a short crosscut run to the north. Two veins showing moderately low values over narrow widths are reported from the development work to date.

Other Properties

A number of other syndicates were doing work on claims in Mongowin township and township 11 during 1934, and some of these were visited. They showed the same type of mineralization as described above, but little is known about gold values.

INDEX, PART VII

A

PAGE

Access.
See also Canoe routes; Roads.
Horwood Lake area 31
Mongowin tp. 57
Opeepeesway Lake area 2
Strathy tp. 48
W. Shiningtree area 46
Ace Exploration and Holding Co., Ltd. 46
Acid volcanics.
See also Dacite.
Horwood Lake area 32
Opeepeesway Lake area 7
Acidic intrusives.
See also Felsite; Granite; Quartz porphyry.
Horwood Lake area 32, 33
Strathy tp. 52
Acknowledgements 1, 49
Agglomerates.
See also Pyroclastics.
Horwood Lake area 32
Opeepeesway Lake area 6-8
photo 8
Agricultural land.
Opeepeesway Lake area 5
Airplane transport 2
Alcona tp. 4
Algoman intrusives.
See also Diorite; Granite; Lamprophyre; Porphyry.
Horwood Lake area 32, 33
Opeepeesway Lake area 6, 16-19
Strathy tp. 51, 52
Allen lake 38, 39
Altitudes, Opeepeesway L. area 3
Amphibolite 9
Amygdaloidal lava 7, 32, 54
Analyses, basalt 10
Anderson, D., gold claims ..... *facing* 32, 36
Andesite.
Asquith tp., veins in 45
Horwood Lake area 35, 36
Opeepeesway Lake area 6, 7, 10
gold associated with 25
Ankerite 28, 37
Anticline 22
Arbutus tp. 1, 4
Rocks 9, 12, 19
structure 20
Topography 3
Argillite.
Mongowin tp., mineralized 57, 60
Opeepeesway Lake area 6, 11, 15, 16
ferruginous 9
Argillite conglomerate 13
Arkose.
Macmurchy tp. 46
Opeepeesway Lake area 6, 11
mineralized 28, 29
petrography 13-15
schists 12

PAGE

Arkose conglomerate 13
Arsenic lake.
Gold mg. *See* Manitoba and Eastern Gold Mines.
Arsenopyrite.
McKinnon tp. 61
Mongowin tp. 57, 60
Opeepeesway Lake area 23
Strathy tp. 48, 53, 55
Asquith tp., gold mining 43-46
Atlas Gold Mines, Ltd. 43
Autoclastics 7

B

Bachmann, Eugene 37
Barlow, A. E. 49
Basalt.
See also Greenstone.
Agglomerate, photo 8
Analyses 10
Opeepeesway Lake area 6, 7, 10
Basic intrusives.
See also Diabase; Diorite.
Horwood Lake area 33
Opeepeesway Lake area 17, 18
Strathy tp. 51, 56
Basic volcanics.
See also Andesite; Basalt.
Opeepeesway Lake area 6, 7, 10
Batholiths 6, 16, 32, 51
Beaches 6, 20
Bear 5
Beaver 5
Benton tp.
See also Fawn ck.; Wakami r.
Rocks 7-13, 17
basalt, age and analysis 10, 11
structure 20, 22
Topography and drainage 3
Bibliographies.
Horwood Lake area 31, 32
Opeepeesway Lake area 2, 3
Bilmac Gold Mines, Ltd.
Property, geology and workings 42, 43
Biotite granite 6, 17, 32
Biscotasing 2
Bob Tough Gold Mines, Ltd. 61
Bobjo Mines, Ltd. 53
Boulder clay 50, 52
Boulder conglomerate, photo 12
Bousquet Gold Mines, Ltd. 57
Property, geology and workings 60
Breccia 6, 7
See also Flow breccia.
Bridger, John 1
Brown, Sydney 43
Bruce series 57, 61
Buffalo Canadian Gold Mines, Ltd. 38
Bullock, Thomas 41
Burvan Gold Mines, Ltd. 41

C

PAGE

Cabot tp., gold mining 46
Calcite.
Opeepeesway Lake area 28, 29
Strathy tp. 51, 54, 56
Cambach Syndicate.
Gold claims, mineralization 37
location, map showing ..... *facing* 32
Camp lake 5, 9, 21
Campbell, J. R. 37
Canadian Champion Reef Mg. Co., Ltd. 41
Canadian National Railways 2, 31
Canadian Pacific Railway 2, 4
Canoe routes.
Horwood Lake area 31
Opeepeesway Lake area 2, 4, 30
Canyon Creek Gold Mines, Ltd. 43, 45
Canyon Creek Mg. Syndicate 43
Carbonate.
See also Ankerite; Calcite.
Mongowin tp., oxidized 60
Opeepeesway Lake area 9, 23, 28, 29
Carbonate schist.
See Chlorite-carbonate schist.
Carter, P. C., gold claim 29
Caswell lake.
Gold mining 42
see also Lake Caswell Mines.
Sketch map, geological ..... *facing* 42
Cedar, Opeepeesway Lake area 4
Cedar lake. *See* Kanichee l.
Chalcopyrite.
Horwood Lake area 35-37
Macmurchy tp. 46
Opeepeesway Lake area 25, 28, 29
Strathy tp. 53-55
Chapleau.
Air service 2
Forest fire 4
Charlton lake 60
Chert 11, 15
See also Iron formation.
Chlorite-carbonate schist.
Opeepeesway Lake area 7, 12, 25
Churchill Mg. and Milling Co., Ltd.
Development; plant, photo 40
Churchill tp. 40, 41, 45
Claims. *See* Mining claims.
Claw lake 46
Clay. *See* Agricultural land; Boulder clay.
Cobalt series 57, 60, 61
Coleman, A. P. 40
Conglomerate.
Macmurchy tp. 46
Mongowin tp. 57
Opeepeesway Lake area 6, 11
basal 16
Huffman l., photo 12
Ridout series, petrography 13
Copper, Strathy tp. 52, 54
Cordes creek 3, 4
Cree lake, gold claims 38
Cross-bedding in greywacké, photos ... 14, 21
Cuniptau Mines, Ltd. 49
Property, geology and workings 54, 55
Cunningham tp., gold mining 38

D

Dacite 7, 10, 25
Dale tp. 32, 35, 37
Daly, R. A. 10
Deer 5
Diabase.
See also Olivine diabase.
Horwood Lake area 33
Mongowin tp. 60, 61
Opeepeesway Lake area 6, 17-19
Strathy tp. 51
see also Serpentine.
Diabase, serpentinized. *See* Serpentine.
Diorite.
See also Diabase; Quartz diorite.
Horwood Lake area 33
Opeepeesway Lake area 6, 29
Dolomite 51
Drag folds.
See also Folding.
McMillan g. m., plan 58
Opeepeesway Lake area 21
sigmoidal, photo 22
Drainage.
Opeepeesway Lake area 3, 4
Strathy tp. 49
Drift, glacial. *See* Overburden, heavy.
Dunn, J. C., gold claim ..... *facing* 32, 37

E

East arm, Opeepeesway l. 4
Rocks 13, 15
structure 12, 21
E. B. 22 gold claim ..... 50, *facing* 52
Economic geology.
See Geology, economic.
Electric power, W. Shiningtree area ... 47
Ellipsoids. *See* Pillow structure.
Emmons, R. C. 2, 11, 13, 15
Eric tp. 1
Eskers 3, 4, 20, 52
Espanola 57
Esther tp. 1, 3
Gold discovery 23
Navigable waterways 4
Rocks 7, 9
Evangeline lake 61
Explorations, early.
Horwood Lake area 31
Opeepeesway Lake area 2
Strathy tp. 49

F

Faults 16, 20, 54
Fawn creek 4, 5, 13
Feldspar porphyry 18, 33, 34
See also Quartz-feldspar porphyry.
Felsite 28
Strathy tp., minerals assoc. with 52, 55
Ferguson highway 48, 52
Pillow lava on 5
Ferland, E. 25
Ferland-Gauldie-Mogridge gold claims.
Discovery 1, 23
Mineralization; sketch map 24, 25
Fingal tp. 1, 3, 4
Rocks 9
Fish, Opeepeesway Lake area 5
Flow breccia.
See also Lava flows.
Opeepeesway L. area 7
Strathy tp. 50

PAGE
Folding.
See also Drag folds.
Horwood Lake area 34
Mongowin tp. 59, 60
Opeepeesway Lake area 11, 16, 20
Foleyet 31
Forest fires 4
Formations, tables of 6, 50
Fox 5
Fox Lake Gold Mines, Ltd. 60, 61
Fracture zones.
Strathy tp., mineralized 55, 56
Fragmental rocks. *See* Pyroclastics.
Fur-bearing animals 5
Furse, George D. 2, 32

G

Gabbro 33
Gabbro-diorite 17, 18
Galena.
Asquith tp. 45
Horwood Lake area 36
Opeepeesway Lake area 28
Game 5
Garnet tp. 4
Gold claims 5
Gauldie, J. H., gold claims 25
Geology, economic.
Horwood Lake area 33-37
Mongowin tp. and vicinity 57-61
Opeepeesway Lake area 23-30
Strathy tp. 52-56
Swayze area 38, 39
W. Shiningtree area 39-47
Geology, general.
Horwood Lake area 32, 33
Opeepeesway Lake area 5-22
Strathy tp. 49-52
Geology, structural.
See also Folding; Lava flows.
Horwood Lake area 34
Opeepeesway Lake area 20-22
cross-bedding, photos 14, 21
Gibson, T. W. 31
Gifford, C. S. 2, 36
Glacial deposits.
Horwood Lake area 33
Opeepeesway Lake area 3, 6, 20
Strathy tp. 48, 50
Glaciation.
See also Glacial deposits.
Opeepeesway Lake area 19
Strathy tp. 52
Gneiss 6, 17
Gneissic diorite 32
Gneissic granite 6, 33
Godefroy, Constans 1
Gogama, air service 2
Gold.
Deposits, conditions favourable to 29, 34, 46
Horwood Lake area 34
Opeepeesway Lake area 29, 30
W. Shiningtree area 46
Discoveries.
Horwood L. area 31, 33
Opeepeesway Lake area 1, 23
Genetic relationships 30, 32, 51
In gossan 60, 61
Native 34-36, 56, 57
Properties. *See* Geology, economic.

PAGE
Gossan, gold in 60, 61
Gosselin Gold Mines, Ltd. 45, 46
Goward 48, 55
Granite.
Horwood Lake area 32
Mongowin tp. 57
Opeepeesway Lake area 6, 9, 17
greenstone contact 8, 17
intrusive effect 20
Strathy tp. 51
Granite porphyry 6, 33
Granodiorite.
Horwood Lake area 32
Opeepeesway Lake area 6, 17, 18
Grant, James E. 43
Gravel.
See Glacial, Recent deposits.
Great Pike lake 32
Greenlaw tp.
Gold mining 38, 39
Greenstone.
See also Basalt; Porphyritic greenstone.
Horwood Lake area 34, 35
Opeepeesway Lake area 6, 27
gold associated with 28
granite contact 8, 17
Strathy tp. 50, 53, 55
"Grey lava" 6, 7, 9
Minerals associated with 25, 27
Greywacké.
Mongowin tp. 57
Opeepeesway Lake area.
Keewatin 6
Timiskamian 6, 11, 15, 16
alteration products 12
cross-bedded, photos 14, 21
sigmoidal folds in, photo 22
Greywacké conglomerate 13
Groundhog Gold Mines, Ltd. 36
Claims, map showing location. *facing* 32
Groundhog river 3, 33
Groundhog River crossing 31
Grouse 5

H

Haileyburian (?).
Opeepeesway Lake area 18
Strathy tp. 50, 51
Halcrow-Swayze Mines, Ltd.
Developments; ore reserves 39
Hammerstrom, Wm., gold claims 28
Harvey Kirkland Mines, Ltd. 43
Hawaii, basalt, analysis 10
Hedley, Paul M. 41
Heenan tp.
Fossil sand dunes 3
Iron formation, magnetic 11
Height-of-land. *See* Drainage.
Hermiston, P. A., gold claims 28
Herring, Opeepeesway lake 5
Highways.
See also Ferguson highway; Roads.
Construction, Shiningtree area 47
Historical notes.
Horwood Lake area 33
Opeepeesway Lake area 1, 23
Hopkins, P. E. 46
Hornblende granite 6, 17
Hornblende schist 9, 32

PAGE
Horwood lake.
See also Northeast arm; South arm.
Rocks ... 32
Surveys, early ... 31
Horwood Lake area.
Geology, report by H. C. Laird ... 31-37
sketch map ... *facing* 32
Horwood Peninsula gold claims.
See Thorne, G. A.
House lake, gold mining ... 57-61
Houston lake ... 46
Huffman lake ... 11, 13
Conglomerate, photo ... 12
Huffman tp ... 1, 2
Gold ... 28
Rocks ... 7-9, 12, 15
iron formation ... 9, 23
porphyry ... 18
Hunting. *See* Game.
Hurd, W. E., gold claim ... 56
Huron, Lake. *See* Lake Huron.
Huronite ... 19
Huycke, F. G. ... 2
Hydro-Electric Power Commission ... 47

I

Ilmenite ... 25
Iron formation.
Keewatin.
Opeepeesway Lake area ... 6, 9, 11
ore, low grade ... 23
quartz veins in ... 29
Strathy tp ... 50, 51
quartz veins in ... 55
Timiskamian, Opeepeesway L. area ... 6, 15

J

Jackson-McNab gold claims ... 56
James, E. B. ... 45
Jasper ... 11, 15
Jessop, J., gold claims ... 28, 29
Jessop-Seery gold claims ... 33, 36
See also Groundhog Gold Mines.
Johnson, Frank L. ... 23

K

Kanichee lake ... 48-50
Kaolin-sericite-carbonate schist ... 12
Keewatin series.
Horwood Lake area ... 32
Opeepeesway Lake area ... 6-11
Strathy tp ... 50, 51
Kenty Gold Mines, Ltd. ... 38
Keweenawan diabase.
Horwood Lake area ... 33
Opeepeesway Lake area ... 6, 19
Strathy tp ... 52
Kirkland Lake, basalt analysis ... 10
Knight, C. W. ... 49, 50, 52

L

Lacustrine deposits ... 6, 20
Laird, H. C. ... 2, 3
Reports by:
on Horwood Lake area ... 31-37
on Opeepeesway Lake area ... 1-30
on Swayze-W. Shiningtree areas ... 38-47

PAGE
Lake Caswell Mines, Ltd.
Developments; plant, photo ... 41, 42
Lake Huron, gold mg. ... 57
Lamprophyre ... 6, 19
Landry-Taylor gold claims ... 37
Location, map showing ... *facing* 32
Porphyry ... 33
Lava flows.
See also Andesite; Basalt; Dacite; "Grey lava."
Horwood Lake area ... 32
Opeepeesway Lake area ... 5-7, 21
Strathy tp ... 50
Lead. *See* Galena.
Lee lake ... 38, 39
Lee Gold Mines, Ltd. ... 39
Property, aerial view ... 38
Lefever, J. E. ... 2
Gold claims ... 36
location, map showing ... *facing* 32
Leith, C. K. ... 2, 23
Limestone (Cobalt series) ... 57
Limonite ... 9, 11
Little Dan vein ... 53
Little Rice lake ... 4, 9, 12
Little Rush lake ... 17, 20, 23
Little Rush river ... 9
Longlac Adair Mines, Ltd. ... 55
Lynx ... 5

M

McClintock, Wm. ... 2
McDonnell, Duncan J., gold claims ... 46
MacGregor, J. G. ... 54
McKinnon tp. ... 57
Gold mining ... 61
McLeod, W., gold discovery ... 23
McMillan Gold Mines, Ltd.
Property, geology and workings ... 57-60
Macmurchy tp., gold mining ... 40-44, 46
McVittie, Wm., Estate ... 43
Magnetite.
Opeepeesway Lake area ... 9, 19, 29
Strathy tp ... 51, 55
Malachite ... 28
Mallard lake ... 3
Mallard tp. ... 1
See also Woman r.
Anticline ... 22
Gold deposits ... 23-28
Rocks ... 7-9
porphyry ... 19
quartz diorite ... 17, 18
mineralized, photo ... 17
Timber ... 4
Topography; drainage ... 3
Maltby gold claims ... 28
Manitoba and Eastern Mines, Ltd. ... 49
Property, geology and workings ... 51-54
Map, geological, coloured (No. 44g). *in pocket*
Maps, geological, sketch.
See also Plans, geological.
Horwood Lake area ... *facing* 32
Lake Caswell g. m. ... *facing* 42
Manitoba and Eastern g. m. ... *facing* 52
Strathy tp. ... *facing* 50
Woman River g. m. ... 26
Maps, key.
Opeepeesway Lake area ... 1
Strathy tp. ... 48

PAGE
Maps, notes on.
Opeepeesway Lake area 5
Strathy tp 49
Maps, sketch.
See also Plans.
Bilmac g. m. 44
Ferland-Gauldie-Mogridge g. claims. 24
Woman River g. m., workings 27
Marion tp 18
Matachewan formation.
See also Diabase.
Horwood Lake area 33
Opeepeesway Lake area 6, 19
Matagaming lake. *See* Horwood l.
Mattagami lake 46
Miller, W. G. 2, 31
Milne, Frank 39, 41
Mining claims.
See also Occupation license; S., T. R., T.R.S., T.R.T., W.D., and W.S. g. claims.
20,506 25
23,961 28
24,362, 24,364 29
24,797 23
24,851 28
25,069 28
54,782 60
Mink 5
Mogridge, L. 25
Mogridge, W. 25
Mogridge gold claims. *See* Ferland-Gauldie-Mogridge g. claims.
Mongowin tp.
Mining activity, notes by H. C. Rickaby 57-61
Montreal river 46
Moore, E. S. 57
Moore, Mortimer 47
Moose 5
Moose lake. *See* Evangeline l.
Moramo Gold Syndicate.
Property, geology and workings 35, 36
location, map showing ..... *facing* 32
Test pit, photo 35
Morris, Peter B. 28
Morse, A. L. 2
Muskegs 3
Muskrat 5

N

Natural resources, Opeepeesway L. area 4, 5
Navigable waterways. *See* Canoe routes.
Net lake 48, 49
Neville Canadian Gold Mines, Ltd.
Operations; plant, photo 40, 41
Newton tp 34
Nickel ore, Strathy tp. 48, 51, 54
Nipissing diabase 57, 59-61
Nipissing district. *See* Strathy tp.
Nipissing Mining Co., Ltd. 33, 36
North arm, Opeepeesway l. 4
Agglomerate, photo 8
Keewatin sediments 11
Lava flows 7, 8, 21, 22
Tuff, structure 21
Northeast arm, Horwood l.
Tuffaceous sediments 32
Northern Aerial Canada Golds, Ltd.
Property; mineralization 23
Northern Aerial Mineral Exploration Syndicate 23
Northern Securities Co. 60
Northwest arm, Opeepeesway l.
Character 4
Gold claims near 23
Greywacké 15
cross-bedded, photos 14, 21

O

Occupation license No. 2,177 52
Olivine diabase.
Horwood Lake area 33
Mongowin tp 57, 59
Opeepeesway Lake area 6, 19
Strathy tp 52, 54
O'Neill, C. E.
Gold claims.
Horwood L. area ..... *facing* 32, 37
Opeepeesway L. area 28, 29
Opeepeesway lake.
See also East, North, and Northwest arms.
Character 4
Fish; fur; game 5
Gold claims near 28
Muskegs 3
Rocks 1, 13-16, 22
Opeepeesway Lake area.
Geology, report by H. C. Laird 1-30
Map, geological, coloured (44g) ..... *in pocket*
Opeepeesway r. 4
Gold claims near 25
Rocks 9, 18
Osway tp 1, 3
Eskers 3, 20
Rocks 7-9, 12, 13
iron formation 23
structure 20
Timber; waterfalls 4
See also Opeepeesway l.
Overburden, heavy.
Horwood Lake area 33, 37
Strathy tp 48
Oxidation. *See* Gossan, gold in.

P

Parks, W. A. 2, 31
Partridge 5
Peat 6, 20
Pentlandite 54
Peridotite 48, 54
Nickel ore assoc. with 51
Pickerel 5
Pike 5
Pillow structure 7, 32, 35, 36
Pine 4
Plan, geological.
See also Maps, geological, sketch.
Moramo Gold Synd., showings. *facing* 36
Plans.
See also Maps, sketch.
Bousquet g. m., workings ..... *facing* 60
L. Caswell g. m., workings 42, 43
McMillan g. m., drag folds 58
Thorne g. claims, workings 34
Platinum metals 52, 54
Pleistocene. *See* Glaciation.
Porcupine-Kirkland Gold Mines, Ltd. 46

PAGE
Porphyritic diabase.
See Quartz diabase.
Porphyritic diorite 32
Porphyritic greenstone 50, 55
Porphyritic lava 10
Porphyry.
See also Feldspar, Granite porphyries; Quartz diorite; Quartz porphyry.
Acid, related to gold deposits 32
Macmurchy tp 46
Opeepeesway Lake area 29
Power.
See Electric power; Water power.
Pre-Algoman intrusives.
Strathy tp 51, 53
Pre-Cambrian.
Horwood Lake area 32, 33
Opeepeesway Lake area 6-19
Strathy tp 50-52
Prospectors, notes for 1, 29, 30, 34
See also Gold.
Provincial Assay office 10
Pulpwood 4
Pyrite.
Horwood Lake area 34-37
Mongowin tp. and vicinity 57, 60, 61
Opeepeesway Lake area 9, 11, 23, 25, 28, 29
Strathy tp 53-55
W. Shiningtree area 45, 46
Pyroclastics 10, 50, 51
See also Agglomerates; Breccia; Tuffs.
Pyrrhotite.
Asquith tp 45
Horwood Lake area 35
Mongowin tp 57, 60
Opeepeesway Lake area 9
Strathy tp 54-56

Q

Quartz diabase 6-19
Quartz diorite.
Horwood Lake area 33, 34
Opeepeesway Lake area 17, 18
mineralized 23, 30
photo 17
Quartz-feldspar porphyry.
Asquith tp 45
Horwood Lake area 37
Opeepeesway Lake area 6, 19, 25, 27
Quartz-hornblende schist 8
Quartz porphyry.
Horwood Lake area 33, 35
Opeepeesway Lake area 6, 18, 19, 25
Strathy tp 48, 51-53
Quartz-sericite schist 9
Quartz veins, auriferous.
See also Geology, economic.
Asquith tp., photo 44
Horwood Lake area 32
Opeepeesway Lake area 30
Quartzite.
Bruce, Cobalt series, Mongowin tp 57, 60, 61
Keewatin.
Horwood Lake area 32
Opeepeesway Lake area 6, 8
Timiskamian, Opeepeesway L. area 11, 15
Quartzite conglomerate 13
Quaternary. *See* Glaciation; Recent deposits.

R

PAGE
Rae lake 3
Ramparts, river 4, 6, 20
Ramsay ck 9, 31
Character 4
Islands near mouth 14, 15, 22
Muskeg 3
Recent deposits 20, 52
Rhyolite breccia 32
Ribble Mines, Ltd 40
Ribble vein 41
Rice lake 9
Rickaby, H. C 2, 3, 28
Notes by, on Mongowin tp. and vicinity 57-61
Ridout series, Opeepeesway L. area.
Age; correlation 6, 15, 16
Distribution and lithology 11-15
Structure 12, 20-22
Roads.
Mongowin tp 57
Opeepeesway Lake area 2
Strathy tp 55
W. Shiningtree area 47
Rush Lake area 11, 18
Rush river 2, 31
Russell, Bruce 1

S

S. 22,549 g. claim 37
S. 24,974 g. claim 34
S. 25,339 g. claim 36
S. 25,369 g. claim 35
S. 25,395 g. claim 36
Sakatawi (Rush) lake 18
Sams lake 46
Sand. *See* Glacial, Recent deposits.
Sand dunes, fossil 3
Satterly, Jack 1
Savage, W. S.
Report by, on part of Strathy tp 48-56
Schists 6, 7, 12
Mineralized. *See* Shear zones.
See also Chlorite-carbonate, Hornblende, Quartz-sericite, Sericite schists.
Scoria 7
Sedimentary rocks.
See also Bruce, Cobalt, Ridout series.
Opeepeesway L. area.
contact with volcanics 16
Keewatin 6, 8, 11
Timiskamian. *See* Ridout series.
Sericite schist 6, 10, 25
See also Quartz-sericite schist.
Serpent quartzite 57, 60
Serpentine, Strathy tp 48, 50
Nickel ore associated with 51, 54
Shear zones, mineralized.
See also Fracture zones.
Horwood Lake area 35
Mongowin tp. and vicinity 60, 61
Opeepeesway Lake area 24, 25
Strathy tp 55
Shiningtree, gold mg. near 43, 46
Shortt, B. R 46
Sigmoidal drag fold, photo 22
Silver.
Opeepeesway Lake area 23, 25, 28, 29
Strathy tp 54
Sketch maps. *See* Maps, sketch; Plans.

PAGE
Slate.
Macmurchy tp., quartz veins in..... 46
Opeepeesway L. area..... 6, 15
Smith, Wm., gold claim.....*facing* 32, 36
South arm, Horwood l.
Gold claims.....35, 36
Specularite..... 28
Sphalerite.....36, 45
Spherulitic lava..... 50
Spruce..... 4
Spruce Falls Pulp and Paper Co..... 5, 33
Stackpool..... 2
Strathy Basin Mines, Ltd..... 55
Strathy tp.
Geology, report by W. S. Savage.... 48-56
map, sketch.....*facing* 50
Striae. *See* Glaciation.
Strong, Horace..... 39
Structural geology. *See* Geology, structural.
Sudbury district.
See Horwood L. area; McKinnon, Mongowin tps.; Opeepeesway L. area; Tp. 11.
Sulphides. *See* Arsenopyrite; Chalcopyrite; Galena; Pentlandite; Pyrite; Pyrrhotite.
Sultan..... 2
Surveys. *See* Explorations, early.
Swayze area.
Developments, notes by H. C. Laird..38, 39
Swayze-Huycke Gold Mines, Ltd..... 38
Swayze river.....31, 32
Gold discoveries near..... 33
Swayze River gold claims.
See Thorne, G. A.
Swayze tp., gold mining..... 38
Syenite, quartz veins associated with.. 29
Syenodiorite..... 32
Synclines.....12, 20, 22

T

Tamarac..... 4
Tanton, T. L.....31, 32
Temiskaming and Northern Ontario Railway..... 48
Thomson, Ellis.....2, 11, 13, 15
Thorne, G. A.
Gold claims, geology and workings...34, 35
location, map showing.....*facing* 32
Timagami, gold mg. near..... 52
Timagami Provincial Forest..... 48
Timber..... 4
Timiskamian period.....6, 15, 16
See also Ridout series.
Timiskaming series..... 5
Timmins Corporation, N. A..... 25
Tionaga..... 31
Todd, E. W.....32, 49, 50, 52
Topography.
Opeepeesway Lake area..... 3, 20
Strathy tp..... 48
Tough, Bob. *See* Bob Tough Gold Mines.
Tough, George..... 23
Tourmaline.....28, 29, 36
Township 11, Sudbury dist.
Gold mining.....57, 60, 61
T. R. 3,187 g. claim.....48, 50-52, 54
T. R. 3,484 g. claim..... 50
Transportation.
See also Canoe routes; Roads.
Opeepeesway Lake area..... 2
West Shiningtree area..... 47
Trapping..... 5
T.R.S. 4,569, 4,570 g. claims..... 46
T.R.S. 6,699 g. claim..... 45
T.R.T. 1,623 g. claim .....50, *facing* 52, 54
T.R.T. 4,318 g. claim..... 56
T.R.T. 4,413, 4,426, 4,427 g. claims... 48
T.R.T. 4,444 g. claim ....*facing* 50, 51, 55
T.R.T. 4,445 g. claim.....*facing* 50, 51, 55
T.R.T. 4, 577 g. claim..... 56
Tuffs.
See also Pyroclastics.
Horwood Lake area..... 32
Opeepeesway Lake area.....6, 7, 21
minerals associated with..... 25

V

Veins, quartz.
See Quartz veins, auriferous.
Vesicular structure..... 32

W

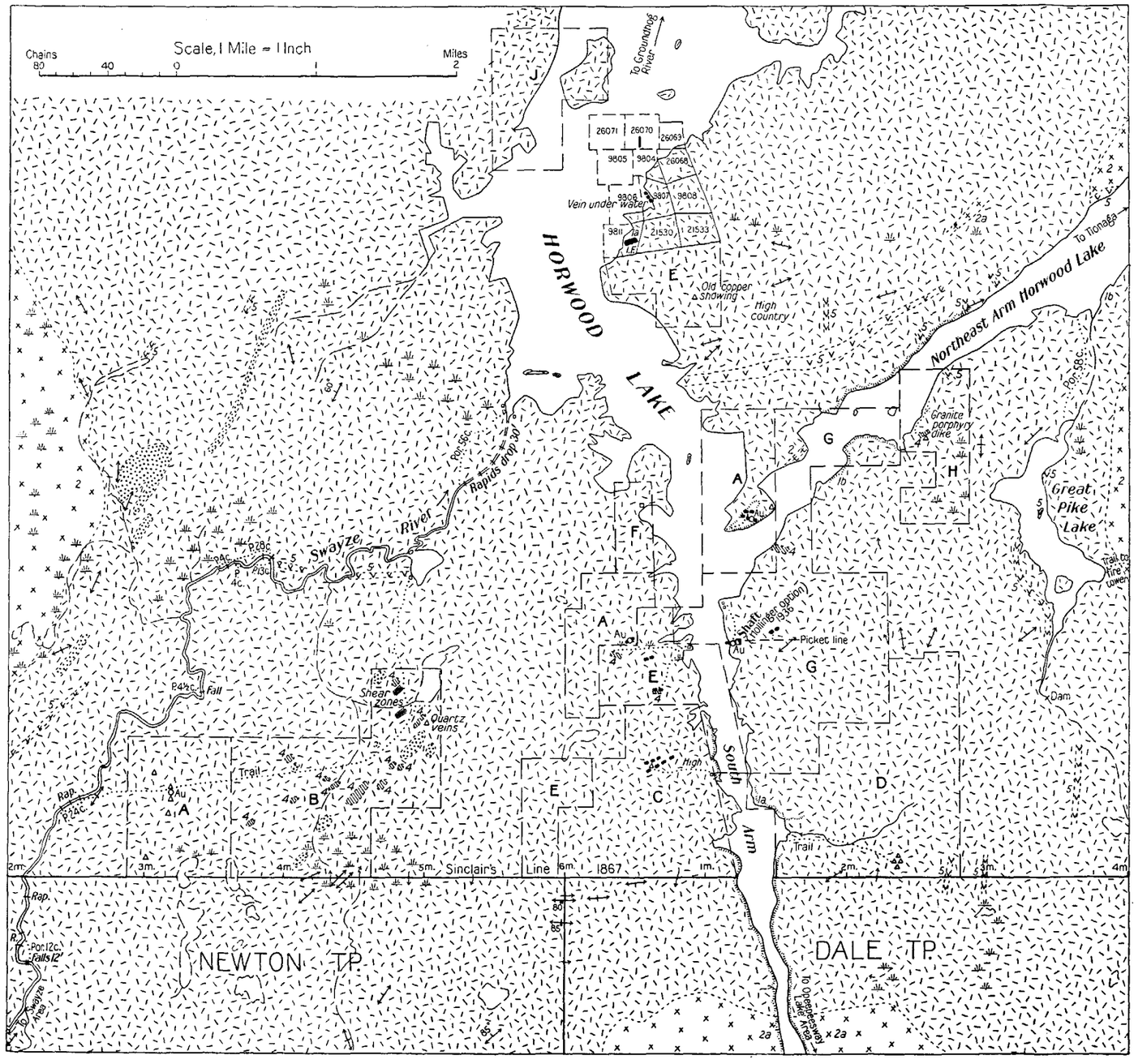
Wakami river.
Character; navigation..... 2, 3
Rocks.....10, 11, 13, 15
porphyry..... 18
Wasapika Consol. Mines, Ltd..... 41
Wasapika Gold Mines, Ltd..... 41
Wasapika section, W. Shiningtree area.
Mining developments..... 39-43
Water power..... 5
See also Electric power.
Waterways. *See* Canoe routes.
W.D. 340 g. claim..... 51
W.D. 409 g. claim..... 51
W.D. 598 g. claim.....50, *facing* 52, 53
Weasels..... 5
West Shiningtree area.
Developments, notes by H. C. Laird..39-47
West Tree Mines, Ltd..... 41
White Rock Mining Co., Ltd..... 43
Woman river..... 1
Character; navigability..... 3, 4
Rocks.....11, 12, 19
Woman River..... 2
Woman River Gold Mines, Ltd.
Property, mineralization.....25, 28
porphyry, types.....19, 25
sketch map of claims..... 26
Woman River Gold Syndicate..... 25
Woman River iron range..... 11
Wright, Jack..... 2
W.S. 13 g. claim.....51, *facing* 52, 53
W. S. 14 g. claim .....50, *facing* 52, 53

Y

Yeo tp..... 4

Z

Zinc blende. *See* Sphalerite.
Zoisite..... 10



SKETCH MAP OF A PART OF THE HORWOOD LAKE AREA SHOWING THE GENERAL GEOLOGY AND THE LOCATION OF THE VARIOUS PROPERTIES.

LEGEND

Keweenawan and Matachewan

- *Diabase dikes; olivine diabase (5).*

Algoman

- *Dikes and small bosses of quartz and feldspar porphyry; granite porphyry (4).*
- *Quartz diorite, diabase, gabbro-diorite.*
- *Biotite granite and granodiorite; hornblende granite (2); syenodiorite (2a).*

Keewatin

- I.F. *Iron formation.*
- *Intermediate to basic lavas, mainly andesite, and their schistose derivatives; agglomerate (1a); chloritic tuff and impure quartzite (1b).*

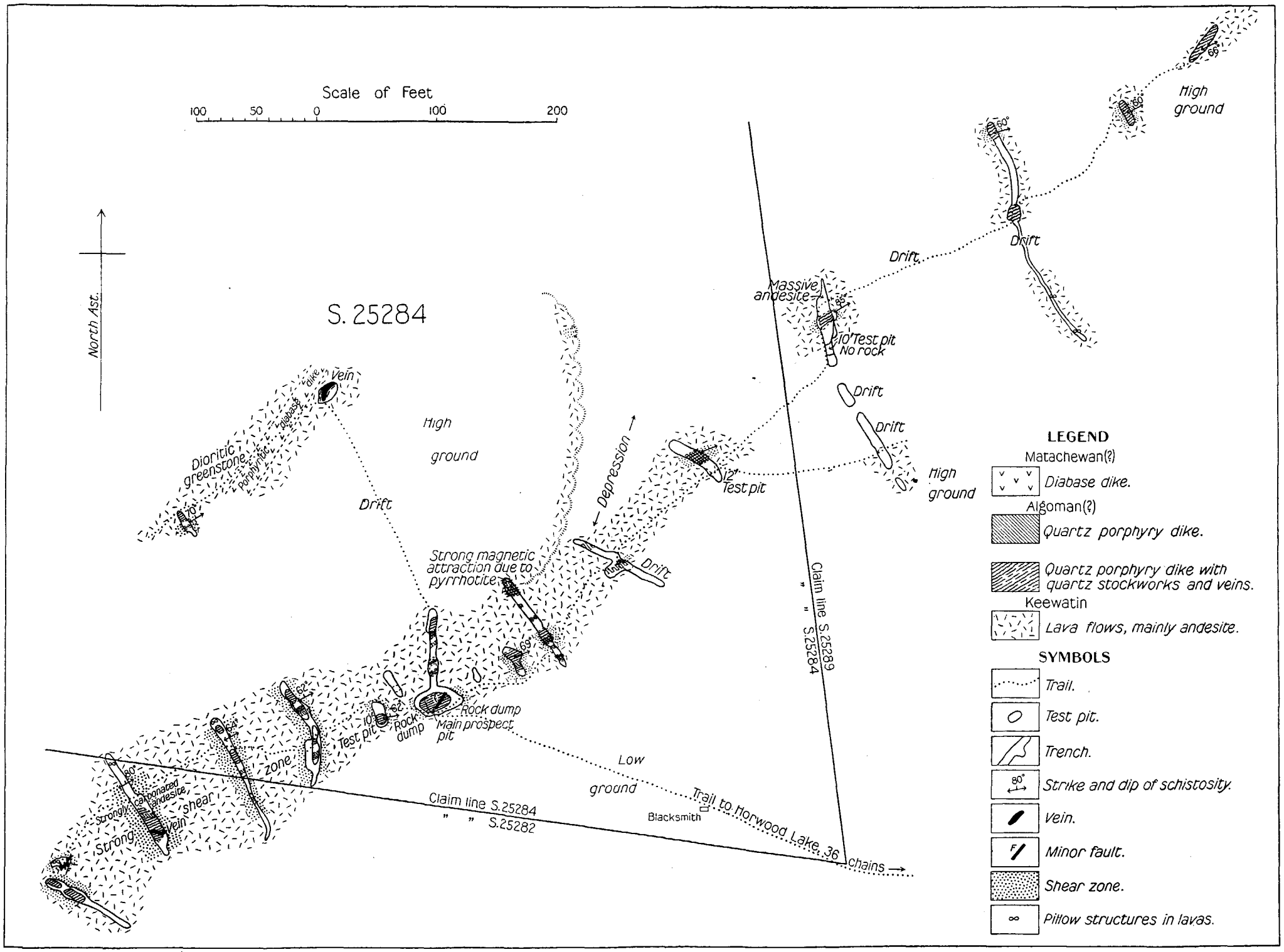
SYMBOLS

- *Mill*
- *Muskeg.*
- *Trail or portage.*
- *Boundary of group of claims, (approximate).*
- *Cabin.*
- *Prospect showing.*
- *Strike and dip of schistosity.*
- *Strike of vertical schistosity.*
- *Geological boundary (approximate).*
- *Quartz veins, mineralized.*
- *Shear zone, carbonated.*
- oAu *Visible gold.*

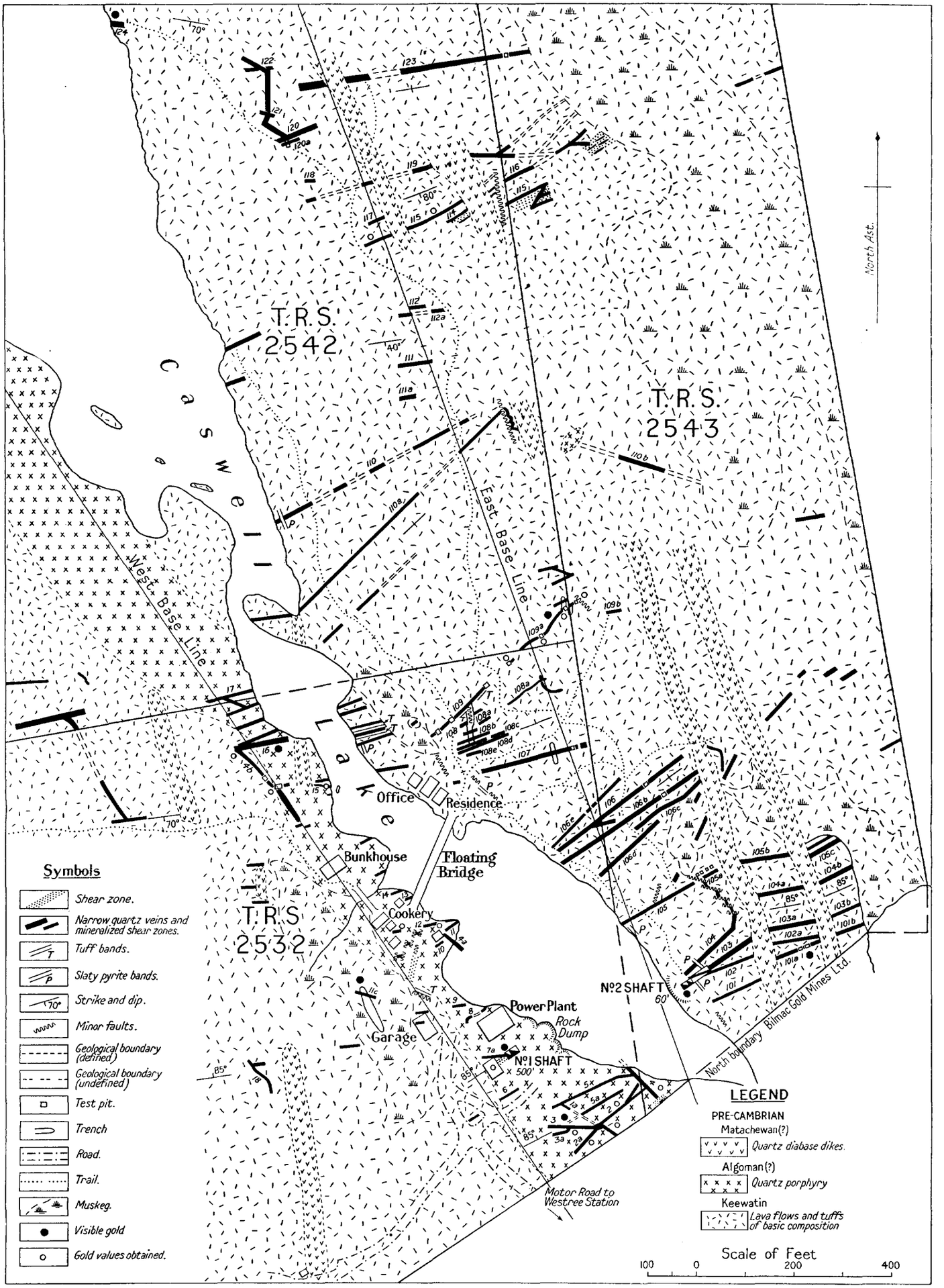
Magnetic declination 7° west (approximate) 1934.

KEY TO GROUPS OF CLAIMS

- **A** G.A. Thorne.
- **B** Landry-Taylor.
- **C** Moramo Gold Syndicate.
- **D** Cambach Syndicate.
- **E** Lefever-Anderson.
- **F** J. Burke.
- **G** Wm. Smith.
- **H** J.C. Dunn.
- **I** Groundhog Gold Mines Ltd. (12 Surveyed Claims).
- **J** C.E. O'Neill.

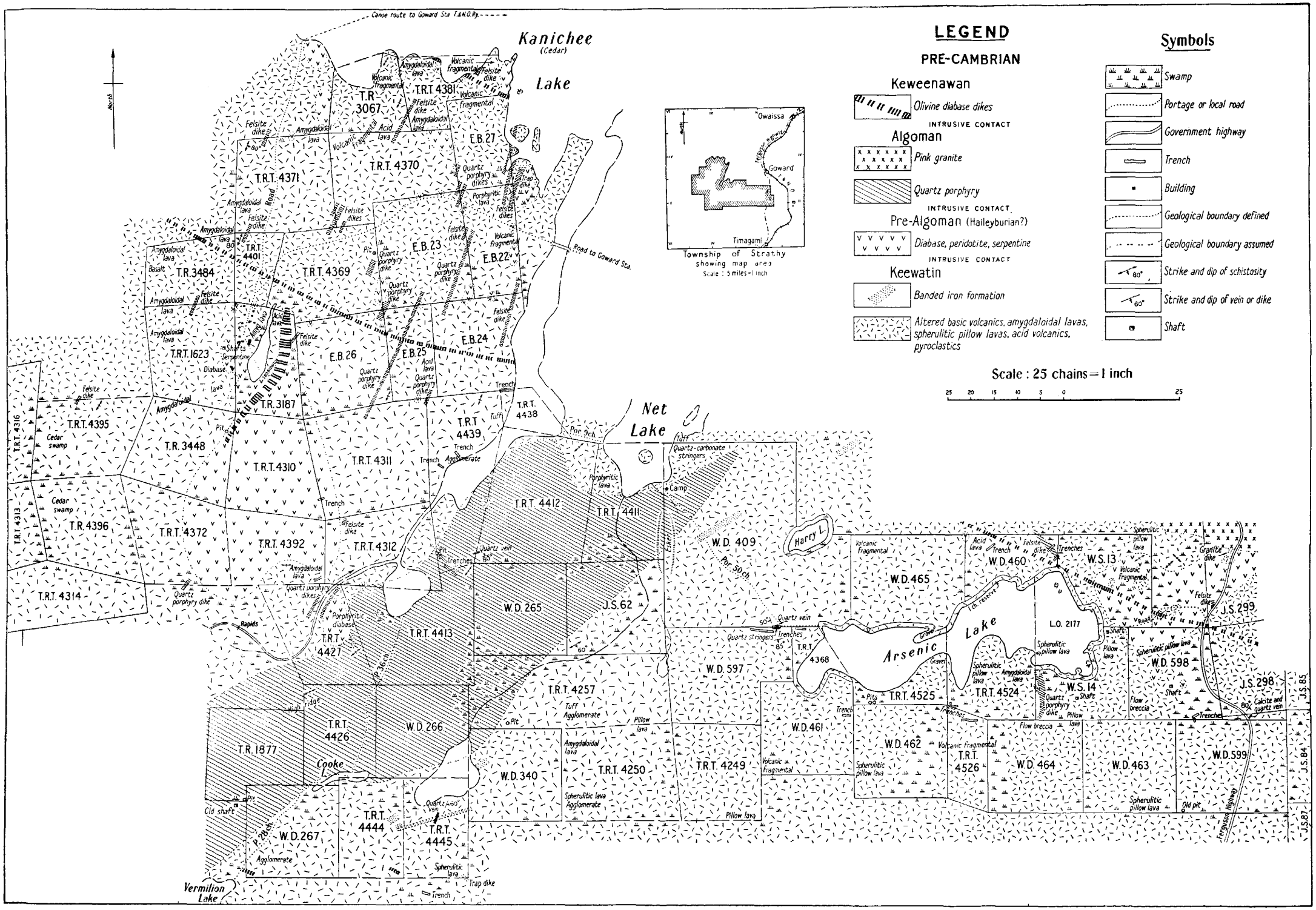


GEOLOGICAL PLAN OF THE MAIN SHOWINGS ON THE PROPERTY OF THE MORAMO GOLD SYNDICATE, HORWOOD LAKE AREA.

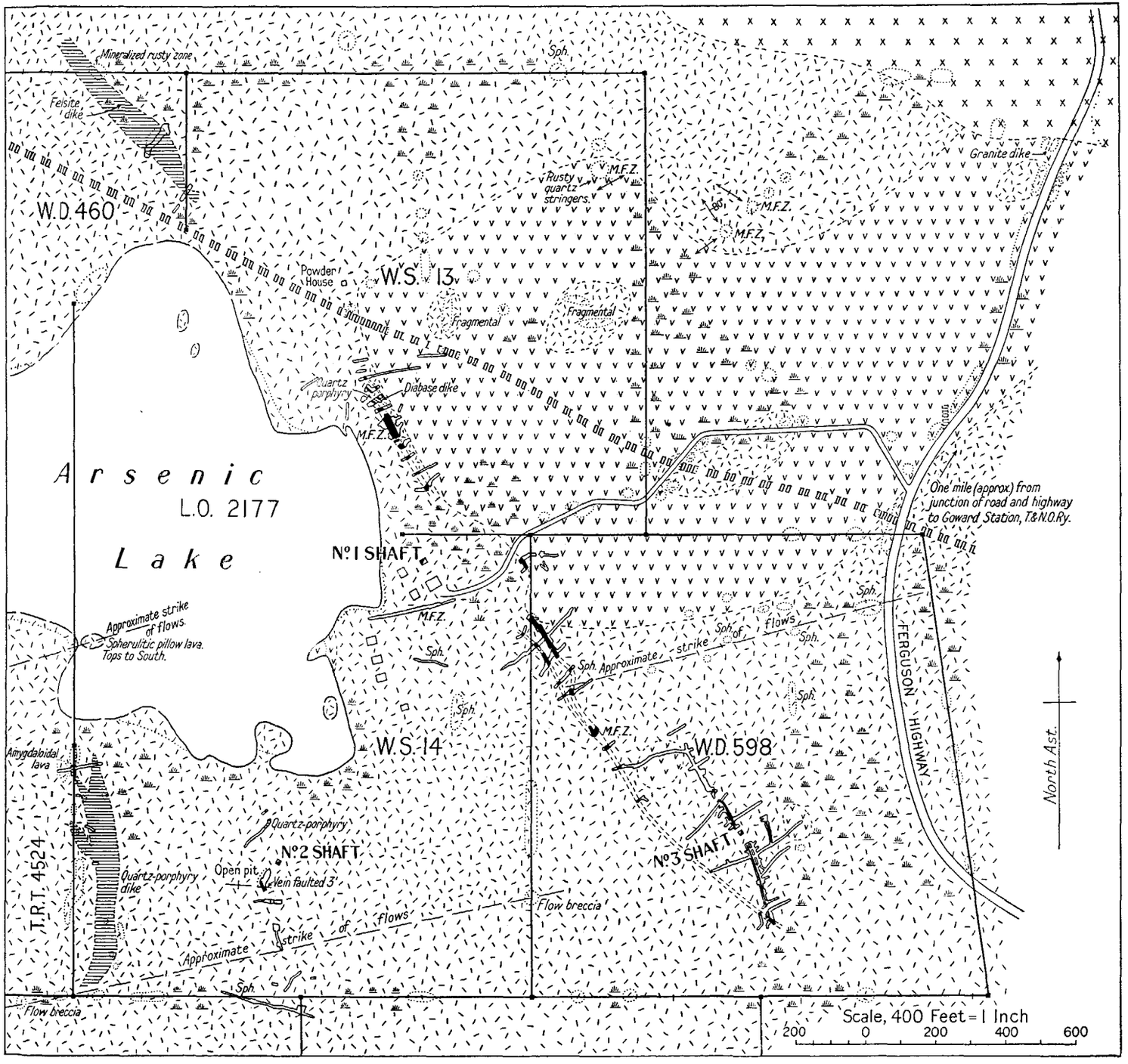


SKETCH MAP OF A PART OF THE PROPERTY OF LAKE CASWELL MINES SHOWING THE GENERAL GEOLOGY, VEIN SYSTEM, AND SHAFT LOCATIONS.

(Information compiled from plans submitted by company officials, 1934.)



GEOLOGICAL SKETCH MAP OF PART OF STRATHY TOWNSHIP.



LEGEND

PRE-CAMBRIAN

Keweenawan

- Olivine diabase dikes.

Algoman

- Granite.
- Felsite and quartz-porphyry dikes. (Algoman?)

Haileyburian?

- Green diabase.

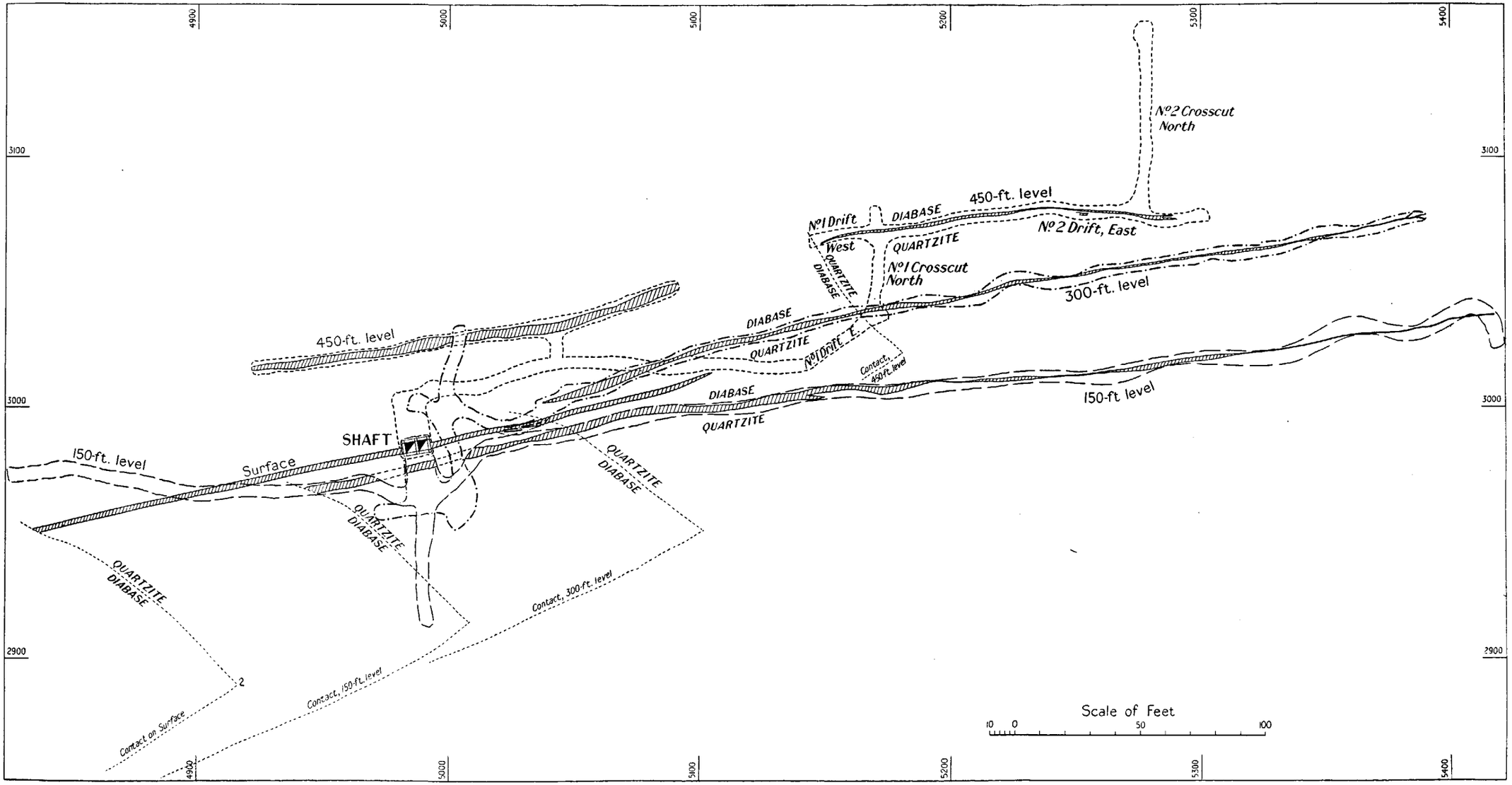
Keewatin

- Basic lava flows. Amygdaloidal and spherulitic lavas, pyroclastics.
- Quartz veins.

Symbols

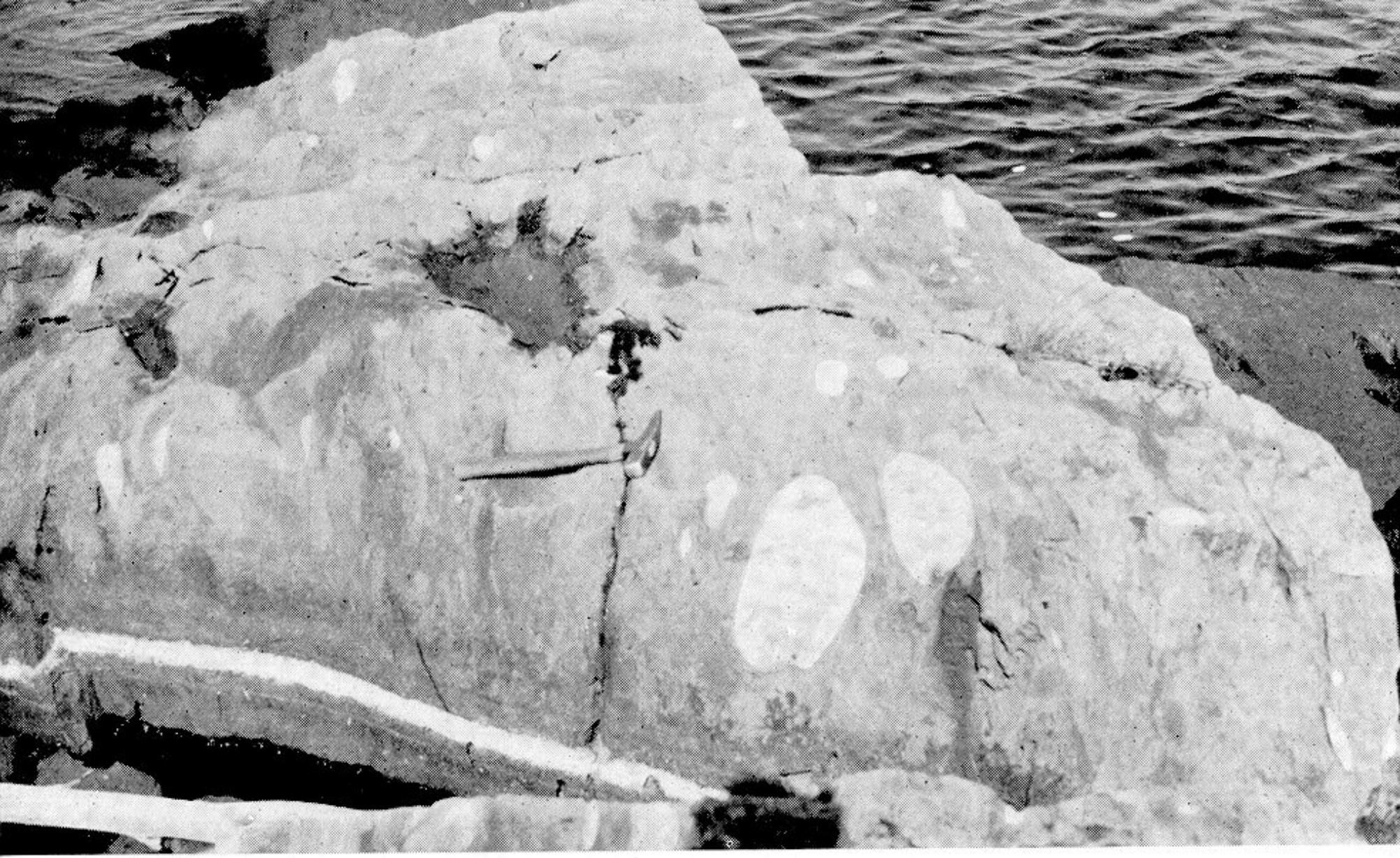
- Swamp.
- Building.
- Trench.
- Rock outcrops observed.
- M.F.Z. — Mineralized fracture zones.

GEOLOGICAL SKETCH MAP OF THE MAIN SHOWINGS ON THE PROPERTY OF MANITOBA AND EASTERN MINES, LIMITED, STRATHY TOWNSHIP, SEPTEMBER, 1934.



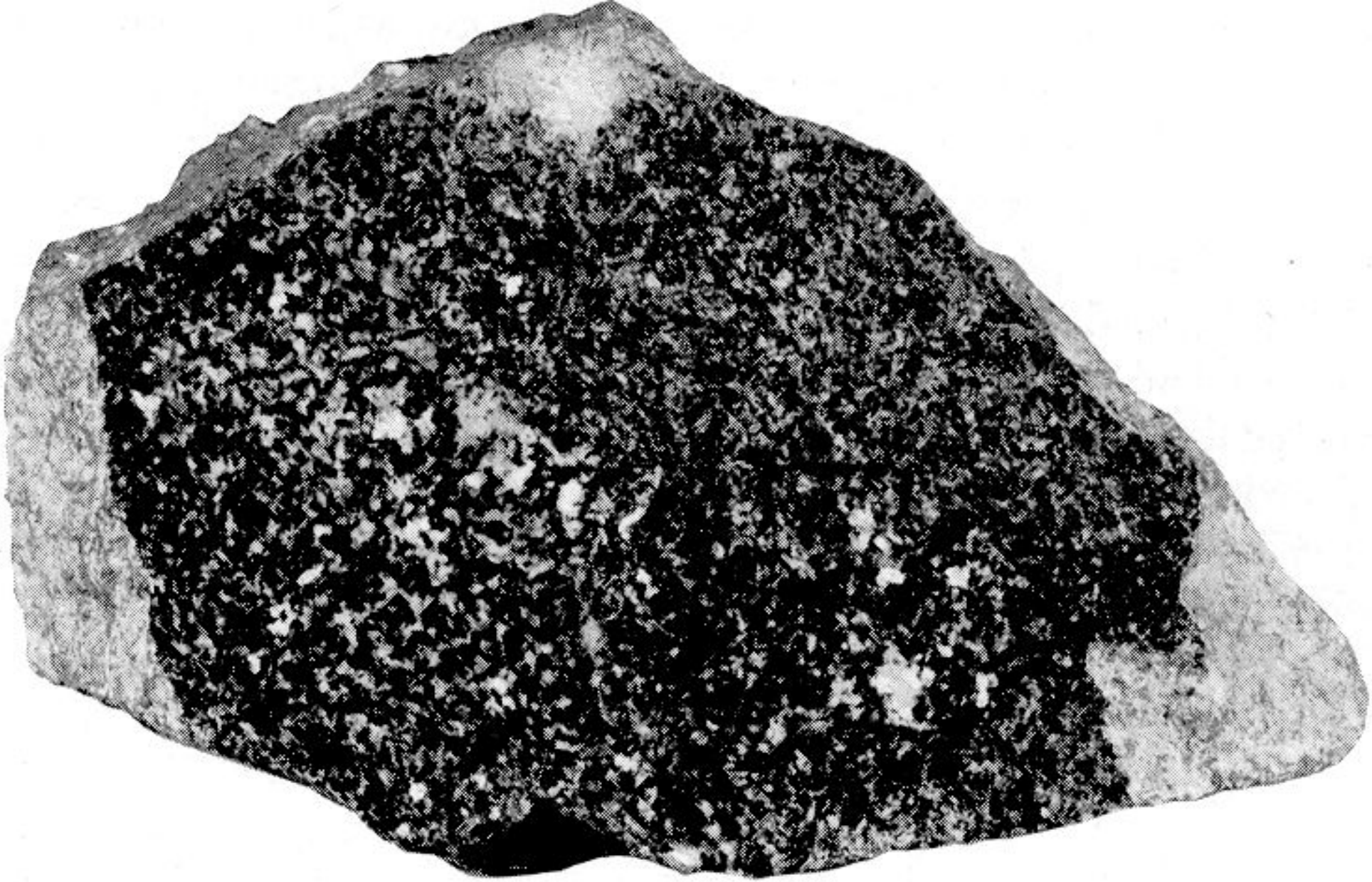
COMPOSITE PLAN OF WORKINGS, BOUSQUET MINE, FEBRUARY, 1936.

(From information supplied by the company.)





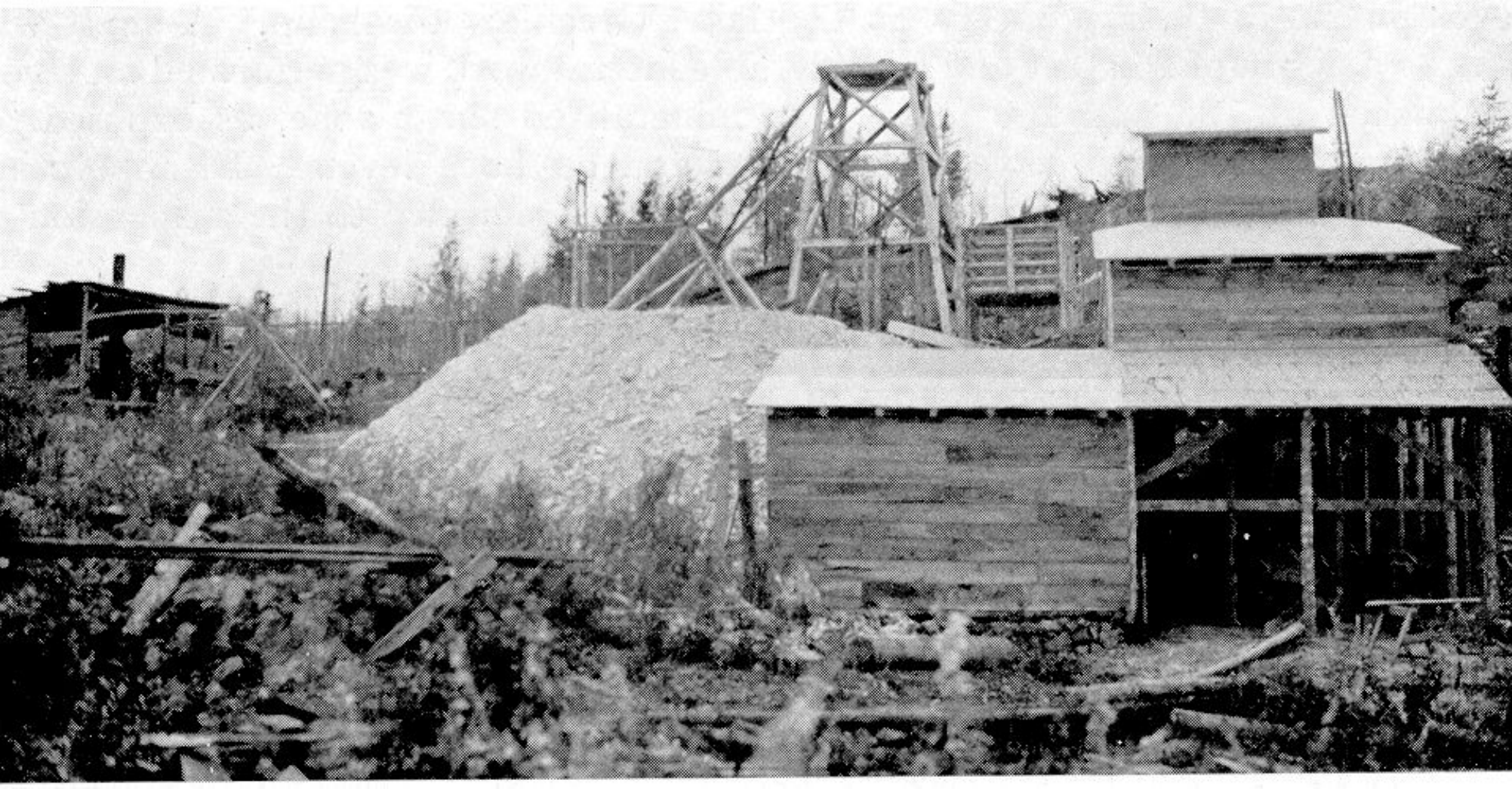






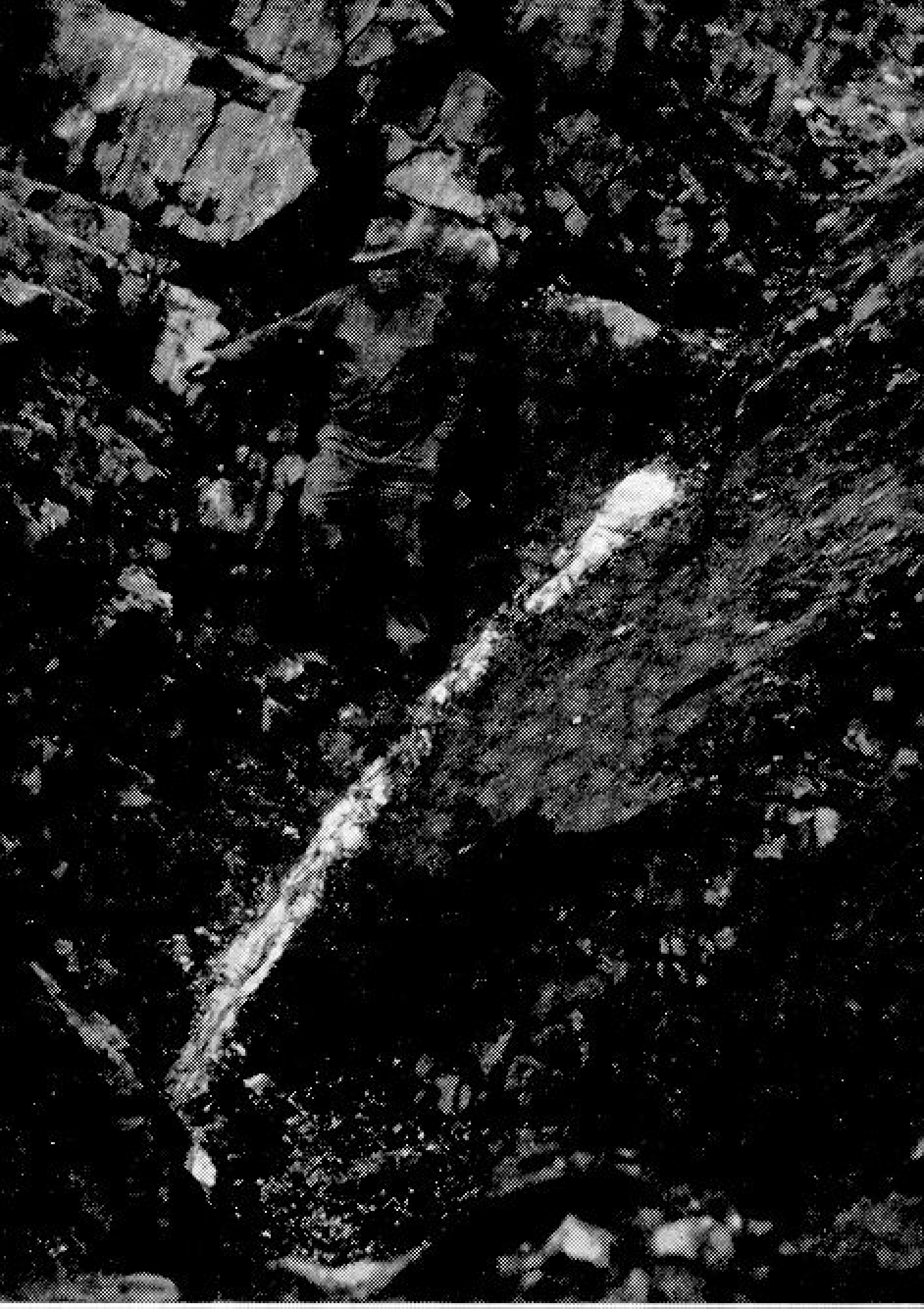


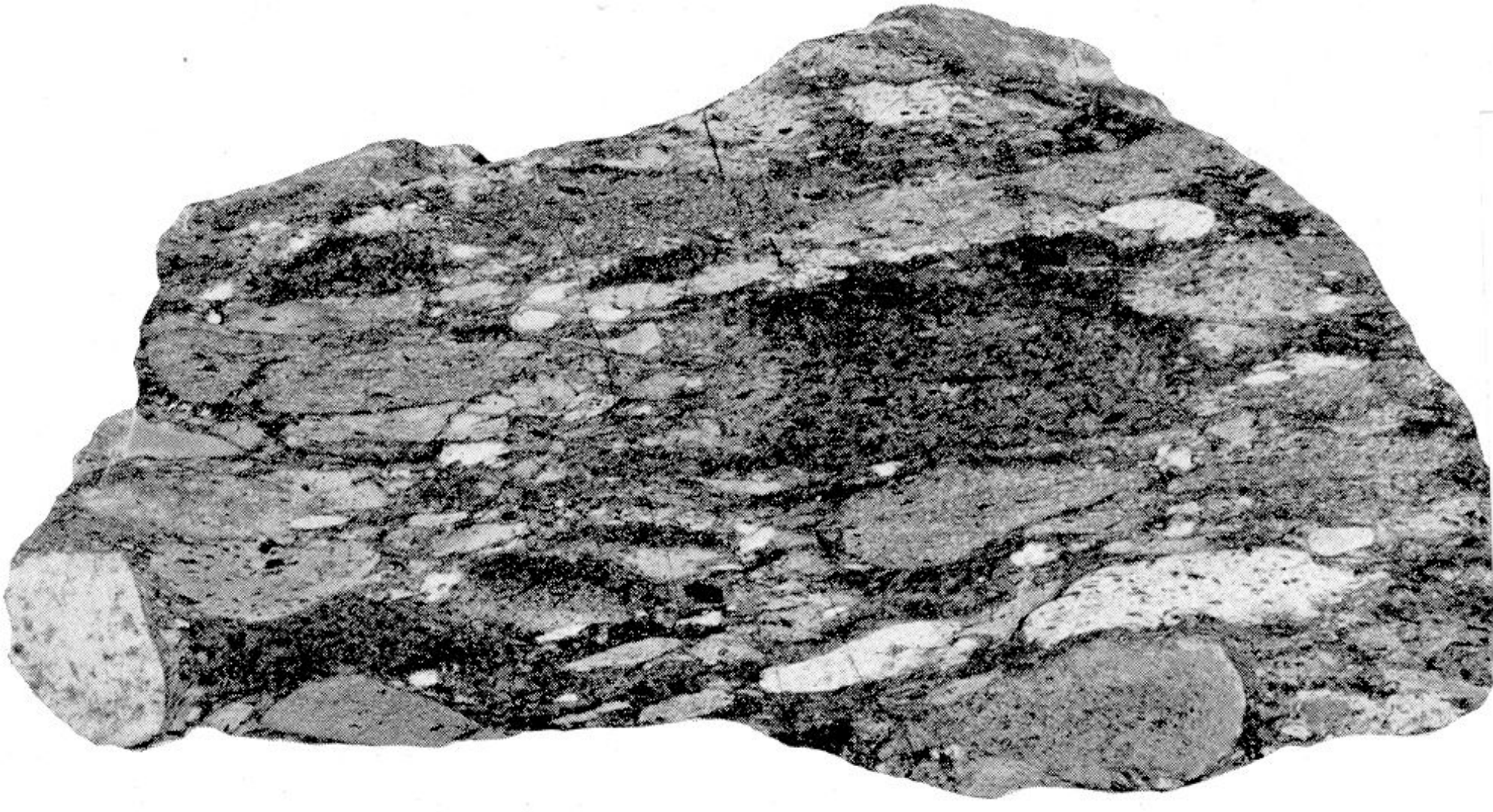












Box # 2

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* T. F. SUTHERLAND, *Deputy Minister*

FORTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLIV, PART VIII, 1935

The Michipicoten-Missinaibi Area, by E. M. Burwash - - 1-26

Geology of the Lochalsh-Missinaibi Area, by E. M. Burwash - 27-38

The Ore Deposits of the Michipicoten Area, by M. H. Frohberg 39-83

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TABLE OF CONTENTS

Vol. XLIV, Part VIII

THE MICHIPICOTEN-MISSINAIBI AREA

PAGE

Introduction 1
Historical Sketch 1
Field Work 4
Acknowledgments 4
Review of Previous Geological Work 4
Description of Properties 9
Goudreau-Lochalsh Area 9
Kozak Gold Mines, Limited 9
Algoma Summit Gold Mines, Limited 10
Edwards Gold Mines, Limited 12
Markes Claims 13
Archer-Crawford Claims (Boundary Lake) 13
Cline Lake Gold Mines, Limited ... 14
Algoma Exploration Company, Limited 14
Near Hawk Junction 17
Soocana Mining Company, Limited 17
Holdsworth Claims 17
Reed-Booth Claims 18
Ohio Gold Syndicate 18
Murray-Algoma Mining Company, Limited 18
Claim S.S.M. 2,591 19
Michael-Boyle Property 19
Appendix—Bibliography of the Michipicoten-Missinaibi Area, 1847–1935 20

GEOLOGY OF THE LOCHALSH-MISSINAIBI AREA

Introduction 27
The Map-Sheet 27
Acknowledgments 28
Topography 28
Lumbering 28
Water Powers 29
Access and Communications 29
Population and Industries 29
Fish and Game 29
Climate and Soil 30
Previous Geological Work 30
General Geology 31
Haileyburian (?) 32
Petrology 32
Algoman 33
Observed Phases of the Algoman .. 34
Keweenawan 34
Pleistocene 37
Recent 37
Description of Properties 38
Charlebois-Cristakos 38
White Discovery 38

THE ORE DEPOSITS OF THE MICHIPICOTEN AREA

PAGE

Introduction 39
History of the Area 39
Field Work and Acknowledgments 40
Bibliography 40
General Geology 40
Keewatin 42
Laurentian 43
Timiskaming 43
Haileyburian 44
Algoman 44
Keweenawan 45
Younger Diabase Dikes 45
Lamprophyre Dikes 46
Pleistocene 48
Structural Geology 48
Folding 48
Fracturing and Faulting 49
Intrusive Structures 50
Economic Geology 51
The Gold Deposits 51
General Character of the Deposits .. 51
Mineralogy of the Deposits 54
Quartz 54
Carbonates 55
Tourmaline 56
Hornblende 57
Gold 57
Arsenopyrite 58
Pyrrhotite 60
Cubanite 60
Pyrite 61
Marcasite 62
Chalcopyrite 62
Sphalerite 63
Galena 63
Hydrothermal Alteration of the Wall Rock 63
The Feldspar-Carbonate Veins 68
Genetic Considerations 71
Mineral Sequence 71
Ore Shoots 73
Description of Properties 74
Mackey Point Gold Mines, Limited .. 74
Wa Wa Gold Fields, Limited 76
Stanley Gold Mines, Limited 76
Minto Gold Mines, Limited 77
Parkhill Gold Mines, Limited 78
S. B. Smith Mine 79
Deep Lake Mine 80
Darwin Gold Mines, Limited 81
Centennial Mine 83

ILLUSTRATIONS

PAGE

Portage between Crooked and Missinaibi lakes 2
Headframe, Kozak mine 8
Photomicrograph of vein material, Algoma Summit mine 10
Specimen of schist in a shear zone, Algoma Summit mine 11
Faulted quartz vein on the property of the Algoma Exploration Company 15
View northward from the summit of Helen mountain 35
Lode formed by quartz filling in fracture cleavage, Michael Syndicate property 36
Inclusions of country rock in a lamprophyre dike, Darwin mine 47
Surface exposure of the Nyman vein, Darwin mine 50
Drift face, Parkhill mine, showing the shear zone with stringers of gold-bearing quartz and carbonate 52
Vertical section of the Grace vein, Darwin mine 53
Footwall section of the Jubilee vein, Jubilee mine 54
Specimen of quartz from the Grace vein, Darwin mine 55
Specimen of vein quartz brecciated and recemented by sulphides, Grace vein, Darwin mine 56
Specimen of vein and wall rock, Parkhill mine 57
Photomicrograph of a thin section of the Grace vein taken with a Lieberkühn mirror, showing native gold in cataclastic quartz 58
Photomicrograph of a polished section of the Grace vein, showing native gold, partly in cracks in cataclastic arsenopyrite and partly in quartz 59
Photomicrograph of a polished section of the Nyman vein showing an arsenopyrite crystal, the interior of which has been largely replaced by pyrrhotite 59
Photomicrograph of a polished section of the Grace vein, showing pyrrhotite decomposing to form pyrite and being replaced by chalcopyrite 60
Photomicrograph of a polished section of vein material, Parkhill mine, showing pyrrhotite replaced by carbonate, while pyrite is formed contemporaneously 61
Photomicrograph of a polished section of the Grace vein showing streaked marcasite with interbedded carbonate 61
Photomicrograph of a thin section of the Grace vein showing a veinlet with chalcopyrite, calcite, and feldspar cutting quartz 62
Photomicrograph of a polished section of vein material, Minto mine, showing chalcopyrite replacing pyrrhotite and sphalerite 63
Photomicrograph of a thin section of the Grace vein showing an arsenopyrite crystal in country rock, partly replaced by biotite 64
Photomicrograph of a thin section of vein material, Parkhill mine, showing a veinlet with native gold, carbonate, and feldspar, traversing vein quartz and sericitized country rock 66
Photomicrograph of a thin section of the Jubilee vein showing an aggregate of broken tourmaline corroded by ankerite and recemented by pyrite 68
Photomicrograph of a thin section of the Grace vein, showing red feldspar-carbonate veinlets cutting ribbons of arsenopyrite 69
Photomicrograph of a thin section of the Grace vein showing native gold corroding an apatite crystal 72
Photomicrograph of a polished section of the Grace vein showing native gold with inclusions of chalcopyrite and a veinlet and crystals of blue hornblende 74
View of the Parkhill mine 79
View of the Darwin mine 82

SKETCH MAPS, DIAGRAM, AND TABLE

PAGE

Comparison of geological tables of the Michipicoten-Missinaibi area ..... *facing* 8
Sketch map showing trenching at the Kozak mine 9
Diagram illustrating the vein structure at the Algoma Summit mine 12
Geological sketch map of the main showings, Edwards Gold Mines 13
Geological sketch map of the Cline Lake property showing trenching completed in 1935 ..... *facing* 14
Geological sketch map of the Kremzar claims of the Algoma Exploration Company 16
Key map showing the location of the Lochalsh-Missinaibi map area 27
Index map showing the location of the mines in the Michipicoten area 75

COLOURED GEOLOGICAL MAP

(In pocket at back of report)

Map No. 44c—Lochalsh-Missinaibi area, Districts of Algoma and Sudbury, Ontario. Scale, 1½ miles to the inch.

The Michipicoten-Missinaibi Area

By E. M. Burwash

INTRODUCTION

Historical Sketch

The belt of early pre-Cambrian rocks that extends inland from Michipicoten bay, on the northeastern margin of Lake Superior, as far as Missinaibi lake has attracted the attention of prospectors and miners since the year 1850. About that time the banded silica and iron formation at Gros Cap near Michipicoten Harbour was explored in the hope of securing workable iron ore. About 1865 a prospector named Johnstone, of Detroit, spent some time and money in exploration for copper along the shore of the eastern part of Lake Superior, without notable results.[1] The prospectors of those times had in mind the rich iron deposits of Marquette and the great copper range of Keweenaw point[2] in Michigan. The earlier reports on the north shore described the small and irregular veins with some indication of copper in a country that was later to be more successfully prospected for gold.

These early attempts were without success, and apart from fur trading the only activity in the region before 1896 was the construction of the Canadian Pacific railway. There was also a lake and road route made from the Hudson's Bay Company's post at Michipicoten River to Gutelius and Missanabie on the new railway line. By this route materials and supplies could be cheaply forwarded to the construction work. Wharves and steamboats were built for summer use on Wawa, Manitowik, and Dog lakes, and roads constructed to cross the intervening portages: from Michipicoten Post to Wawa lake; from Wawa lake to Manitowik lake, skirting the south shore of Hawk lake; and across the stony portage from Manitowik lake to Dog lake. In winter the ice of the lakes completed the roadway throughout for traffic by sleighs.

After the railway was completed the old tote road was used to supplement the canoe route from Lake Superior to Hudson bay by way of the Missinaibi river, and the wagon roads were kept open as far as Hawk lake. Beyond that point, from Hawk lake to Manitowik lake, the Hawk river was available for canoe navigation, and the roadway at Stony portage was soon replaced by the usual portage trail.

Another branch of this road system ran northward from the east end of Wawa lake past Eleanor lake, and after paralleling the Magpie river ran near the present site of Goudreau and thence northeastward to Pic station. The western section of the present Goudreau-Lochalsh road appears to correspond with a part of this older route, which diverges from the newer road 3¼ miles east of Goudreau and can still be easily followed on foot to Pic. The northeastern part appears on the recent maps by Thomson[3] and Moore,[4] and the southwestern end is mapped on the Michipicoten Iron Range sheet by Coleman and Willmott.[5] A third branch extended from the south shore of Manitowik lake near the mouth of Dingman creek eastward to Dalton.

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[1]Ont. Dept. Mines, Vol. V, 1895, p. 253.
[2]T. Macfarlane, Geol. Surv. Can., Rept. of Progress, 1863-1866, p. 120.
[3]Ellis Thomson, "Missinaibi Area," Geol. Surv. Can., Mem. 147, map No. 2050, 1925.
[4]E. S. Moore, "Goudreau Gold Area," Ont. Dept. Mines, Vol. XL, pt. 4, 1931, map No. 40e.
[5]A. P. Coleman and A. B. Willmott, "Geological Map of the Michipicoten Iron Range," Ont. Bur. Mines, Vol. XI, 1902.

The decade following the completion of the Canadian Pacific was for the most part a period of depression or of very slow advance in the affairs of the country. Western settlement and the readjustment of business to the new developments proceeded slowly, following the collapse of the boom after the construction days were over. The first event that brought a marked stimulation of the business affairs of Canada was the discovery of rich deposits of placer gold in the Yukon valley in 1896. Strangely enough one of the immediate results of this was the revival of a keen mining interest at Michipicoten. In the same year gold was found at Emily bay on Dog lake near Missanabie station.



Portage between Crooked and Missinaibi lakes on the route from Lake Superior to Hudson bay via the Missinaibi river.

In June, 1897, an Indian, William Teddy, and his wife discovered gold at Mackey point on the south side of Wawa lake,[1] and there was a rush of prospectors into the locality, many of whom were diverted to Michipicoten while on their way to the Yukon. Disappointed at finding the Lake Superior sand benches barren and the bush difficult to travel, the placer men soon left the region, but others continued the search for gold. On September 23, Inspector D. G. Boyd, sent from Toronto by the Ontario Bureau of Mines, opened a recording office at the Hudson's Bay post at Michipicoten River. An area named the Michipicoten Mining Division was demarcated on the map, sufficiently large to include all the probable prospecting grounds. This was the first such division established

[1]For a further account, see T. L. Gledhill, "Michipicoten Gold Area," Ont. Dept. Mines, Vol. XXXVI, pt. 2, 1927, p. 4.

in Ontario. Two hundred and twenty-five claims were registered in the division that year, 55 in Toronto and the remainder at the Michipicoten office. Among the properties so recorded were those representing the first discovery at Mackey point (Y. 103), the Helen iron mine (claim No. 68), and the adjacent Ely claims (Nos. 33-36), staked as "a large quartz and pyrite vein." The name Helen was also at first applied to a gold claim, No. 98, 2 miles south of Wawa lake. The Jubilee gold property, owned by the Great Northern Mining Company, was claim No. 75. The Minto comprised claims Nos. 92 to 95, and the Grace claims were numbered irregularly from D.J. 6 to D.J. 80. The Mariposa had claims J.D. 1, 2, 3, and 4.

These numbers indicate that practically all the properties that have since proved valuable were staked during the first season. At the present time the producing mines are the Parkhill, formerly the Mariposa and Longbottom groups; the Darwin, formerly the Grace; the Jubilee; and the Minto. Work was also in progress during the writer's visit in August, 1934, at the Mackey Point (the original discovery, claim Y. 103 and adjacent claims), Stanley, Wa Wa Gold Fields, S. B. Smith, and Norwalk mines. These gold properties are all located south of Wawa lake in an area that extends southward beyond the Michipicoten river and lies mainly in township 29, range 23.[1]

Meanwhile the development of the Helen iron mine north of Wawa lake, the construction of the Algoma Central railway and its branch from Hawk Junction to Michipicoten Harbour, and the exploitation of the country by the Clergue interests in general, led to active prospecting toward the east and north as far as Dog lake and beyond toward Easey lake and Missinaibi lake; but the only early property in the eastern part of which accounts are now available was the Emily mine on Dog lake, discovered in 1896.

Very early in the development of the Michipicoten Mining Division, the chief interest was centred in the Helen mine, which continued production from July, 1900, when the first shipments of ore were made, to April, 1918.[2] This was essentially a deposit of siderite weathered in part to göthite, with an iron content of from 57 to 63 per cent., averaging about 60 per cent. Later the Magpie siderite mine was discovered to the north in township 29, range 26, and worked experimentally for some years, but without decided success.

Of the early gold mines the Grace was the only one to continue in operation for more than a few months. Work on this mine (claim D.J. 7) began in July, 1900, and was carried on intermittently by different companies until 1910.[3] Since then it has changed hands and been refinanced several times and is at present (1935) being operated by Darwin Gold Mines, Limited.

During the construction of the Algoma Central railway through the area in 1900 and 1901, prospecting for iron was carried on energetically by the Algoma Commercial Company. The "iron ranges" were systematically mapped and examined, and this work resulted in the discovery, among others, of the Magpie and Goudreau ranges. The occurrence of gold on McVeigh creek near Goudreau was also observed at that time by a prospector, who reported it to the present writer, but no further development was undertaken then.

[1]References to the early stakings and reports on the work as annually inspected can be found in the following reports of the Ontario Bureau of Mines: Vol. VII, 1898, pp. 3, 101; Vol. VIII, 1899; Vol. IX, 1900; Vol. X, 1901; and Vol. XI, 1902, under the heading "Michipicoten Mining Division" and earlier references by J. A. Barron in the Report of the Royal Commission, 1890. See also Vols. II, 1892; IV, 1894; and V, 1895.

[2]For a full account see W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, pt. I, 1926, pp. 115-120.

[3]For full accounts see W. H. Collins and T. T. Quirke, op. cit., pp. 126-128; T. L. Gledhill, Ont. Dept. Mines, Vol. XXXVI, pt. 2, 1927, pp. 30-34. See also p. 81 of this report.

Under the pressure of war demands the pyrite deposits immediately east of the railway at Goudreau were vigorously mined from 1915 to 1918, and a flourishing chemical industry was established by the Nichols Chemical Company adjacent to the source of sulphur. On the incursion into the market of the native sulphur of the Gulf coast after the close of the war, this project was abandoned and the buildings were wrecked, but meanwhile, and since then, more or less promising gold discoveries were made along the strike of the greenstone belt in which these pyrite deposits lie. In 1918, the McCarthy-Webb property, lately operated by Algoma Summit Gold Mines, Limited, was staked a short distance east of the pyrite mines. Discoveries at Godon lake in 1920 followed, and in 1921 work was in progress at the Cline Canadian mine.

Most of these properties, after a few seasons' work, were virtually abandoned, but the advance in the price of gold to $35.00 in January, 1934, has brought renewed activity to the area.

Field Work

The writer was assigned to work in the Michipicoten-Missinaibi area during the summer of 1934. This assignment included two distinct objects: (1) a geological survey and mapping of the unsurveyed part of the area lying to the east of the Goudreau-Lochalsh area, and (2) an examination of the properties (except in the Michipicoten area proper[1]) where active work was being prosecuted. The details of the first project are embodied in a separate report, "Geology of the Lochalsh-Missinaibi Area,"[2] accompanied by a geological map, No. 44c.

Acknowledgments

The writer wishes to express his appreciation of the kindness of the officers in charge at all of the mines visited: Mr. Humphries at the Edwards; Messrs. J. Cline and C. F. Cockshutt and Mr. Proctor at the Cline Canadian; Mr. Patice Kremzar at the Algoma Exploration; Mr. F. A. Brandt at the Algoma Summit; Mr. Wm. E. Markes at his claims near Godon lake; Mr. A. Fisher at the Aurcana Mines; Mr. F. W. Chubb at the Murray-Algoma; Mr. I. L. Whitehead, of Saginaw, Mich., vice-president, and Mr. B. C. Lamble, engineer in charge, of the Holdsworth properties; Mr. R. E. Barrett, manager of the Parkhill mine; Mr. J. C. Canfield at the S. B. Smith mine; Mr. J. J. Hawkins, Mr. H. F. I. Williams, and Mr. D. C. McKechnie, manager, at the Mackey Point; Mr. A. C. Melkman at the Wa Wa Gold Fields; Mr. O. H. Adams and Mr. S. MacDonald at the Stanley; Messrs. David Racicot and E. G. Archer and Mr. Crawford of the Boundary lake properties; and Mr. J. Lang, engineer in charge of the Goudreau-Lochalsh road improvements.

REVIEW OF PREVIOUS GEOLOGICAL WORK

Since it first attracted attention as a region of possible economic importance, the Michipicoten district has been extensively studied by various geologists.[3] They are in many cases very thorough and exhaustive in detailed information available at the time of their publication, and the reader is referred to them for such material as each is intended to cover. They contain vastly more of value than could possibly be reprinted or recapitulated here. In the matter of strati-

[1]For a description of these properties, see pages 74 to 83.
[2]See pages 27 to 38 of this volume.
[3]See list of published papers in the Appendix to this report.

graphic sequence they illustrate the history of the development of the geology of Northern Ontario and its different schools of nomenclature.

The first geologist known to have visited the region was Logan,[1] followed by Macfarlane,[2] who adhered to the Loganian classification of all the pre-Cambrian as Laurentian or Huronian, considering the Laurentian as the older. Logan gives a very detailed description of the rocks exposed at Gros Cap and Michipicoten bay and the mineralized quartz and calcite veins of the Doré river, and Macfarlane adds a discussion of the iron-mining operations at Gros Cap. Among other measures, Logan describes the slate conglomerate at the Doré river near Gros Cap, of which he measured a thickness of 1,700 feet, which did not cover the entire section. Strangely enough Lawson refers to this conglomerate in describing the fragmental volcanics of the Lake of the Woods region and takes the position that the Doré conglomerate differs from "the typical Huronian agglomerates."[3]

Robert Bell on his journey in 1875 from Moose Factory to Lake Superior, by way of the Missinaibi river, noted the Laurentian gneisses, Huronian slates, and granite veins (evidently intrusive granite) on the Michipicoten river.[4] In the following year he again visited the locality and described the Doré conglomerate as containing pebbles of red granite and a fine quartz conglomerate and having a strike of N. 80° W. He also noted a "trap dike" (presumably Keweenawan diabase) 50 feet in width and striking in a northerly direction.[5] Again in a later report, he notes in more detail "Huronian schists, with diorites, syenites, and granites" between Dog lake and Michipicoten, gneiss at Cat portage and Long portage, calcareous schists at Stony portage, red syenite and chlorite schists on Dog lake with conglomerate opposite Waboose (Rabbit) island, and similar schists with mica and hornblende schists and diorite on Wabatongwashene (Wabatongushi) lake as far as the granite contact.[6] Bell's geology still had the Loganian stamp.

All of the subsequent writers have been post-Lawsonian in their views, recognizing the intrusive nature of the granites and gneisses and the fact that they are, therefore, subsequent in age to the schisted volcanics and sediments which they intrude. The gneisses are, therefore, placed later in age than the Lower Huronian or Keewatin, following Lawson's nomenclature derived from his study at the Lake of the Woods.[7]

The first serious study of the geology following the important mineral discoveries of 1897 was made by A. P. Coleman and A. B. Willmott in the summer of 1901.[8] The terminology adheres to the older forms, except in placing the Laurentian above the Huronian as representing its later age. The table of formations adopted then was:—

LAURENTIAN:	Gneisses and granites.
UPPER HURONIAN:	Acid eruptives. Basic eruptives. Doré conglomerate.

[1]W. E. Logan, Geol. Surv. Can., Rept. of Progress from Its Commencement to 1863, pp. 53, 54, 703.

[2]T. Macfarlane, Geol. Surv. Can., Rept. of Progress, 1863-1866, pp. 115-164.

[3]A. C. Lawson, "Report on the Geology of the Lake of the Woods Region," Geol. Surv. Can., Vol. I, 1885, pt. CC, p. 10. See also Ont. Dept. Mines, Vol. XLII, pt. 4, pp. 52-55.

[4]Robt. Bell, Geol. Surv. Can., Rept. of Progress, 1875-76, p. 332.

[5]Ibid, 1876-77, pp. 219, 220.

[6]Ibid, 1880-81-82, pp. 3, 4.

[7]A. C. Lawson, op. cit.

[8]A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines Vol. XI, 1902, pp. 152-185.

LOWER HURONIAN:	Eleanor slates. Helen iron formation. Wawa tuffs. Gros Cap greenstone.

At this time the Algoman granite had not been distinguished from the Laurentian. Most of the granite in the region penetrates intrusively all the formations here mentioned as Upper and Lower Huronian. The acid and basic eruptives, classed with the Upper Huronian, are found cutting both the Upper and Lower Huronian, and their age has not been determined. They would now be classified in most cases as sheared Algoman porphyries and unsheared Killarney granite and Keweenawan diabase. The Doré, therefore, is the principal member of the Upper Huronian. The age relationship of the iron formation and the Eleanor slates is discussed but without arriving at any definite conclusion. Both are Lower Huronian.

The Gros Cap greenstones included basic ellipsoidal lavas, weathered massive diabase,[1] and chloritic schist. The Wawa tuffs were mainly acid extrusives and not entirely tuffaceous. The Helen iron formation was thought to lie above them, and the Eleanor slates, as already stated, above or below the iron formation.

Following the work of Coleman and Willmott, which was done mainly to assist the iron-mining industry near Wawa lake and the territory just to the north, and was largely confined to that locality, the later work of Collins, Quirke, and Thomson was undertaken to gain more information about the iron formation in view of the development of pyrite and siderite mining after 1913 and during the war period that followed. The western end of the field was surveyed by them in 1918. This was followed by further field work in 1919 and 1920. The results were outlined in summary reports and further elaborated in Memoir 147 of the Geological Survey of Canada. This is accompanied by two maps, one covering the region west of the Algoma Central railway and the other that to the east of it as far as Dog lake. The general results obtained by the authors are based largely on the advances in the classification of the pre-Cambrian achieved by intensive work in the eastern parts of Ontario during the two decades following the work of Coleman and Willmott. They did their work, however, independently of that of Miller and Knight and others in the eastern part, but have adopted the idea of two periods of granitic intrusion and abandoned the conception that the Doré conglomerate, because of its content of granite pebbles, must be unconformable on the Keewatin as a whole. They found along its northern margin intrusive granite gneiss, which they believed had supplied the granitoid pebbles of the conglomerate and which was known to be younger than the schists to the north because it intruded them. These schists have also furnished pebbles found in the conglomerate, and for this reason they take the latter to be a formation representing a large erosion interval in the Keewatin, during which coarse mountain wash accumulated in valleys and became finer in texture as the valleys were filled and the heights above eroded away, resulting in lower gradients of stream flow and finally in lacustrine deposition. It is probable that these mountains were of volcanic origin and that active vulcanism went on in the range during the time of the Doré deposition. It is clear, however, that while there were volcanic vents active in the range during this period, the greater part of the range was composed of folded, perhaps schistose volcanic materials intruded by a batholith, which was already largely unroofed and

[1]Possibly the "older diabase," which is metamorphosed.

deeply dissected. The granite boulders 2 feet in diameter found in the conglomerate must have travelled down steep slopes, whether borne by water or other agencies. The pre-Doréan schists were also of volcanic origin, but not of a vulcanism contemporary with the deposition of the Doré.[1]

Considerations of this sort have led Gledhill[2] and Moore[3] to the conclusion that the time interval for the probable mountain-building and subsequent batholithic intrusion, followed by erosion sufficient to unroof the batholith, prohibits the assignment of the Doré to the same geological period as the pre-Doréan schists. With this decision the present writer is disposed to agree, and would also concur with them in holding that the Doré occupies the same place in the time sequence of the pre-Cambrian that is occupied elsewhere by the Timiskaming.

The authors of Memoir 147 disagree with Coleman and Willmott also in putting the great series of schists, mainly volcanic, which lie to the south of the Doré conglomerate in the Michipicoten bay region in a higher place in the series than the Doré though still attributing them to the upper part of the Keewatin. The entire Keewatin, including the Doré, would thus be represented by a belt some 10 miles wide at this point and having an average dip of at least 45 degrees, indicating a thickness, measured at right angles to the schistosity, of over 7 miles.[4] The continuity of this series is based on the continuously similar dip of the schistosity. It must be admitted that quite different types of material appear in various parts of it. The schist to the north of the Doré, which is pre-Doréan in age, is predominantly basic, with small amounts of iron formation, and was originally predominantly lava. The post-Doréan, which lies south of the Doré conglomerate, contains notably large acid elements and is in great part pyroclastic. It also differs strikingly in the large amount of carbonaceous matter included; and the iron ranges, which are so notable a characteristic of it, differ from any found elsewhere in the province, especially in the large amount of siderite that they contain.

The early view of Coleman and Willmott appears to have been that the area now known as post-Doréan included both the lower and upper part of the Keewatin, the latter represented by the acid pyroclastic part. The Doré was an Upper Huronian formation higher than either. Gledhill,[5] who worked over the area in 1926, agrees with Coleman and Willmott in assigning the entire schist area to the Keewatin and in placing the Doré conglomerate above it, as equivalent to the Timiskaming. Moore, who examined the Michipicoten and Goudreau gold areas in 1930, definitely adopts the same view.[6] The present writer, as previously stated, believes with Gledhill and Moore that the Doré series is equivalent in age to the Timiskaming. If Collins and Quirke are correct in placing the schist horizon that contains the typical iron ranges above the Doré, it follows that the post-Doréan schists occupy a position possibly equivalent to the Haileyburian dikes recognized in the more easterly parts of the province as younger than the Timiskaming but older than the Algoman. This may be regarded as a tentative presentation of the matter by the writer, who

[1]Conditions in the Coast range of British Columbia during the Recent deposition of similar coarse sediments involve all of the conditions here described—old schisted lavas, batholithic intrusive, and later volcanic vents in the range, as sources of material. See E. M. Burwash, "Geology of Vancouver and Vicinity," Univ. of Chicago Press, 1918.

[2]T. L. Gledhill, Ont. Dept. Mines, Vol. XXXVI, pt. 2, 1927, pp. 8, 10, 56 *et seq.*

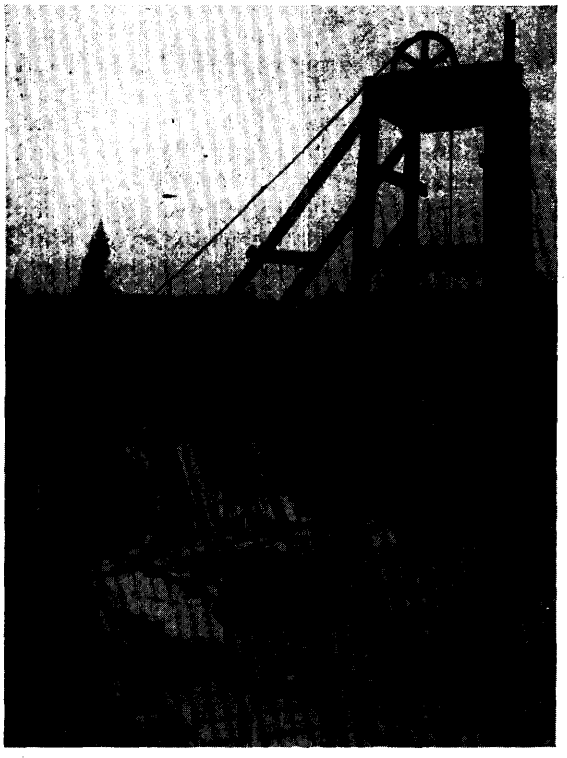
[3]Op. cit., pp. 4-8.

[4]On a line drawn from a point at the west end of Dog Tooth lake to a point south of the Michipicoten river, and passing slightly to the west of the Grace mine.

[5]Op. cit., pp. 10, 57.

[6]E. S. Moore, op. cit., pp. 4, 8.

did not have sufficient time in the field to examine the evidence as to the relative ages of the Doré series and the post-Doréan of Collins and Quirke. This arrangement has been used in the legend of the map accompanying the report on the Localsh-Missinaibi Area, since the greenstone area lying east of Goudreau and including the area mapped by the writer is continuous with and lies along the same strike as the post-Doréan at Michipicoten. Apart from the continuity of structure from the pre-Doréan through the Doré upwards into the post-Doréan, as held by Collins, the character of the post-Doréan is sufficiently different petrologically to suggest a difference in age at least in part.



Headframe, Kozak mine. The vein shows white at the left-hand edge of the pit in the foreground.

One difficulty that faces this interpretation of the post-Doréan is the fact that such intensive folding and schistification as is here seen has not been known to occur later than the Keewatin in any other part of the province. The main folding throughout the pre-Cambrian is post-Timiskaming, but not post-Haileyburian. This is a very serious if not conclusive objection to the assignment of the post-Doréan to Haileyburian time.

The comparative table (see insert) includes the various interpretations of the general geology of the area so far proposed. The last column gives the table of formations suggested by M. H. Frohberg, manager of the Darwin mine, in his report on "The Ore Deposits of the Michipicoten Area,"[1] which accompanies this report, and to which the reader is referred for further discussion.

[1]Pages 39 to 83.

DESCRIPTION OF PROPERTIES

A description of the properties in the Lochalsh-Missinaibi map area will be found in the writer's report on that area.[1] The properties in the Michipicoten area are described in Frohberg's report.[2] The following detailed description of the other properties in the area is mainly the result of the writer's field work but has been supplemented by further information obtained by the geological staff of the Department of Mines in collaboration with some of the engineers and geologists working in the area. Special reference might be made to assistance rendered by W. S. Dyer, of O'Brien Gold Mines, Limited, in connection with the Cline Lake mine and by P. E. Hopkins in connection with the property of the Algoma Exploration Company, Limited.

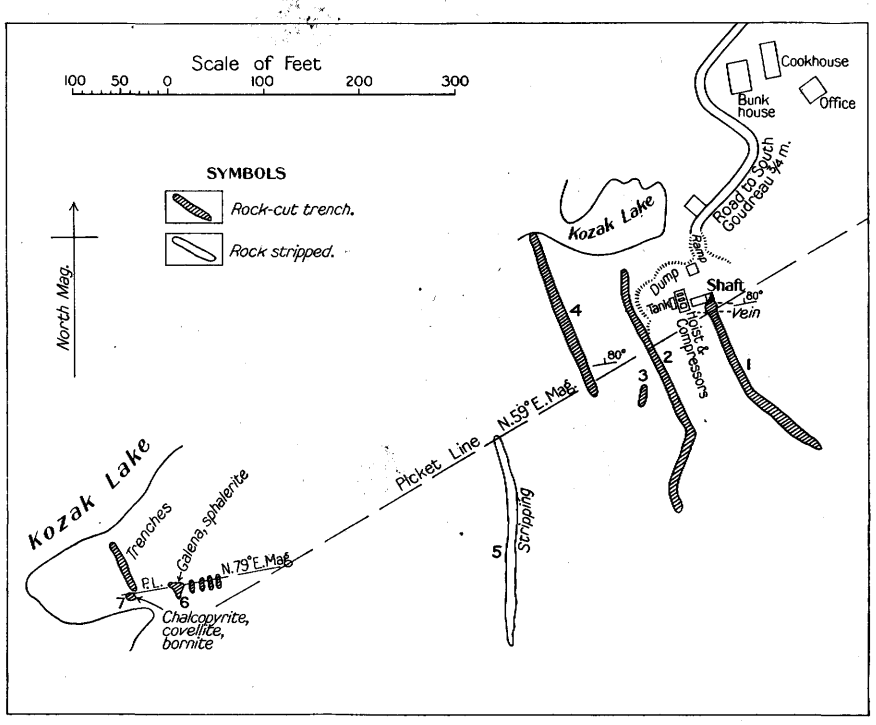


Fig. 1—Sketch map showing trenching at the Kozak mine.

Goudreau-Lochalsh Area

KOZAK GOLD MINES, LIMITED

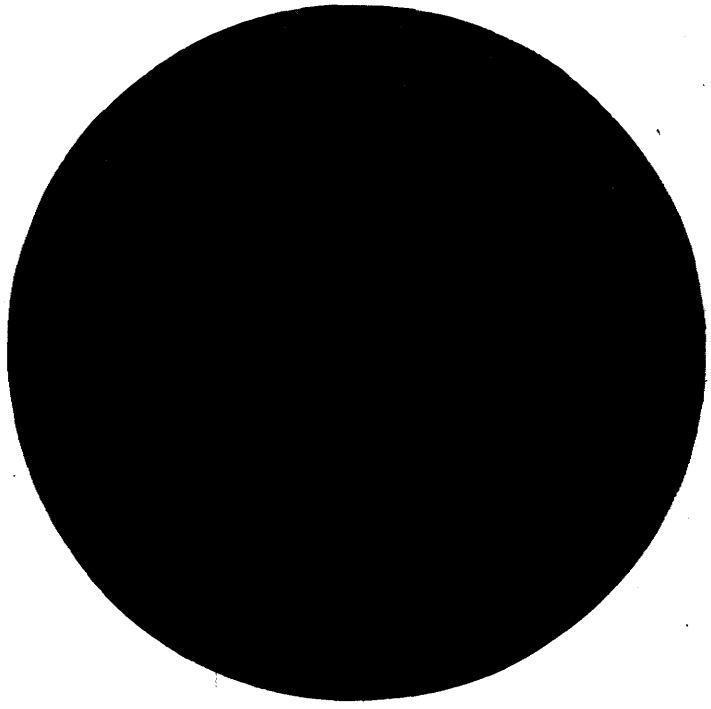
Kozak Gold Mines, Limited, controls the Kozak property, which is located about three-quarters of a mile west of South Goudreau in township 28, range 23. The workings are near the east side of Kozak lake. The property was inactive at the time of the writer's visit in July, 1934. It is reported that a shaft has been sunk to a depth of 100 feet and that 300 feet of crosscutting and drifting has been done from this level.

The geology of the property has been described by Moore.[3] The veins lie in an area of acid volcanic rocks. The country rock adjoining the veins has been

[1]Page 38.
[2]Pages 74 to 83.
[3]Op. cit., pp. 25, 26.

altered to a chlorite-sericite schist. At the shaft the vein is about 8 feet wide and consists of quartz and rusty-weathering carbonate. The vein quartz has been fractured, and pyrite, chalcopyrite, galena, sphalerite, native gold, and native silver have been introduced along the fractured zones.

In one of the test pits about 450 feet to the southwest of the shaft near the shore of Kozak lake some quartz and sulphides may be seen. Among others, a specimen of covellite was collected there.



Photomicrograph of vein material, Algoma Summit mine, showing sheared quartz-sericite schist (Q-S) in primary quartz (Q). Pyrite = P. (× 100.)

ALGOMA SUMMIT GOLD MINES, LIMITED

The property of McCarthy-Webb-Goudreau Mines, Limited, in township 49 was acquired in 1934 by Algoma Summit Gold Mines, Limited. The geology of the property has been discussed in detail by Moore[1] and Gledhill.[2]

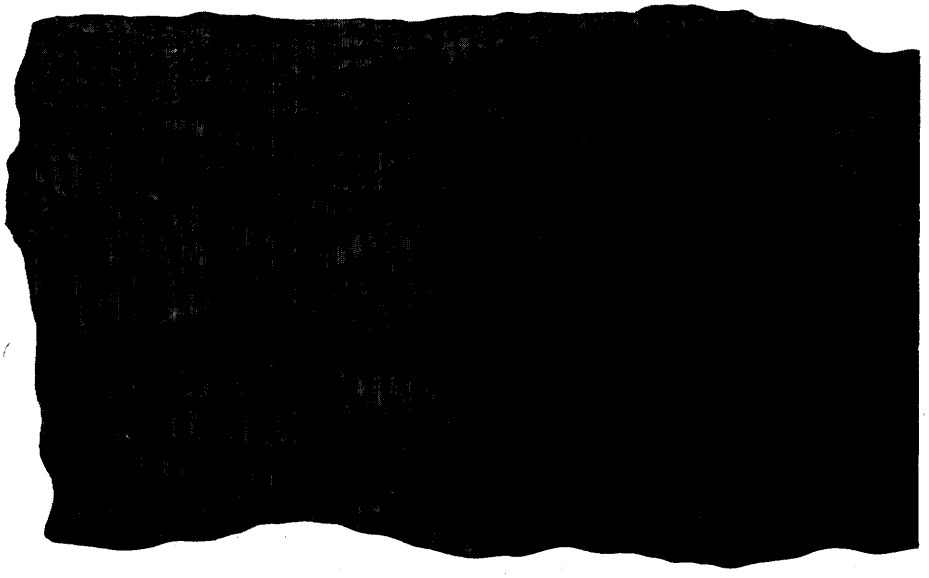
In 1934 the new company was operating a mill for testing purposes under the direction of F. A. Brandt. Mill feed was being obtained from one of the sheared zones in granite porphyry. An inclined shaft has been sunk on the vein system with a crosscut at 100 feet vertical depth. A new mill of 500 tons daily capacity is now under construction.

Moore describes the rocks in the vicinity of the veins as follows:—

> The gold veins lie in a large intrusion of Algoman rock, which may be classed as granite porphyry grading into monzonite, quartz porphyry, and feldspar porphyry. Most of the rock has been altered considerably by shearing, silicification, and carbonatization.[3]

[1]Op. cit., pp. 32-35.
[2]Op. cit., pp. 73-76.
[3]E. S. Moore, op. cit., p. 32.

The intrusive body has a width from north to south of 750 to 800 feet. Along the sheared zones there has been considerable development of sericite and chlorite and impregnation of quartz (see photographs on pages 10 and 11). On the south side of the body the contact with the greenstone is exposed and displays the usual gneissic contact zone, which in this case is highly impregnated with sulphides. The several phases of the intrusive body have undoubtedly been produced by assimilation of the enclosing greenstones. The veins and sheared zones strike approximately N. 75° E., parallel to the strike of the schistosity in the rocks adjoining the intrusive.



Specimen (natural size) of schist in a shear zone injected with quartz (Q), in which are embedded carbonate (C) and pyrite (P), Algoma Summit mine. The tourmaline veins (T) are later than the carbonate and quartz.

In addition to the exposures mapped by Moore,[1] a number of quartz veins are exposed on the north side of the Goudreau-Lochalsh road. They have the same general strike as those to the south, but local shearing is not so pronounced. They are typically narrow fissure veins traversing granite porphyry or monzonite. The wall rock of these veins has been hydrothermally altered for a relatively great distance on either side. Veins 3 to 6 inches wide are bordered by 5 or 6 feet of mineralized wall rock. The veins themselves are reported to carry high gold values. The outer limit of the mineralized zone in the wall rock is marked by a narrow band of tourmaline (Fig. 2). Cross-veins striking in a general north-south direction intersect the above-mentioned zones. Moore[2] has described the occurrence of tourmaline, quartz, chlorite, carbonate, pyrite, and pyrrhotite in the veins on the property. In some cases the mineralization along sheared zones has a banded appearance owing to the presence of certain layers with a high pyrite content. On the weathered surface a banded effect is produced, which sometimes makes it difficult to distinguish from iron formation.

[1]Op. cit., p. 34.
[2]Ibid, pp. 33, 34.

The ore shoot extending west from the main shaft is reported to average $12.84 across an average width of 4.29 feet over a length of 290 feet. Other ore shoots are shorter and of a lower grade. No information as to the probable grade of ore to be supplied to the 500-ton mill under construction was available. The plant is supplied with electric power and a good set of camp buildings has been erected.

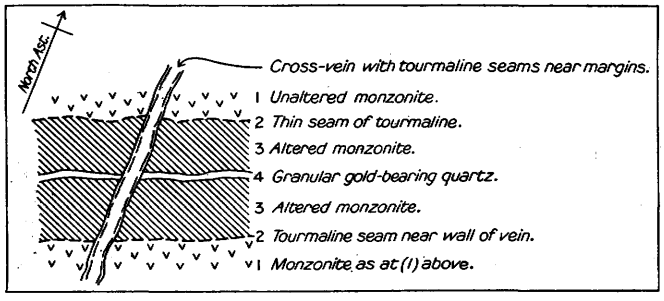


Fig. 2—Diagram illustrating the vein structure at the Algoma Summit mine.

EDWARDS GOLD MINES, LIMITED

The property of Edwards Gold Mines, Limited, lies west of Cline lake in township 48 and is crossed by the Goudreau-Lochalsh road. It adjoins the claims of Cline Lake Gold Mines on the west and includes the patented claims S.S.M. 4,013, 3,862, 3,846, 3,303, 3,304, 3,559, 3,553, 3,804, and 3,805. The main workings are on claim S.S.M. 3,559.

A shaft had been put down to a depth of 200 feet by August, 1936, and approximately 500 feet of drifting had been done on two levels at 100 and 200 feet. A mill of 75 tons daily capacity was being constructed, and a power line was being extended to the property. J. A. S. Roussac is manager of the property.

The country rock includes both acid and basic types. The basic rocks are chlorite, hornblende, and epidote-bearing schists, derived from andesites or more basic flows. The acid rock type is a quartz porphyry with well-developed phenocrysts of quartz and some orthoclase and muscovite. It is difficult to determine with certainty whether the porphyry is intrusive or extrusive and interbedded with the other volcanics. The evidence suggests that it is extrusive. An intrusive quartz diabase is exposed on the bluff southwest of the outcrop of No. 2 vein.

The vein matter is for the most part banded, and consists of magnetite and quartz, or mineralized chloritic schist injected by quartz and similar to iron formation in appearance. Most of the veins strike about east-west, parallel to the direction of the schistosity in the country rock. An exception to this, however, is No. 1 vein, which strikes S. 60° E. The veins vary in character. No. 4 vein is a mineralized shear zone. Other types consist of alternate bands of quartz and magnetite with carbonate and secondary quartz. The earlier quartz is granular in texture, whereas the later quartz is glassy white in appearance and shows pyrite, pyrrhotite, and visible gold. The richest showing on the property is in the shaft at a depth of 100 feet; here a quartz vein intersects a mineralized band of rock, which resembles iron formation. Ore from this intersection consists of banded quartz heavily mineralized with pyrite, which contains fine-grained visible gold in considerable amounts.

MARKES CLAIMS

The Markes claims include a group numbered S.S.M. 7,262, 7,647, 7,680, 7,263, 7,648, and 7,681. These lie immediately to the east of the original Cline claims in township 48.

The country rock consists of greenstone alternating with quartz porphyry. The greenstone is vesicular, and the quartz porphyry in most cases is probably extrusive. The mineralized bands are in the porphyry and look like banded silica and iron, just as at the Edwards mine. The quartz has a very fine grained, sugary appearance.

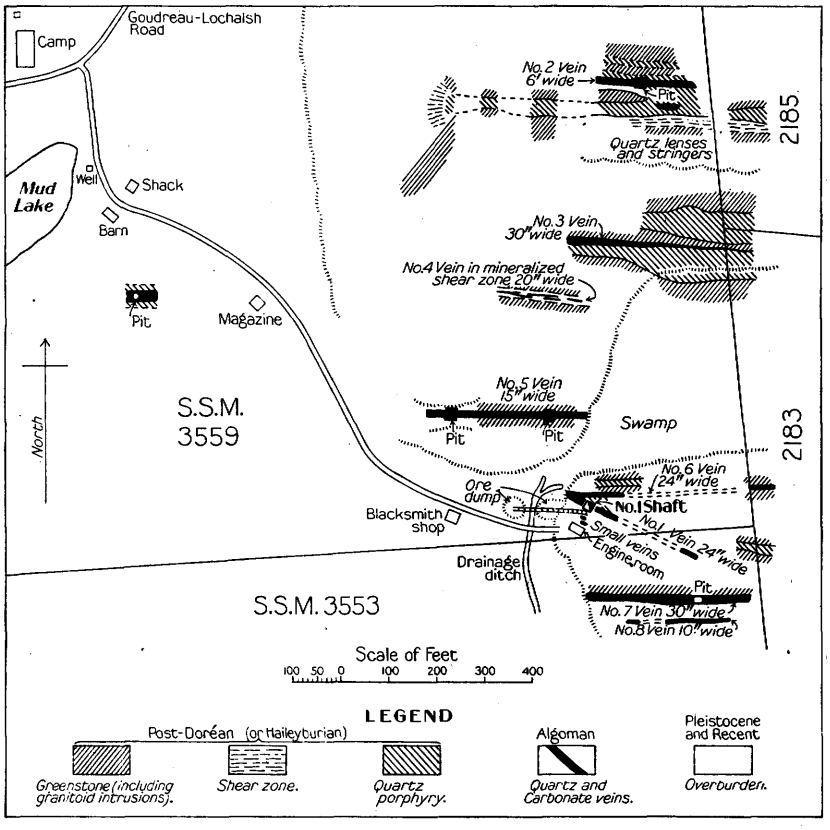


Fig. 3—Geological sketch map of the main showings, Edwards Gold Mines, Limited.

A trench across a sheared and mineralized acid rock showed mineralization over a width of 20 feet. The best 3-foot section of this width was reported to assay 0.19 ounces gold per ton. Another trench, which runs along the boundary between claims S.S.M. 7,263 and 7,648, exposed the contact of the greenstone with the porphyry. The greenstone is well silicified and mineralized for about 10 feet from the contact.

ARCHER-CRAWFORD CLAIMS (BOUNDARY LAKE)

In August, 1934, development work was being done on several claims lying south of Godon lake in township 48. These were owned by Messrs. Archer and Crawford.

On the south side of Godon lake, on claim S.S.M. 7,994, a strong quartz vein with sulphides and included chlorite schist is traversed by later pyritic veins. The quartz vein is 8 feet wide and lies in a sheared acidic country rock.

On claim S.S.M. 7,995 a quartz-tourmaline-carbonate vein is exposed in a trench over a width of about 8 feet. The strike is N. 85° W. Some banded iron formation was noted on these claims.

On claim S.S.M. 7,923 a strong vein 14 feet wide in places strikes N. 75° W. It is a carbonate body injected with quartz and mineralized with pyrite, pyrrhotite, and chalcopyrite. Gold values are reported from this location. About a hundred feet to the south a body of pyrrhotite was reported.

CLINE LAKE GOLD MINES, LIMITED

The property owned by Cline Lake Gold Mines, Limited, formerly known as the Cline Canadian, lies near Cline lake in township 48 and is readily accessible by motor road from Lochalsh station on the main line of the Canadian Pacific railway, a distance of 6 miles, and from Goudreau station on the Algoma Central railway, a distance of 12 miles. In 1932 the Cline Canadian mine was purchased by Dyment Mining and Investments, Limited, who formed the present company. In June, 1936, a controlling interest in this company was taken under option by O'Brien Gold Mines, Limited, who are at present carrying on development work. The property, as optioned, included 19 claims, to which a further 16 claims have been added by staking.

The general geology of the property is shown on Moore's map.[1] A new discovery was made in 1933 on claim No. 2,271 south of the eastern part of the workings shown on Moore's map. In July, 1934, thirty trenches had been dug on this showing over a length of 750 feet along a picket line running S. 70° E. Sampling of the vein in these trenches, according to the management, indicated an average value of $13.43 (0.380 ounces gold) over a width of 11.8 feet for a length of 430 feet.

The deposit consists of a highly sheared zone traversed by longitudinal and transverse slips or minor fault planes. One of the longitudinal slips forms a footwall over part of the ore section and has a nearly vertical dip at the surface. Drilling, however, has shown that the general dip of the vein is 85° N. Some of these fault planes appear to represent slips or minor folds which plunge eastward parallel to the vein. The schistosity is not parallel to the strike of the flows, as indicated by the occurrence of successive different types of rock along the mineralized zone. These include sericite, chlorite, and sericite-chlorite schist. The first and last often contain bluish quartz "eyes" and are the altered equivalent of quartz porphyry and quartz andesite porphyry. The chlorite schist was developed from the more basic lavas. In one trench at the west end a pyroclastic rock was noted.

A considerable amount of diamond-drilling has been done on the main ore zone, and according to the management 300,000 tons of ore, averaging $13.85 per ton (gold at $35 per ton), is indicated over a length of 500 feet and down to a depth of 350 feet. An excellent set of camp buildings has been erected and shaft-sinking operations are under way.

ALGOMA EXPLORATION COMPANY, LIMITED

Algoma Exploration Company, Limited, owns a group of claims in township 49, formerly known as the Kremzar property, which are located along the Pic

[1]Ont. Dept. Mines, Vol. XL, pt. 4, 1931, map No. 40e.

road about a mile north of Goudreau lake. About 1925, Patice Kremzar discovered some rich gold floats on claim No. 3,909. A considerable amount of surface work was done to find the source of the float, and some veins were located. In 1930, M. J. O'Brien, Limited, optioned the Kremzar group, and a number of diamond-drill holes were put down to test the extent of the veins. About 1934, some further surface work was done under the direction of the late J. M. Bell. In the early months of 1936 the property was taken over by P. E. Hopkins and C. F. Cockshutt, and further diamond-drilling was done. During the summer of 1936 the property was idle.



Faulted quartz vein on the property of the Algoma Exploration Company, Limited.

The geology of the property and early development have been described by Moore.[1] The claims are largely underlain by Keewatin lava flows. These have been locally sheared and intruded by porphyries of probable Algoman age and by Keweenawan diabase dikes. In some places the lavas show pillow structure. The veins are located in fractured or sheared zones in the lava flows. C. F. Cockshutt believes that there are two sets of fractures, one along the flow tops and the other at an angle of 30 to 45 degrees to the flow tops. He reports that some of the flows are over 100 feet thick and are quite coarse grained in the central portion. They have a general strike of around N. 65° E. and dip about 65° N.W. The veins strike about N. 20°E. and dip steeply northwest. Work to date would suggest that the ore shoots in the veins are controlled by their position in the flows and rake to the north with the dip of the flows.

The three most promising veins occur in a width of about 600 feet across the strike (see Fig. 5), and are known as No. 1, No. 2, and the Tent vein. No. 1 vein follows a strong sheared zone, which contains lenses of quartz. It is well exposed for several hundred feet on the surface and was traced by five shallow drill-holes to the north in 1936, and by a deeper hole put down by M. J. O'Brien, Limited, in 1930. On the surface the country rock is greenstone with a band of

[1]Op. cit., pp. 26-30.

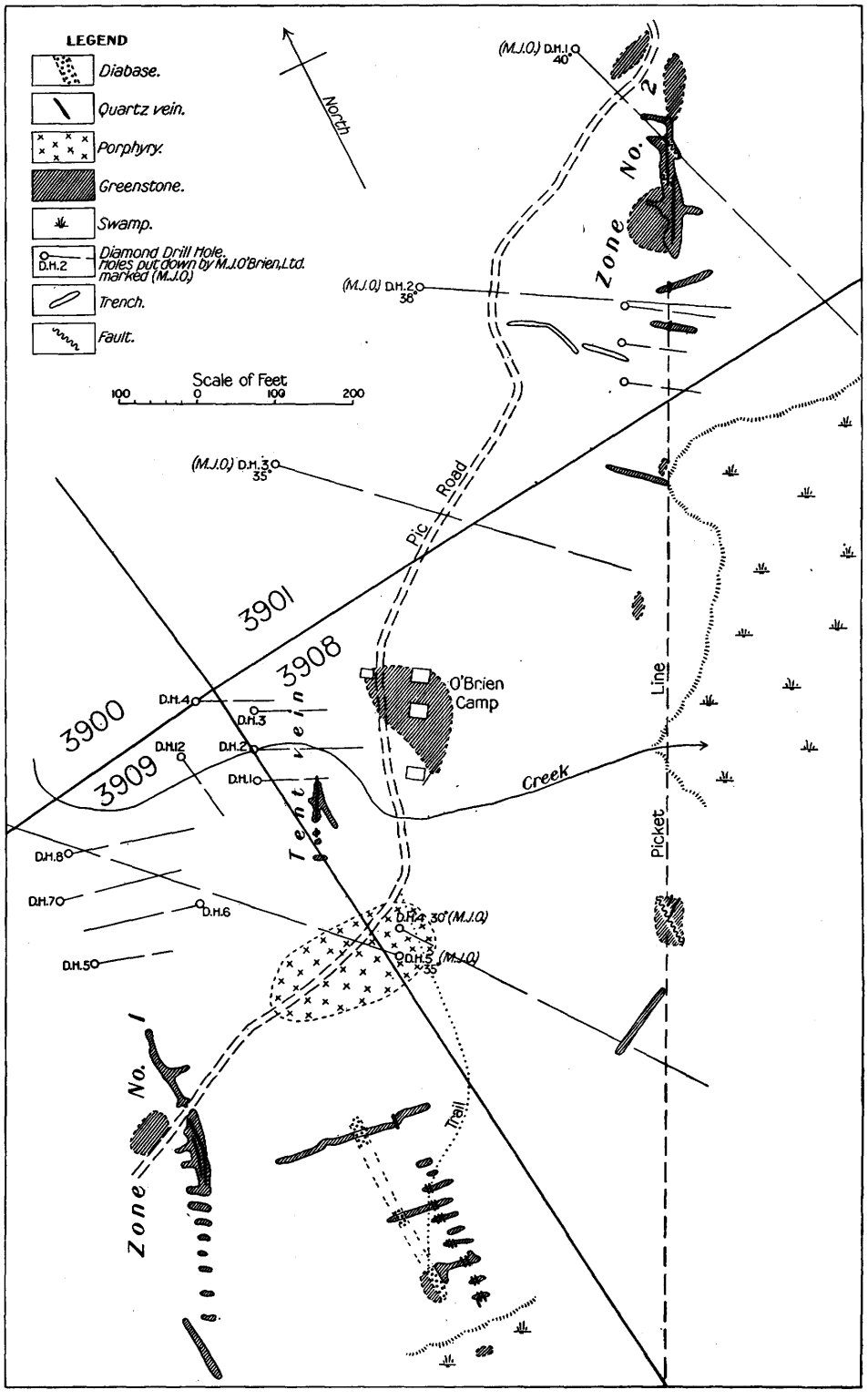


Fig. 5—Geological sketch map of the Kremzar claims of the Algoma Exploration Company, Limited.

schist along the vein zone. The schist is cut by stringers and two parallel veins of granular quartz about 4 feet apart. Where the vein runs under drift at the Pic road the lode is about 9 feet wide and composed of two quartz veins and a zone of schist cut by stringers of quartz. The quartz shows a little sulphide mineralization. Work to date does not indicate an ore shoot on this vein.

The Tent vein has an ore shoot exposed on the surface for a length of 40 feet and averages 1.9 feet in width. Drill-hole No. 1 to the north indicated high values over 1.2 feet. Three more holes cut the shearing but no quartz.

No. 2 vein has two ore shoots on surface with a 40-foot gap between them. The southern shoot makes ore over a width of 6.2 feet and a length of 40 feet. Three holes to the south failed to pick up the vein.

Other showings on the property have been developed by surface work. The most important of these appear to be No. 3 zone on the southwestern part of the property and No. 8 zone about a mile east of the camps on claim No. 3,904. Mr. Cockshutt reports that No. 3 zone will show medium to low values in gold over an average width of 12 feet for 150 feet; both ends of the zone are exposed and are of lower grade. One claims Nos. 6,159 and 3,951 this zone lies in a grey quartz porphyry dike, which strikes N. 30° E. The dike, which intersects the greenstone but has been later schisted with the lava, contains a quartz vein running parallel to the dike wall, but in places it forms a network throughout the intrusive. North of the dike, beyond a high ridge, the vein is intersected by a diabase dike. Here the lode is 8 to 10 feet wide.

No. 8 zone consists of mineralized and silicified sheared zones, in places containing quartz veins and stringers. Pyrite, pyrrhotite, and native gold may be seen. At the south end of the zone a lens of quartz porphyry intrudes the schisted greenstone. In this vicinity an area of rock 200 feet in length and from 20 to 40 feet in width is mineralized and silicified and carries low gold values.

The source of the high-grade float on the property has not been definitely determined but may come from a small ore shoot under the muskeg on the No. 1 zone.

Near Hawk Junction

SOOCANA MINING COMPANY, LIMITED

In 1934 the Soocana Mining Company, Limited, was working the Holdsworth claims, which are situated in township 28, range 24, on the Michipicoten branch of the Algoma Central Railway about two miles from Hawk Junction. In 1936 the company took over the adjoining Reed-Booth group of claims. It is reported that shaft-sinking has been commenced on the latter group.

Holdsworth Claims

Originally John Holdsworth staked a large body of pyrite,[1] which lies in the northwestern part of a group of 14 claims. Three claims in the southern part of the group were being investigated for their gold possibilities in 1934. A quartz vein, 12 feet wide in places, has been exposed at intervals over a distance of about 3,000 feet along the strike. The vein material contains tourmaline, sericite, pyrite, chalcopyrite, pyrrhotite, and galena. At the mill, which is located near the railway, the vein is intersected by a diabase dike, 55 feet wide, which strikes about N. 2° E. The dike occupies a fault fissure. The vein shows evidence of drag along either side of the fault plane. A similar dike intersects the vein farther east. A large band of carbonated mariposite schist is associated

[1]W. H. Collins and T. T. Quirke, op. cit., pp. 123, 124.

with the vein. Alternate bands of quartz and carbonate 4 to 5 feet in width were reported to have been intersected by drilling. The carbonate material in the veins does not seem to carry values, even when mineralized with pyrite. Gold values are reported to occur where the quartz carries chalcopyrite.

B. C. Lamble was in charge of the property.

Reed-Booth Claims

The showing on the Reed-Booth group of 6 claims, Nos. 3,041 to 3,046, inclusive, consists of two parallel sheared zones, each of which is estimated to have been traced about 1,000 feet. They strike about N. 25° W., and dip steeply to the northeast. A 20-foot shaft had been sunk on the most westerly sheared zone, which lies in a mass of quartz porphyry. The shearing is about 12 feet wide. Some good assays in gold are reported from channel samples taken in the shaft.

The sheared zones are highly silicified and contain pyrite, chalcopyrite, galena, sphalerite, and native gold. Mineralization occurs both in the quartz and schist. In the quartz it is associated with dark, thin seams of schist or possibly tourmaline. Rusty carbonate veinlets occur in the quartz, and small patches may be seen in the schist.

A contact between the quartz porphyry and granite lies a quarter of a mile to the southeast of the shaft and runs in a northeast-southwest direction.

OHIO GOLD SYNDICATE

The Ohio Gold Syndicate holds claims Nos. 2,927 to 2,930, inclusive. The group was formerly known as the Peters property and lies immediately south of the Holdsworth claims in township 28, range 24.

On claim 2,930, a 2-foot quartz vein lies in a dark-coloured quartz diorite porphyry. Some pyrite mineralization cocurs near the wall of the vein, which strikes S. 49° E. and dips almost vertically. Farther south on the claim a quartz-carbonate vein lies at the contact of quartz porphyry and grey schist. It contains tourmaline and pyrite. The mineralization is largely confined to the sheared part of the lode.

On claim No. 2,929, a vein occurs in a coarse-grained greenstone and runs N. 40° E. The quartz contains a little carbonate and is mineralized with pyrrhotite and chalcopyrite.

Gold values taken on this property so far are reported to be low.

MURRAY-ALGOMA MINING COMPANY, LIMITED

The property of the Murray-Algoma Mining Company, Limited, consists of a group of 18 claims, approximately 700 acres, in township 28, range 24, half a mile west of Hawk Junction.

The main showing lies at the north end of a small lake in the western part of claim A.C. 2,301. The country rock consists of a carbonated schist intruded by quartz porphyry and cut by several parallel or interlacing quartz veins forming a mineralized body about 50 feet wide and 200 feet long, which strikes about east and west. The west end is marked by a fault striking N. 48° W. To the southeast it follows the bed of the lake. Northwest of the main showing a series of trenches have exposed a vein of quartz from 9 to 12 feet wide mineralized with pyrite, chalcopyrite, pyrrhotite, and sphalerite. This vein appears to lie along the fault. Some good assays in gold are reported from these veins.

Another vein, known as the Blacksmith vein, lies about a quarter of a mile southeast of the main showing. It strikes about N. 70° E. and has been exposed for a length of 500 feet, showing widths up to 10 feet. Grab samples from this vein are reported to show good values in gold. A number of other smaller veins have been uncovered on the property.

The property contains a set of camp buildings and a 25-ton mill. No underground work has been done to date.

CLAIM S.S.M. 2,591

Claim S.S.M. 2,591 is one of a group of nine claims that lies west of the Murray-Algoma property. On this claim a well-defined sheared zone up to 10 feet in width contains large lenses of quartz and much carbonate material. This is called the Armstrong vein. Sulphides occur in the quartz and schist. The vein is strong and well defined and extends for a considerable distance along the strike. It lies in greenstone but close to a porphyry body. Other veins lie to the north of the Armstrong vein. Gold can be panned from the gossan around some of the veins.

MICHAEL-BOYLE PROPERTY

The Michael-Boyle property is situated in the northeastern part of township 27, range 25, and is 5½ miles by road east of a point on the Algoma Central railway a mile and a half south of Alden station. The workings are on the south side of Smith lake, which has to be crossed from the road. On claim A.C. 2,067 a tunnel runs northward from the bottom of a ravine and intersects some small veins. A shaft has been sunk from the top of the hill above the tunnel. The shaft is located on a vein that runs across the strike of the country rock. The country rock is schisted greenstone and is much carbonated in the immediate vicinity of the veins. It is intersected near the shaft by a quartz porphyry dike, which is considerably sheared and carbonated.

Three mineralized schist zones occur at the tunnel. The transverse vein in the shaft bends sharply about and apparently follows the schistosity to the east in two distinct branches. Gold values at the property were reported to be rather low.

APPENDIX

Bibliography of the Michipicoten-Missinaibi Area, 1847-1935

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"On the Geology and Economic Minerals of the North Shore of Lake Superior," Geol. Surv. Can., Rept. of Progress, 1846-47, pp. 5-13.
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"Lake Superior: Its Physical Character, Vegetation, and Animals," Boston, 1850.
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"Survey of Roadway from Sault Ste. Marie Northward along the Lake Superior Coast," Upper Canada Surveys, 1860-1866.

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Section of Huronian slates at the Doré river, p. 52; copper pyrites at Michipicoten bay, p. 703.

1867—MACFARLANE, T.
[On the Laurentian, Huronian, and Upper Copper-bearing rocks, and the economic minerals of Michipicoten island and the east shore of Lake Superior], Geol. Surv. Can., Rept. of Progress, 1863-66.
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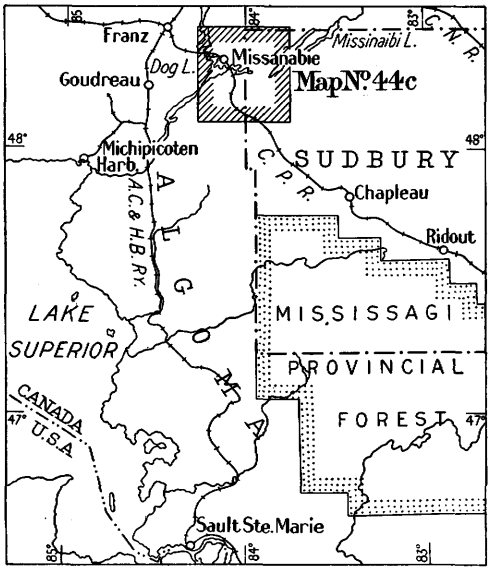
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Geology of the Lochalsh-Missinaibi Area

By E. M. Burwash

INTRODUCTION

The area of volcanic schists that contains the gold and iron ores of Michipicoten and Goudreau extends in an east-northeast direction from Michipicoten bay to the west end of Missinaibi lake and into the townships of Bracken, Leeson, and Lang. Before the present survey it had already been geologically surveyed and mapped as far as Dog lake. The easternmost part was mapped by Ellis Thomson.[1] His map extends from the Algoma Central railway eastward to the eastern boundary of townships 43, 45, and 46, which lies a short distance



Key map showing the location of the Lochalsh-Missinaibi map area. Scale, 50 miles to the inch.

east of the Canadian Pacific Railway line between Dalton and Missanabie stations. The greenstone area east of this sheet and in the townships that lie to the north of part of Thomson's sheet and eastward remained unmapped, and it was thought advisable to continue the areal mapping to the limit of the gold-bearing formation.

The Map-Sheet

The surveys for map No. 44c, accompanying this report, were made in the summer of 1934, and although they are not complete it was thought better to publish the result of the work. The area included in the map covers part of Thomson's sheet and for this part his map is simply reproduced without change. As some of the township lines in the northeast part had not been surveyed, even moderately good controls for micrometer and compass work were lacking over

[1] "Missinaibi Area," accompanying Mem. 147, Geol. Surv. Can., 1926.

much of this part of the area. The old Niven base line, which forms the northern boundary of Glasgow, Meath, Rennie, and Leeson townships, could not be located where one or two of our traverses crossed it, and fire had obliterated other township lines, especially to the north of Crooked lake and in the eastern part of Dog lake. Owing to the time required for topographical surveys of the waters in the northeastern part of the sheet, only a few land traverses were made, except along surveyed lines. On the other hand the topographical maps of Wabatongushi (Lochalsh),[1] Crooked, and Missinaibi lakes afforded a fairly accurate base.

Acknowledgments

For the completeness of the result, especially in mapping the eastern part of the area, the writer has especially to thank G. A. Harcourt, W. W. Moorhouse, and O. S. Carter, who were efficient assistants.

Hearty thanks are also due to many within the area traversed who afforded the assistance indispensable to the success of any expedition comprised of persons relatively unacquainted with the locality. Mr. H. Charlebois and Mr. Adkins at the Ash lake property rendered much assistance. Mr. D. A. Stuart at Missanabie station not only furnished the party with excellent supplies at reasonable cost, but rendered many services, including the securing of Indian guides, the supplying of topographical information, and personal hospitality. Mr. J. W. Jamieson, secretary of the Railway Y.M.C.A. at Chapleau, kindly provided accommodation in the matter of storage, forwarding, and sale of canoes.

Topography

The Lochalsh-Missinaibi area is situated astride the height-of-land between Lake Superior and Hudson bay. The topography in general is that of a leve plateau. The surface is broken by monadnocks, which rise as high as 200 feet These, so far as determined, are erosion remnants of resistant rocks, mainly diabase, but in a few instances granite or syenite. In only a few cases are the schists exposed in the higher hills, and in all such cases this is due to the presence beside them of more resistant rocks. The lowlands are largely covered with level deposits of sand and gravel overlying till, which often reach a thickness of 50 or more feet. The chief exposures of the schists in which gold veins might occur lie along the shores of lakes and the beds of streams, where recent erosion has laid them bare. The remains of old camps and small workings in mineralized shear zones or quartz veins attest to the former presence of the prospector, but at the time of the writer's visit in 1934 active work was proceeding on only one property, the Charlebois-Cristakos claims at Ash lake in the northwestern part of township 44 near Cowslip station.

Lumbering

The region was formerly well forested, largely with Banksian pine, black spruce (on flats), poplar, balsam, and red and white pine, the last two somewhat sparsely represented. Large logging operations have been carried on, both for ties and sawn lumber. Throughout the area dams have been built at the outlets of the lakes, and around some of them, especially Easey lake, considerable areas of wooded country were flooded. These dams are now for the most part broken and the "drowned" lands with their dead timber left dry. To the north of

[1]The name Lochalsh was originally applied to the north end of Dog lake, afterwards to Wabatongushi lake and now to a small lake lying between.

Easey lake, on Crooked lake, and in the intervening country, large areas have been burned. The result of these conditions now is that streams are blocked with log-jams, old portages covered with a "slash" of fallen trees, and travel on foot or by canoe rendered difficult. On the other hand a few logging roads are still open and afford means of access to some parts of the land between the lakes. The area east of Wabatongushi lake as far as the group of small lakes lying north of Loch Katrine has escaped burning and is covered with good forest, mainly of second growth.

Water Powers

Owing to the position of this area on the level summit of the divide between Lake Superior and Hudson bay, there are no steep gradients in the streams to furnish a large supply of power. For the same reason the streams are not large. In a few instances small power units might be installed at the outlets of lakes by building dams to conserve the water supply in the lakes. Dog lake, Wabatongushi lake, and Crooked lake are already dammed to distribute their outflow through the year and regulate the water supply at the power sites on the Michipicoten river where it descends steeply toward Lake Superior in the lower part of its course.

Access and Communications

The Canadian Pacific railway passes obliquely across the western part of the map area, and the remaining parts are easily reached by air, canoe, or lumbermen's roads. A canoe route connects with the railway at a point 2 miles east of Shumka station, giving access to townships 41 and 42 and the southeastern part of Lang township by way of Bolkow lake and its connecting waters. Near Dalton a canoe route crossing the railway uses the upper waters of the Shikwamkwa river by which access can be gained to Ogasiwi lake. To the north of Carry station, Pickle and Ash lakes are reached by canoe. From Ash lake, also, roads connect with Dog lake and Crooked lake. The various arms of Dog lake lead to a number of canoe routes: (1) to Crooked lake and thence to the Missinaibi river, (2) via Stony portage to Manitowik lake and the Michipicoten river, (3) by Dog Lake river to the lake system of Meath and Rennie townships, (4) by McKewen lake to the northern parts of township 46 and Stover township, (5) to Wabatongushi lake and north to Oba lake and the Oba river, and (6) by McKee creek north through the northern part of Stover to the group of lakes in Rennie township. Lochalsh station also affords direct access to Wabatongushi lake and is connected by a graded road with Goudreau on the Algoma Central railway.

Population and Industries

The villages of Dalton and Missanabie contain most of the population of the fifteen townships covered by the map. At Dalton a short spur leads to Dalton Mills, where a good-sized lumbering industry is situated. At Missanabie station the trading posts of the Hudson's Bay Company and of D. A. Stuart form the centre of a small settlement, composed for the most part of Indians. There are no farms, but a few gardens surround these villages. Some summer campers have their cottages on the shores of Dog lake, and a Forestry Department station is situated on the bay near Missanabie.

Fish and Game

The roughly oblong area between the Canadian Pacific and Canadian National railways extending from the Chapleau river on the southeast to the

Algoma Central railway on the northwest is closed to hunters. The usual game and fur-bearing animals native to the region are found, including beaver. The waters are also stocked with pike, pickerel, and lake trout especially, besides smaller varieties of fish.

Climate and Soil

Climatic records have been kept at Franz, a few miles east of the map area, and an outline of meteorological conditions is given in the following tables of monthly and annual mean temperatures and precipitation.

TABLE OF TEMPERATURES[1] (DEGREES F)

	Monthly means												Annual means
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Maxima	13	16	27	45	59	71	73	70	61	47	31	21	45
Minima	-13	-13	- 1	19	39	45	50	47	39	30	15	- 2	21
Means (average)	0	2	13	32	49	58	62	58	50	38	23	10	33
Brandon, Man. (av. mean)	3	0	16	39	51	60	64	62	53	41	20	7	34

[1]Data from A. J. Connor, Meteorological Tables, Canada Year Book, 1931.

Warmest recorded in December	18.8 mean
Coldest recorded in December	1.2 mean
Warmest recorded in July	68.2 mean
Coldest recorded in July	55.9 mean

TABLE OF PRECIPITATION (IN INCHES)

	Monthly mean precipitation												Annual mean totals
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Total[1]	1.36	1.09	1.75	1.82	1.90	2.36	4.33	2.22	3.66	2.44	2.93	1.92	27.78
Snow	1.28	9.2	11.8	7.8	.6	.....	.....	.....	.1	1.4	16.3	14.8	74.8
Rain	.08	.17	.57	.04	1.84	2.36	4.33	2.22	3.65	2.30	1.30	.44	19.3
Brandon, Man.	.96	.72	.80	1.07	1.85	3.10	2.50	2.27	1.42	.84	.81	.69	17.03

[1]The total is calculated as rain: 10 inches of snow = 1 inch of rain.

The climate is of the eastern interior continental type. It has temperatures during the growing season slightly below those of Brandon, Man., and precipitation considerably higher, especially in July. The soil throughout the area is, in general, poor, being mainly sand and gravel. Exceptions occur along the lower courses of streams, especially on the Dog Lake river, where silty alluvium covers a small flood plain, and in some places where clay till is exposed. Vegetable crops flourish in the gardens at Missanabie village.

Previous Geological Work

Robert Bell passed across this area in the years 1875 and 1876. He described the rocks on Dog and Wabatongushi lakes and noted the relative levels of the lakes on the flat topography of the height-of-land.[1] Gold was discovered by John Halliday at Emily bay on Dog lake in 1896. In the following year, A. P. Coleman made an examination of the locality on behalf of the Ontario Bureau

[1]Robt. Bell, Geol. Surv. Can., Rept. of Progress, 1875-76, pp. 330-335; ibid, 1876-77, pp. 219, 220.

of Mines, and his report[1] describes the country rocks and mode of gold occurrence. In 1897, also, A. B. Willmott made a general geological survey of the Michipicoten Mining Division.[2] His work is of very great interest and affords the best account so far published of the early history of the area, a very complete list of the early geological references, and a more advanced view of the geology than any done up to that time. He traces the schist series as far as the eastern part of Dog lake.

In Memoir 147 of the Geological Survey of Canada, Professor Ellis Thomson[3] describes the eastern part of the schist area, which he extends as far as the west end of Dog lake and southeastward to Matchinameigus lake, and differentiates the Keweenawan dikes and peridotite. He describes somewhat fully the properties in the vicinity of the old Emily mine on Dog lake. His map work is partly included in the southwestern part of the map accompanying this report.

GENERAL GEOLOGY

The crystalline rocks that underlie the area are divided into three main types. Most of the oldest rocks are schists, to which the name Keewatin has ordinarily been given. As found in this area they include two types: (1) a basic or greenstone type, corresponding in general to the Gros Cap greenstones of Coleman and Willmott,[4] and (2) an acid type or phase, which agrees in general with their Wawa tuffs. The same distinction of types has been made by Moore in his report,[5] and these formations appear to extend through from the Michipicoten area, where they were originally defined. Both the greenstone and acid schists appear for similar reasons to belong to the post-Doréan or Upper Keewatin, as defined by Collins and Quirke[6] in the Michipicoten area.

The second general division of rocks includes granite, gneiss, and other granitoid rocks, porphyries, and quartz veins, which are here assigned to the Algoman period.

The third group contains dikes of quartz diabase, normal diabase, and olivine diabase, and a large intrusion of peridotite. These are assigned to different ages within the Keweenawan period. Certain dikes of younger granite observed on Easey lake and certain veins as later described may also belong to this period.

A fourth geological division, which is areally very important in this map-sheet includes the drift and subsequent unconsolidated deposits.

Table of Formations

QUATERNARY	
RECENT:	Alluvium, peat.
PLEISTOCENE:	Lacustrine or outwash sand and gravel. Till.
	Unconformity
PRE-CAMBRIAN	
KEWEENAWAN:	Later diabase, olivine diabase, and peridotite. Younger granite and quartz veins. Earlier quartz diabase.

[1] A. P. Coleman, "Fourth Report on the West Ontario Gold Region," Ont. Bur. Mines, Vol. VII, pt. 2, 1898, p. 136.

[2] A. B. Willmott, Ont. Bur. Mines, Vol. VII, pt. 2, 1898, pp. 184-206.

[3] Ellis Thomson, "Missinaibi Map-area," Geol. Surv. Can., Mem. 147, pt. 2, 1926, pp. 143-161.

[4] See page 6 of this volume; also A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines, Vol. XI, 1902, pp. 155-158.

[5] E. S. Moore, "Goudreau and Michipicoten Gold Areas," Ont. Dept. Mines, Vol. XL, pt. 4, 1931, pp. 4-7, accompanied by map No. 40e.

[6] W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, pt. 1, 1926, p. 26.

Intrusive contact

ALGOMAN: Granite, granodiorite, diorite, syenite, pegmatite, quartz porphyry, feldspar porphyry, lamprophyre, quartz veins.

Intrusive contact

HAILEYBURIAN(?) (Post-Doréan ?):
- Upper volcanics, mainly basic, massive or ellipsoidal, largely represented by chloritic schists.
- Iron formation.
- Lower volcanics, mainly acid, partly basic; both largely schisted.

Haileyburian(?)

This series of schists, considered by previous writers as Keewatin, has been taken by the present writer, for reasons already stated,[1] to be possibly Haileyburian in age. As divided by Coleman and Willmott the included formations from top to bottom were:[2]—

Eleanor slates.
Helen iron formation.
Wawa tuffs [acid].
Gros Cap greenstones [basic].

This subdivision was worked out in the immediate vicinity of the Helen mine. Later study of a wider area by Collins and Quirke led them to the belief that the sediments represented by the Eleanor slates in that locality were to be found at various horizons,[3] and that the more important iron formations generally occur above the acid and below the basic members of a much folded formation.[4] Moore agrees with this, adding that iron formation is also to be found within the greenstone.[5] In the Lochalsh-Missinaibi area, the latter condition of the iron formation was the only one observed. The acid member of the series was found to occur in the townships of Stover, Rennie, and Leeson. Little time, however, could be given to an examination of the contact line, and much of it is covered by the deposits of sand and gravel, which are spread over a large part of the region. Data as to whether the structure of the acid belt is anticlinal or synclinal are also lacking. The only part of the map-sheet where iron formation has been observed, lies on the west side of Dog lake, where several bands of it were mapped by Thomson. The bands of iron formation are there shown as lying parallel and close together at different horizons. Thomson's map does not differentiate the acid and basic members, but the author states that the bands of iron formation are "intercalated between post-Doréan rocks of about the same age and composition, chiefly basic."[6]

Petrology

Perhaps the chief petrographic distinction between the pre-Doréan (Keewatin) and the post-Doréan is the large development of carbonaceous matter in the latter, especially in the iron formation, but also noticeable elsewhere in the various members of the series. Collins and Quirke[7] state that not much petrographic difference exists between the upper pre-Doréan and the lower post-Doréan, lying on the other side of the Doré sediments, a fact that might well be adduced in support of the contention of Coleman and Willmott that both are

[1] Pages 7 and 8 of this volume.
[2] A. P. Coleman and A. B. Willmott, op. cit., p. 155.
[3] W. H. Collins and T. T. Quirke, op. cit., p. 34.
[4] Ibid, p. 53.
[5] E. S. Moore, op. cit., p. 7.
[6] Ellis Thomson, op. cit., p. 155.
[7] W. H. Collins and T. T. Quirke, op. cit., p. 23.

Keewatin of similar age and that the Doré deposited above them forms an infold, flanked by similar limbs of a Keewatin syncline.[1] This is a matter of minor concern to the present writer as the Doré does not occur in his map area.

The types of the post-Doréan examined were largely chlorite-sericite schists, the alteration products of volcanic rocks of medium basicity, and sericite-carbonate schists. In few cases were there evidences of decidedly basic types. Ilmenite and its alteration product leucoxene are the typical accessories, and often afford the best indication of the original rock type. Magnetite and pyrite are also frequently associated in the same section and suggest the more acid rocks. In a few cases chlorite or biotite-hornblende schists represent the more basic volcanics. Little of interest can be added to the able studies carried out in the neighbouring Goudreau area by Moore.[2] The occurrence of pyrite as phenocrysts in some of the quartz porphyries was observed. Pyrite might also be taken from its abundance to be a characteristic of the post-Doréan, but not a distinguishing characteristic since it occurs in large deposits in Keewatin rocks elsewhere.

The acid area in Rennie and Stover townships is of undoubtedly extrusive character. The rocks are rhyolitic in type, characterized by flow structures, and also in observed cases pyroclastic. In most instances the rocks are quartz porphyry flows exhibiting blue quartzes up to a quarter of an inch in diameter and often well-developed idiomorphic feldspars. The groundmass is generally schistose. A sheared pyroclastic structure occurs in the same area.

Certain plutonic rocks also may be assigned to the Haileyburian or post-Doréan. The fact that the granodiorite occurring in the schist area is often sheared and that gold is deposited in these shear zones indicates that in all probability this plutonic rock is older than the Algoman, to which it has been referred. It might appear that it belongs to the same (post-Doréan) period as the lavas into which it was intruded, but that being more massive it has escaped the complete schistification of the surrounding extrusives. An alternative is that the shearing of the granodiorite and the gold mineralization along the shear zones are both Keweenawan (Killarnean). A better view would make the schists Keewatin and the granodiorites Haileyburian. The evidence collected by Frohberg[3] in the Michipicoten area is to the effect that the later quartz veins (possibly assignable to the Keweenawan) are barren; but this is not true of the quartz at the Michael Syndicate shaft, which, as circumstances would indicate, may be Keweenawan in age. The fact that most of the gold veins in this area lie along the strike of the schists, and that the shear zones in the granodiorite strike in general in the same direction, points to a pre-Algoman origin for the fissures and Algoman age for the veins.

Algoman

The term "Algoman" is usually applied to granite intrusions later than the Laurentian and also later than the Hastings or Timiskaming series and the still younger lamprophyric dikes and extrusive volcanics of the Haileyburian series. Where the Laurentian and the Algoman granites occur together, the Algoman can generally be distinguished as a massive red granite intrusive in the greyer-toned Laurentian gneiss. Where extensive movements have taken place subsequent to the Timiskaming folding, the Algoman also may be gneissic and grey in colour,

[1] A. P. Coleman and A. B. Willmott, op. cit., p. 165.
[2] Op. cit., pp. 4-6.
[3] See page 51 of this volume.

as at Regina bay on the Lake of the Woods.[1] The study of the granites and gneisses in the Michipicoten region has not yet been attempted in such a way as to differentiate various ages of the granite intrusives that surround the greenstone belts. Both massive granites and gneisses are known to occur, but their relationships are not yet definitely known. The older granite, described by Collins and Quirke, from which the Doréan pebbles were derived, is massive in part and in part gneissic. The later (Algoman) granite and granodiorite throughout the region is also in part massive, but affected by many shear zones. It, however, intrudes both the Doré and the supposedly later post-Doréan or Haileyburian schists. All granitoid or gneissoid rocks that have an intrusive relation to these schists are considered to be Algoman or younger, as are also the granitoid rocks in the Lochalsh-Missinaibi area wherever they are seen in contact with the post-Doréan schists.

Observed Phases of the Algoman

The rocks collected and examined during the writer's survey of this area to which Algoman origin might be attributed vary from medium basic diorite or granodiorite, through syenite, to granite and rhyolite. The sections examined were determined as follows:—

I. Wabatongushi lake (south shore):
1. Quartz-mica diorite gneiss (possibly a hybrid contact phase).
2. Red hornblende granite porphyry gneiss.
3. Rhyolite porphyry with idiomorphic pyrite.
4. An acid hornblende-biotite lamprophyre-like type.
5. Porphyritic granodiorite.

II. Loch Katrine:
1. Highly amphibolitic phase of quartz diorite (possibly Keweenawan).
2. Hornblende granite.

III. Moorhouse lake (east end):
1. Granite.

IV. Ash lake:
1. Hornblende granite porphyry (gneissic).
2. Acid lamprophyre dike.
3. Biotite syenite-pegmatite.

V. Canadian Pacific railway between Missanabie and McKewen Lake portage:
1. Granite.

VI. Harcourt lake:
1. Hornblende syenite.

VII. Easey lake:
1. Porphyry dike.
2. Gneissic granite dikes (cut by red, massive Keweenawan granite dikes).
3. Sheared feldspar porphyry.
4. Grey granite cut by later red granite dikes.
5. Quartz veins.
6. Lamprophyre (on traverse north from the lake).
7. Granite.

VIII. Northern part of Rennie township:
1. Granite.

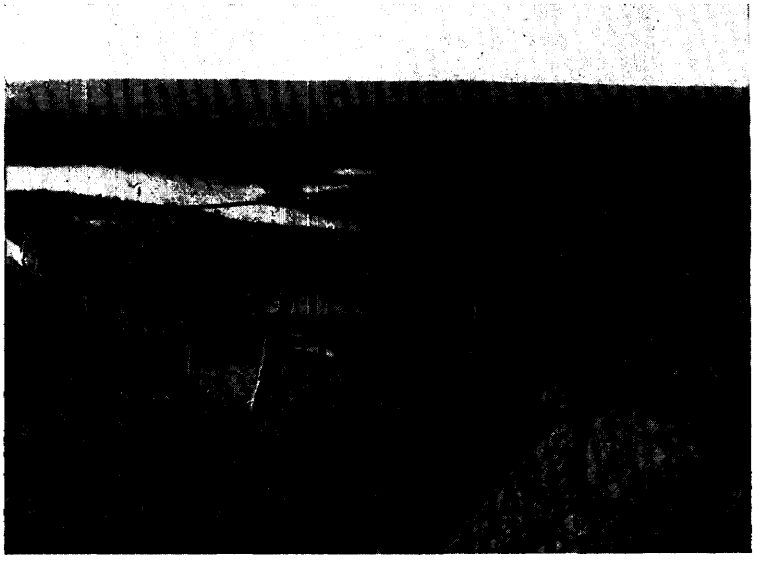
Keweenawan

Throughout the area of volcanic rocks from Lake Superior to Missinaibi lake there has been much fracturing, mostly in a direction averaging about

[1]E. M. Burwash, "Geology of the Kakagi Lake Gold Area," Ont. Dept. Mines, Vol. XLII, pt. 4, 1933, p. 64.

N. 30° W. The fractures contain dikes of diabase ascribed to the Keweenawan period. In a few instances these dikes follow the direction of the schistosity, about N. 60° E. to N. 70° E.[1]; in other cases they follow the direction of an intermediate set of fractures, related to the direction of many of the principal lake reaches on the map, which lie about N. 45° E. On both the north-northwest and northeast fractures, extensive faulting of the post-Doréan has developed, and both are later in age than the Algoman.

Faults of 40 to 50 degrees azimuth undoubtedly exist along the axis of Manitowik lake and extend through Dog lake and along other axes of erosional weakness parallel to this and occupied also for the most part by lakes. The Keweenawan dikes, so far as evidence can be deduced from the published maps,



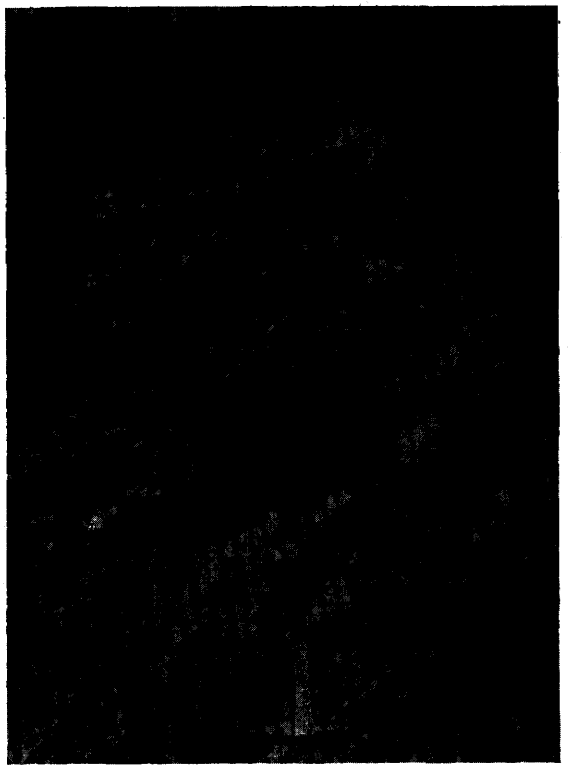
View northward from the summit of Helen mountain. The light-toned rock in the right foreground is the banded iron and silica phase of the iron formation. The depression with bushes is occupied by the right-hand dike of the two diabase dikes seen below in the distance.

either cut across these faults without offsetting or terminate against them. In either case the dikes are younger than the faults. This applies to the older as well as the younger Keweenawan dikes. In one case a dike of the younger diabase lies parallel to such a fault, indicating that up to that time a few fissures formed during the period of this faulting still remained open. The great majority of these dikes, both older and younger, follow fissures that strike about N. 30° W., but in some cases a little east of north. These fissures were open in the Keweenawan period but not in the Algoman, since they contain no Algoman dikes or veins. These dikes also generally cut across the boundaries between the post-Doréan and Algoman formations without disturbance, but occasionally end at the

[1]The strikes of the schist in the eastern part of the area are also often due east or even more to the south. In the Michipicoten region the strikes are often more northerly, owing to drag connected with extensive faulting movements. The directions of the schistosity due to post-Haileyburian foldings are very comparable to the strikes of the Keewatin-Timiskaming foldings of the eastern part of Northern Ontario, as in the Sudbury region, the Kirkland Lake gold range, and the Porcupine gold range, and also to the foldings to the west of Lake Superior.

contact. The fissures trending N. 30° W., therefore, appear to be younger than those trending N. 45° E.

Of these dikes the older set of quartz diabase are much altered and often deformed and mashed by later regional movements, which were probably connected with the opening of new fissures in which the younger diabase, acid dikes, and veins were intruded. Great faultings have taken place along the fissures occupied by the older dikes, which were intruded after the fault movement had ceased. Enormous extrusions were then in progress round the margin of Lake



Lode formed by quartz filling in fracture cleavage, Michael Syndicate property.

Superior not far distant, accompanied and followed by the subsidence with radial foldings and faultings which produced the Lake Superior synclinorial basin.[1] The first fissuring and faulting must have occurred early in this period of diastrophic movement. The first dike intrusion occurred later and was followed by a renewal or continuation of the diastrophism. The diastrophic movement had come to an end before the intrusion of the later dikes. Studies at Keweenaw point and Michipicoten island indicate that the extrusive rocks were alternately basic and acid. At Sudbury the order of intrusion is (1) norite-micropegmatite, (2) granite, and (3) olivine diabase. It would not be unreasonable, therefore, to expect to find acid intrusions and quartz veins in the Keweenawan of the Michipicoten-Missinaibi area.

[1]E. M. Burwash, "Geology of Michipicoten Island," Univ. of Toronto Studies, Geol. Series No. 3, 1905, pp. 40, 41, and map.

The faulting along the fissures intruded by the older dikes is marked by considerable flexure or "drag" of the rocks on either side, sometimes by a series of cleavage cracks diagonal to the line of shearing. One such set of cracks at the Michael Syndicate property in the Goudreau-Lochalsh area has been filled with quartz, and the whole structure forms a gold-bearing lode (parallel to a dike), on which a shaft has been sunk. A similar lode has been traced on the Algoma Exploration property. The quartz injection is, no doubt, older than the dike and might indicate that strains along these nearly north-south lines took place as early as the Algoman, but there is no other evidence of this. The direct evidence as to Algoman veins lies in the fact that gold-bearing quartz veins, such as that on the Holdsworth property near Hawk Junction, are bent and faulted to the left (as one looks across the fault) against the diabase dikes. The veins there, which are of the same age as the Algoman batholith, are, therefore, older than the fissuring and faulting that preceded the intrusion of the diabase. Quartz, like that at the Michael Syndicate shaft, which appears to be secondary to the fissures and fissured shear zones that contain most of the diabase dikes, must be of a later age than the Algoman.

In addition to the quartz occurrence above described there are also red feldspathic dikes in the Michipicoten area that are later than any other intrusion except the latest set of diabases and lamprophyres.[1] Both cut the quartz veins. Lastly, in the Lochalsh-Missinaibi area there are massive red granite dikes which cut the Algoman granites in places where the Algoman has been rendered gneissoid by the strains due to Keweenawan diastrophism. Therefore, these red granite dikes also must be assigned to the Keweenawan. They are intruded by the late Keweenawan diabase. These occurrences may be observed on the north shore of Easey lake and on the south shore near the outlet.

Pleistocene

The close of the Keweenawan was followed by a prolonged period of erosion, and there is no evidence of any later deposition either extrusive or sedimentary in this area until the Pleistocene.

The tops of the hills are bare of drift with the exception of a scattering of travelled boulders, which may be the remains of a former till-sheet now eroded away. The lower plains between the hills are covered by deposits of sand and gravel, which are underlain in part by till.

The sands and gravels or sandy till cover the rock surfaces so completely that exploration for mineral deposits is difficult.

The origin of the sands and gravels on the height-of-land may be referred with some probability to outwash from a retiring ice front. Their elevation is in many cases well over 1,100 feet above sea-level, or 500 feet above Lake Superior.

Recent

In the lower valleys of the larger streams and in lakes, sand, silt, and marsh deposits are common but do not occupy a large part of the area. The silts are due to erosion of the Pleistocene deposits and transportation of their finer constituents to the place of deposition.

[1]The presence of lamprophyres among the later dikes has been described by M. H. Frohberg, Beitrage zur Kenntnis der turmalinführenden Goldquartzgänge des Michipicoten-Distriktes, Ontario, Leipzig, 1933, p. 16, and by T. L. Gledhill, Ont. Dept. Mines, Vol. XXXVI, pt. 2, pp. 14-16, who places these dikes in the Algoman.

DESCRIPTION OF PROPERTIES

Charlebois-Cristakos

During the summer of 1934, some development work was done on a property owned by H. Charlebois and N. Cristakos in township 44, a short distance north of the east end of Ash lake. The property is reached by canoe from Missanabie station by way of Crooked lake and a creek which enters the southwestern bay of this lake. The creek is ascended to the point where it is crossed by a timber road leading to Ash lake. The workings are located near the point where the timber road passes close to a small lake.

Two test pits are located a short distance northwest of the small lake. In this vicinity the rock is a hornblende schist containing some pyrite and cut by small dikes of magnetite and pyrite. A channel sample taken across 30 feet of this schist is reported to have assayed 0.1 ounces gold per ton. Farther northwest on claim S.S.M. 22,095 a gold-bearing quartz vein 2 feet in width lies in sheared basalt and runs parallel to a 4-foot dike of granite porphyry. The dike and vein strike N. 30° W. and dip almost vertically. About 1,200 feet northwest along the strike on claim S.S.M. 22,099 a smaller vein is exposed. It carries pyrite, chalcopyrite, pyrrhotite, and native copper, the latter apparently being secondary. No gold values were obtained here. Some small veins and stringers lie farther along the strike.

White Discovery

Since the conclusion of field work for this report a gold discovery was made by G. L. White of Chapleau on the north side of the peridotite hill located southeast of Lochalsh station. A rich showing of gold about 25 feet in length is found in a series of narrow parallel quartz veins in diabase. Up to date, sampling results on the property indicate that the gold is confined to small pockets, and the property is inactive at present.

The Ore Deposits of the Michipicoten Area

By M. H. Frohberg

INTRODUCTION

The Michipicoten area is located in the district of Algoma, about 100 miles north of Sault Ste. Marie and little over 5 miles east of Lake Superior. It is close to 7 miles long and 3 miles wide, and extends from Wawa lake southward to the Michipicoten river.

Since there are no highway connections with the more populated regions of Ontario, access to the area depends chiefly upon the Algoma Central and Hudson Bay Railway, a branch line of which links Michipicoten Harbour and Wawa station with Hawk Junction on the main line from Sault Ste. Marie to Hearst. During the navigable season, a bi-weekly steamboat service is maintained on Lake Superior by the Dominion Transportation Company between Sault Ste. Marie and the mouth of the Michipicoten river.

Roads passable for automobiles lead from Wawa station to the various mines, Michipicoten Mission, and the power plant at High Falls on the Michipicoten river. Michipicoten Mission with approximately 100 inhabitants is the oldest settlement and lies close to Lake Superior near the confluence of the Michipicoten river and the Magpie river. Recently, small communities have grown up near the productive mines. Parkhill, the largest of the new mining towns, has hotel accommodation, several stores, and a post office (Gold Park).

The Michipicoten area is a gently undulating region, which in its untouched portions is still covered by dense virgin forest. A higher relief prevails near Lake Superior, owing to the sinking of the lake level since the retreat of the glacial ice-sheet. The two largest rivers of the region, the Michipicoten and the Magpie, in their lower courses have deeply entrenched valleys with rapids and water falls. The old peneplain that formerly surrounded Lake Superior may be traced on the higher elevations of the region, which north of Wawa lake attain an altitude of more than 1,100 feet above Lake Superior, or 1,700 feet above sea level.

History of the Area

The first gold discovery in the Michipicoten area was made in 1897 at Mackey point on the south shore of Wawa lake. The news of this find caused a gold rush, which led to the discovery of various other occurrences, such as the Ganley, Golden Reed, Grace, Hornblende, Kitchigami, Mariposa, and Manxman veins. Some of these deposits were soon explored by prospecting shafts, and several small mills were erected on various properties, but only the Grace and Manxman mines were productive during this early period. After a few years, mining activities gradually ceased, and nearly twenty years of idleness followed.

It was probably due to the rapid development of gold mining in the Porcupine and Kirkland Lake areas after the world war that the public began to show renewed interest in the gold veins of Michipicoten. In 1926, new development work was started on the Cooper and Grace properties. A revived prospecting campaign resulted in the discovery of several new deposits. These included the so-called "Jubilee break" and the veins of Parkhill Gold Mines. In 1931, the Minto and Parkhill mines started production. In April, 1936, the list of producing properties included the Darwin (the old Grace), Jubilee, and Parkhill mines. From 1931 to the end of 1936, the area produced a total of 120,203 ounces of gold.

Field Work and Acknowledgments

The present report is based on a thesis submitted in 1932 to the Mining Academy, Freiberg, Saxony, in partial fulfillment of the requirements for the degree of Doctor of Engineering.

The writer first studied the gold veins of the Michipicoten area during a two-year period from the spring of 1928 to 1930. Further field work connected with additional microscopic studies was done during 1934 and 1935.

The original investigation, for which 198 thin sections and 81 polished sections were prepared, was carried out in the laboratories of the Department of Geology in Freiberg, Saxony. The author is greatly indebted to his former teachers, Dr. F. Schumacher, Dr. F. Kolbeck, and Dr. H. von Philipsborn, Freiberg, for their kind interest and assistance in connection with the original thesis. Acknowledgment is also due to the mine managers of the various mines in the area, particularly to Mr. R. E. Barrett, Parkhill mine, and Mr. J. Knox, Jr., Minto mine, who contributed much valuable information. The writer also wishes to thank Mr. H. C. Rickaby, Provincial Geologist, and Dr. H. C. Cooke, of the Geological Survey, Ottawa, for their co-operation and helpful criticism,

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A. F. Matheson, "Michipicoten River Area," Geol. Surv. Can., Sum. Rept., pt. D, 1932, pp. 1-21

GENERAL GEOLOGY

Apart from Pleistocene and Recent sediments, only pre-Cambrian rocks are known to occur in the Michipicoten area. Since most of the rock formations are of igneous origin, Collins and Quirke[1] have used the sediments of the Doré series as a means of subdividing the large masses of volcanic rocks into a lower and upper group, which they call, respectively, pre-Doréan and post-Doréan. The sedimentary complex borders Lake Superior near Michipicoten Harbour and is composed of conglomerates, greywackés, arkoses, and stratified pyroclastic material, the total thickness of which ranges from a few hundred feet to nearly two miles. The Doré conglomerate is of particular interest as it encloses pebbles and boulders of granite, thus indicating a granite intrusion in pre-Doré time. In places, the Doré series is cut by later granite and metamorphosed along the contact.

The rocks believed by Collins and Quirke[2] to be pre-Doréan are represented by various types of schists as well as by granite, and their post-Doréan group comprises a thick sequence of various pyroclastics, lava flows, iron formation, and

[1]W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147 pt. I, 1926, p. 13.
[2]Ibid, p. 25.

subordinate intercalations of sedimentary origin. In this subdivision, the post-Doréan assemblage includes all pre-Algoman rocks of the Michipicoten area.

Collins and Quirke[1] have classed the entire complex, consisting of the pre-Doréan group, Doré sediments, and post-Doréan series, with the Keewatin. This interpretation, however, seems to neglect the evidence of a granite intrusion in pre-Doré time, which undoubtedly was followed by a considerable erosional interval.

Considering this fact, Gledhill[2] tentatively correlated the Doré series with the Timiskaming conglomerates of the Porcupine and Kirkland Lake areas, which appear infolded into the Keewatin. In this opinion, Gledhill is supported by Moore.[3] Gledhill pointed out that the Doré series in places contains fragments of iron formation such as occurs in the post-Doréan group of Collins and Quirke. The latter suggested that these inclusions of iron formation might be derived from similar beds in the pre-Doréan series.[4] Such rocks, however, have not been recognized in the areas that Collins and Quirke mapped as pre-Doréan.

Collins's and Quirke's classification of the Doré series with the Keewatin rests largely on the assumption that these sediments are tilted up in a single inclined band, dipping south.

During a visit to the area in July, 1936, Dr. H. C. Cooke, of the Geological Survey, Ottawa, found a short distance south of Michipicoten Harbour a sequence of basic lava flows with ellipsoidal flow tops dipping at steep angles to the northwest. Similarly, an excellent exposure of the base of the Doré series, on the southernmost island west of Gros Cap, yielded additional proof that the southern part of the Doré series dips steeply to the north. According to this structural evidence, the Doré series lies in a syncline enveloped by Keewatin rocks.

The Keewatin and Doré formations are both intruded by granitic rocks that have been exposed by erosion to varying depths. The consensus of opinion of all recent investigators is that these igneous intrusions are probably of Algoman age. This correlation permits the inference that the older pre-Doréan granite corresponds to the Laurentian, as has been suggested by Moore.[5]

The following sequence of rock formations in the Michipicoten area and its vicinity is in accord with the foregoing evidence:—

Table of Formations

QUATERNARY	
RECENT:	Alluvial deposits.
PLEISTOCENE:	Glacial drift and lake deposits.
PRE-CAMBRIAN	
KEWEENAWAN:	Lamprophyre dikes. Red feldspar-carbonate veins. Younger diabase dikes.
ALGOMAN:	Pegmatitic quartz veins. Gold-bearing quartz veins. Granite, granodiorite, diorite and related porphyries, aplites.
HAILEYBURIAN:	Older diabase dikes.
TIMISKAMING:	Doré series: conglomerates, greywacké, arkose, tuffs.
LAURENTIAN:	Granite, diorite, various porphyries.
KEEWATIN:	Basic and acid volcanics (flows, tuffs, breccias, agglomerates) with local sedimentary material and iron formation.

[1]Op. cit., pp. 11, 41.
[2]T. L. Gledhill, "Michipicoten Gold Area," Ont. Dept. Mines, Vol. XXXVI, pt. 2, 1927, p. 10.
[3]E. S. Moore, "Keewatin-Timiskaming Boundary," Bull. Geol. Soc. Amer., Vol. 40, 1929, p. 553; "Goudreau and Michipicoten Gold Areas," Ont. Dept. Mines, Vol. XL, pt. 4, 1931, pp. 8, 10.
[4]W. H. Collins and T. T. Quirke, op. cit., p. 73.
[5]Op. cit.

Keewatin

The oldest formation in the Michipicoten area is represented by an intensely folded and metamorphosed complex of Keewatin volcanics, with which are associated iron formation and insignificant intercalations of sedimentary origin. The entire group forms a deeply eroded framework surrounding numerous minor intrusions of granitic rocks and porphyries.

The Keewatin series bears witness of an intensive volcanic activity, which produced a great variety of rocks ranging in composition from acid to basic. A large volume of these volcanics is light-coloured fragmental material, which varies from very fine grained tuffs to coarse breccias and agglomerates, with angular fragments up to 20 inches in diameter. In general, the tuff-like members are not stratified and were obviously deposited on a land surface.

Rather conspicuous beds of agglomerate occur both at the Darwin and Parkhill mines. They strike in a northeasterly direction and can be traced for several thousand feet. The fragments contained in these beds are made up of tuffs, porphyries, and basic flow rocks.

Basic lava flows appear to be scarce in the vicinity of the gold mines. A fairly large area of ellipsoidal greenstone adjoins the gold camp on the west. It extends from Michipicoten Harbour along the coast of Lake Superior toward the Michipicoten river, and consists essentially of massive greenstone with local horizons of tuff-like material. Outcrops of the ellipsoidal phase, found near the mouth of the Michipicoten river, have an important bearing on the geological sequence.

Flow rocks of intermediate and acid composition include andesites, rhyolites, and various types of porphyry. Some of the latter closely resemble certain intrusive porphyries of Algoman age. Microscopic examination tends to show that the Keewatin porphyries are more highly altered than the Algoman rocks. In the field, however, it is almost impossible to distinguish the respective members unless there is direct evidence as to their age.

Nearly all rocks constituting the roof of the Algoman intrusions have been altered so intensely that their original petrographic character is more or less obliterated. In general their macroscopic structure is surprisingly well preserved, although the present mineral composition affords no information other than the original acidity of the rocks. Judging by their present mineral constituents, most of the Keewatin volcanics had an intermediate to acid composition. The original feldspars were essentially of the plagioclase group, but are now largely replaced by zoisite, epidote, or sericite; and the ferromagnesian minerals to a varying degree were changed to form chlorite. Practically all of these rocks carry a fairly high percentage of carbonate, on the average about 5 per cent. As products of recrystallization, certain volcanics contains fresh albite, biotite, hornblende, and garnet.

As for the cause of the metamorphism of the pre-Algoman rocks, it may be suggested that they were first subjected to regional metamorphism in connection with the folding that preceded the Algoman intrusions. Later the Algoman rocks caused contact metamorphic alterations, which were followed by hydrothermal processes.

In contrast to the region north of Wawa lake, the iron formation plays an insignificant part in the gold-mining area. Most occurrences are narrow lenses only a few feet wide and less than one hundred feet long. They are made up chiefly of banded silica with minor amounts of iron oxides. Some iron formations, however, carry sufficient magnetite to cause a deflection of the compass needle

A rather persistent band of iron formation, which strikes about W. 20°N., extends from the Mission Road on claim B.Y. 80 toward the west end of Mountain lake, where it is intruded by quartz porphyry.

Outcrops of iron-bearing carbonate are known between the east end of Wawa lake and Firesand river on what is generally referred to as the Gibson claims.

Laurentian

In the northern part of the Michipicoten area two periods of magmatic invasions are evidenced by the presence of granite pebbles in the Doré series and a younger granite intruding the Doré sediments. While the younger granite is generally believed to be Algoman, opinions have been at variance regarding the age of the pre-Doréan granite. As has been pointed out by Moore,[1] there is good reason to assign to the older granite a Laurentian age.

In the vicinity of the Darwin mine, diorite and feldspar porphyry intrude the Keewatin series and are cut by dikes of older diabase. The latter, in turn, is intruded by quartz porphyry and pink granite, thus manifesting two different periods yielding plutonic rocks.

Although no pre-Algoman granite has been definitely recognized so far in the gold area proper, it is of great interest that in the region south of the Michipicoten river, grey, slightly gneissic granite is cut by dikes of older diabase.

The following two analyses illustrate the difference in composition between a diorite of possibly Laurentian age and an Algoman granodiorite.

ANALYSES OF LAURENTIAN(?) DIORITE AND ALGOMAN GRANODIORITE

	No. 1	No. 2
	per cent.	per cent.
Silica	56.68	63.16
Alumina	16.87	17.31
Ferric oxide	2.71	2.49
Ferrous oxide	5.42	3.39
Lime	7.06	3.10
Magnesia	4.64	1.25
Potash	1.16	1.40
Soda	2.70	4.66
Titanium dioxide	.80	1.06
Phosphorus pentoxide	.14	.....
Carbon dioxide	.05	.72
Water	1.82	1.68
Sulphur	.04	.....
Total	100.09	100.22
Specific gravity	2.89	2.773

Sample No. 1—Diorite from claim D.J. 7, south of the Darwin camp. Analysis by Provincial Assay Office.

Sample No. 2—Granodiorite from claim D.J. 13. (After T. L. Gledhill, op. cit., page 13.)

Timiskaming

Although no equivalent of the Doré series is known to occur in the area where the producing mines are situated, the correlation of the Doré sediments is of fundamental importance in the stratigraphic interpretation of the pre-Algoman rocks in the entire region south of Wawa lake.

[1]E. S. Moore, "Keewatin-Timiskaming Boundary," Bull. Geol. Soc. Amer., Vol. 40, 1929, p. 553.

As previously stated, Collins and Quirke considered the Doré sediments as Keewatin lying between a thick assemblage of volcanics of the same age. For general geological reasons Gledhill advocated a correlation of the Doré series with the Timiskaming sediments of the Porcupine and Kirkland Lake areas. This classification has found firm support by conclusive structural evidence (see page 41).

Haileyburian

Among the large number of diabase dikes occuring in the Michipicoten area there is one group that is commonly referred to as "older diabase." Characteristic of these dikes are peculiar sinuous outlines as well as exceedingly variable widths, ranging from 10 to 150 feet, and more. The common strike is to the northwest, though a few dikes follow a northeasterly direction.

The older diabase is a fine- to medium-grained rock and generally displays a distinct decrease in grain size toward the margins of a dike. Locally coarse-grained, gabbro-like textures prevail in the centre of very wide intrusions. Petrographically the older diabase represents a quartz-bearing type, the dark-green colour of which is due to an advanced alteration of the primary augite to uralitic hornblende. The plagioclases also are strongly attacked and contain innumerable inclusions of zoisite and epidote. As far as ilmenite was present among the original components, it is almost completely decomposed to form leucoxene. In places chlorite and biotite may be observed under the microscope, both being alteration products of hornblende. Quartz occurs only in minor amounts, part of it being probably of secondary origin.

Collins and Quirke[1] and Matheson[2] have described an older set of diabase dikes occurring north and south, respectively, of the gold-mining area. Their "older diabase" closely matches the above type and has been found to cut the Keewatin volcanics as well as the granite.

Similar dikes on the property of Darwin Gold Mines, Limited, cut Keewatin volcanics as well as intrusive masses of diorite and feldspar porphyry. It is interesting to note that in a number of places, the same type of diabase was found to be intruded by Algoman granite and quartz porphyry. These age relations can be studied on the old trail half way between the Parkhill and Minto mines, where a dike of older diabase is intruded by dikes of pink granite. Both rocks in turn are cut off by a dike of very fresh looking younger quartz diabase. The considerable difference in age between the older and younger diabase dikes is also borne out by the fact that the older type is traversed by the gold quartz veins, whereas the younger diabase dikes intersect the gold deposits.

The older diabase dikes are distinctly pre-Algoman in age and probably correspond to the Haileyburian of other regions in Ontario. Wherever they are present they should offer means to distinguish Algoman plutonics from earlier intrusions of Laurentian age.

Algoman

Outcropping in countless places within the gold area is a complex group of plutonic rocks, which are generally believed to be of Algoman age.[3] These rocks are probably derivatives of one common magma and occur in relatively small

[1] Op. cit., p. 36.
[2] A. F. Matheson, "Michipicoten River Area," Geol. Surv. Can., Sum. Rept., pt. D, 1932, p. 8.
[3] W. H. Collins and T. T. Quirke, op. cit., p. 42.
T. L. Gledhill, op. cit., p. 10.
E. S. Moore, "Goudreau and Michipicoten Gold Areas," Ont. Dept. Mines, Vol. XL, pt. 4, 1931, p. 8.
A. F. Matheson, op. cit., p. 8.

intrusive masses, which may be classed as cupolas, bosses, dikes. Some of the intrusions are very irregular and resemble tongue-shaped protuberances. The linear dimensions of the plutonic masses vary from a few yards to nearly one mile, and it appears as if their size increases toward the southern part of the area.

On the basis of their texture and mineralogical composition, the following rock varieties may be distinguished: granite, granodiorite, quartz diorite, diorite, quartz porphyry, granodiorite porphyry, quartz diorite porphyry, diorite porphyry (Gledhill's porphyrite[1]), and aplite. The silica content of the diorites and granodiorites ranges from 60 to 70 per cent., whereas the granites show somewhat higher percentages. The most acid type analysed is a rather fresh granite of pink colour, which reaches 76.89 per cent. silica.

Prominent among the feldspars is a plagioclase of the albite-oligoclase group, which is accompanied by varying quantities of orthoclase. Quartz is present in most of the Algoman rocks but plays a subordinate part as compared with the feldspar. Among the ferromagnesian components biotite is more common than hornblende. Apatite and rutile are the chief accessory constituents. Secondary products are minerals of the zoisite-epidote group, chlorite, sericite, carbonate, as well as sulphides.

The zoisitization and partial sericitization of the feldspars, and the alteration of hornblende to biotite and chlorite are due to pneumatolytic-hydrothermal reactions during a late stage of the consolidation of the parent magma. The same processes were responsible for the introduction of carbonate and sulphides, such as pyrite, pyrrhotite, and chalcopyrite. As a whole, these late magmatic effects resemble the hydrothermal alteration of the country rock of the gold deposits.

There is little known about the age relations of the different Algoman plutonics. In several places, the writer observed quartz diorite and granodiorite cutting feldspar porphyry. In view of the uncertain age of some of the porphyries, however, this evidence cannot be regarded as conclusive.

A fine-grained, almost felsitic rock with the texture and composition of an aplite occurs in the footwall of the Jubilee break. It apparently intrudes Keewatin volcanics as well as diorite and feldspar porphyry. Locally this rock shows signs of late crushing, but there is little evidence that it owes its origin to a silicification of the wall rock of the Jubilee gold deposit.

Keweenawan

Younger Diabase Dikes

All rocks in the Michipicoten area, including Algoman plutonics and gold quartz veins, are cut by dikes of "younger" diabase and lamprophyre. While the diabase dikes are generally believed to be of Keweenawan age, Gledhill[2] and Moore[3] are inclined to consider the lamprophyres as late differentiates of the Algoman magma. Recent mining operations, however, have yielded conclusive evidence that the lamprophyre dikes cut all diabase dikes, including the late olivine-bearing variety. In view of this fact, either the lamprophyres are not related to the Algoman intrusives or the diabase dikes are older than Keweenawan.

The writer wishes to class both the younger diabase and the lamprophyre dikes with the Keweenawan, and suggests a possible affiliation of the lamprophyres with the olivine diabase intrusions.

[1]T. L. Gledhill, op. cit., pp. 10, 11.
[2]Ibid, p. 10.
[3]Op. cit., p. 12.

Dikes of younger diabase are fairly common in the gold-mining area, though not as abundant as the lamprophyre dikes. Most diabase dikes strike northeast or northwest, and dip at steep angles. Their width varies from a few feet to 100 feet and more. In contrast to the pre-Algoman diabase intrusions, the younger set of dikes are remarkably straight and of consistent thickness. A characteristic feature of wide dikes is a pronounced jointing in three directions, causing a blocky parting of the rock. Three types of younger diabase have been recognized, namely quartz diabase, normal diabase, and olivine diabase. Near the gold mines, no definite information is available regarding the age relations of the three varieties. Moore,[1] however, found evidence that the olivine-bearing type cuts the normal diabase and the quartz diabase.

Most of the post-Algoman diabase dikes are of the quartz-bearing variety. As a rule, the rock has a fresh, black appearance and exhibits a rather fine grained ophitic texture, with conspicuous laths of feldspar. Gradations toward an almost dense texture are common in the marginal portions. In many thin sections, the augites are still remarkably fresh, but in some dikes part of the original augite has been altered to hornblende. The plagioclase is close to labradorite in composition and shows little if any signs of decomposition. The quartz occurs in micrographic intergrowths with plagioclase, filling the interstices between the augite and feldspar crystals. Ilmenite or magnetite is invariably found as microscopic accessories.

Dikes of normal diabase invariably form narrow intrusions. In general, the rock is so fine-grained that the diabasic texture is evident only under the microscope. The main constituents are: pyroxene, plagioclase, black iron oxide, and apatite. A nearly opaque glassy groundmass was observed near the contact of a 5-foot dike, causing a basalt-like appearance of the hand specimen.

Only a few olivine diabase dikes have been recognized in the area. Very sharp contacts and a tendency toward porphyritic textures are characteristic of this variety. Lath-shaped phenocrysts of plagioclase up to 0.5 inches long were found in one dike, with a fine-grained groundmass consisting of plagioclase, augite, ilmenite, magnetite, and brown olivine.

Lamprophyre Dikes

Lamprophyre dikes are abundant in the region south of Wawa lake. They represent not only the latest intrusions but also the youngest of all rocks known in the Michipicoten area. These dikes range in width from a few inches to over 5 feet and frequently occur in groups of several closely spaced fissures. As they cut the gold veins, they are a great nuisance in mining, although there is generally little or no displacement connected with them. With few exceptions, the lamprophyre dikes dip steeply to the north and strike in a northeasterly direction.

All lamprophyres are rather fine-grained rocks with a common tendency toward a development of porphyritic textures. Gledhill[2] distinguished two types of lamprophyres, a biotite-rich and an olivine-bearing variety, which he classed with the picrite family. The writer found clear evidence in the underground workings of the Centennial mine that dikes of the biotite variety cut the olivine-bearing dikes.

The primary mineral components of these dikes include olivine, biotite, augite, apatite, and magnetite. Locally there are also small quantities of glass in the groundmass, which on devitrification seem to yield some feldspar. In most dikes, one or two of the above-mentioned constituents predominate. Among

[1]Op. cit., p. 12.
[2]Op. cit., p. 14.

extreme cases studied under the microscope were types consisting essentially of olivine, with some biotite and magnetite. Others are made up of biotite and apatite, with some magnetite; and one dike encountered underground at the Parkhill mine, contained as much as 50 per cent. magnetite, with biotite and carbonate as additional components.

Characteristic of most lamprophyre dikes is a strong decomposition of the original constituents, carbonate being the final and most important of the various alteration products. In places all serpentine and chlorite, which generally



Inclusions of country rock in a lamprophyre dike, Darwin mine; note the contact on the right-hand side. The vertical range of the photograph is approximately 5 feet.

develop from the decomposition of olivine, augite, and biotite, are replaced by carbonate. Much rutile and minor amounts of a blue fibrous hornblende occur as additional alteration products. According to its chemical composition and its optical characteristics, the blue hornblende is closely related to riebeckite. This peculiar mineral is frequently observed in the gold quartz veins in the neighbourhood of lamprophyre dikes, from which it was introduced into cracks in the quartz.

The alteration phenomena in the lamprophyre dikes are not due to weathering but are the results of hydrothermal infiltrations, which usually proceeded along the dike walls. This fact is readily borne out by the bleached appearance of the marginal portions of the dikes. It is interesting to note that during this late hydrothermal stage of the picrite intrusions, sulphides such as pyrite, mar-

casite, and chalcopyrite have been locally deposited along the walls. Numerous assays, however, have established proof that no gold has been introduced by the hydrothermal infiltrations connected with the lamprophyre intrusions.

Some lamprophyre dikes contain numerous country rock fragments. Such inclusions may be well rounded, giving the rock the appearance of a conglomerate (see photograph on page 47).

According to observations of the writer, there are lamprophyre dikes that cut the gold veins but are traversed by the picrite type. These older lamprophyres are close to a kersantite in composition and contain as primary constituents a feldspar of the andesine group, biotite, and locally some orthoclase. Secondary products are chlorite and carbonate. As compared with the picrite dikes, the kersantites are very little altered.

Although the age relations of the kersantites to the younger diabase dikes are not known, the mineralogical composition of the kersantites suggests a consanguinity with the Algoman intrusions.

Pleistocene

Since there is no evidence of younger sediments and igneous rocks, the Michipicoten area has apparently been subjected to continuous erosion since the close of the pre-Cambrian.

During the Pleistocene, the region was buried under a glacial ice-sheet, which according to striation marks on polished rock exposures moved in a south-southwesterly direction.

In the gold-mining area, the covering of glacial drift is slight, and in places glacial deposits are entirely lacking. The drift material consists chiefly of large boulders, gravel, and sand. Locally, as on the Dysey farm, clay is found in depressed areas, but as a whole, such deposits are of minor importance.

To the west, the mining camp is bounded by large terraced sand plains, which owe their origin to glacial Lake Algonquin, the predecessor of present Lake Superior. The remarkable series of terraces correspond to intermittently diminishing lake levels, the highest of which extended nearly 500 feet above the present level of Lake Superior. The water courses of the region, particularly the Michipicoten and Magpie rivers, in the vicinity of Lake Superior, are deeply entrenched in these glacial-lake deposits.

STRUCTURAL GEOLOGY

Folding

In its structural features the Michipicoten area exhibits a complexity characteristic of most gold-bearing areas of the Canadian shield. Host rocks of the gold deposits are a considerably folded series of early pre-Cambrian volcanics and a variety of plutonic rocks intrusive into the former group. There is evidence of two major periods of folding, which were closely linked with batholithic intrusions, both phenomena being the result of pre-Cambrian mountain-building.

An older period of diastrophic movements connected with intrusive activity preceded the deposition of the Doré sediments. The coarse boulder conglomerate of the Doré series indicates that the physiography of the region was of mountainous relief when these sediments were accumulating, and erosion had undoubtedly advanced to a considerable depth before the granite, from which some of the boulders were derived, was exposed.

After the deposition of the Doré sediments, a new folding pattern was superimposed upon the earlier folds before the intrusion of the Algoman plutonics. In places the Algoman intrusives cut across the folded structures. Their texture lacks signs of deformation, thus proving that the diastrophic movements had nearly subsided at the time of their intrusion.

Owing to an extensive overburden and a scarcity of horizon markers, relatively little is known about the folded structure of the rocks in the gold area proper. Moreover, intrusive bodies have nearly everywhere interrupted the few persistent beds that are easy to identify. In the area between Wawa lake and the Norwalk mine the strike of bands of agglomerate and tuffs varies from N. 15°E. to N. 45°E., with dips ranging from 60° to 90° N.E. About one mile west of the Parkhill mine, Keewatin volcanics and iron formation strike between due north and N. 45°W., and dip steeply to the west. These conditions suggest that the pre-Algoman rocks of the gold camp form part of a large anticline, the major axis of which points to the northeast.

Fracturing and Faulting

The entire region is traversed by innumerable fractures and faults, which strike and dip in all possible directions. There are two major lines of weakness, however, one striking N. 20°–45° W. and the other N. 45°–70° E. Both directions predominate as lines of jointing, faulting, and diking. The same strike also prevails among the gold quartz veins of the area.

Although there are probably a great number of faults antedating the formation of the gold deposits, it is difficult to obtain data as to the amount and direction of movement, owing to the lack of sediments and other horizon markers. Evidence of definite displacement was established in the case of several older diabase dikes, which appear to cause an offset toward the left hand.

The gold-bearing quartz veins are connected with shear zones which were formed after the intrusions of the Algoman plutonics. Most of the veins can be classed with two groups, one striking N. 20°–40° W., and the other N. 50°–90° E. The dip of the first set is moderate to steep to the northeast, and the second group has rather flat dips to the southeast. There is probably a slight difference in age between the veins of the two groups. Near intersections with east-west veins, the Grace vein, which strikes N.20°W., is generally folded and slightly displaced. It is also significant that the east-west veins of the Darwin mine carry practically no arsenopyrite, whereas this mineral constitutes the chief sulphide of the Grace vein.

The shear zones along which the gold-bearing quartz occurs were formed by compressive stresses, which in many places led to the development of minor folds. Remarkable drag folds with overthrusts along the vein structure amounting to several scores of feet were observed in the underground workings of both the Darwin and Parkhill mines. Such folds are termed "rolls" by the miner and generally pitch at flat angles, to the right of an observer looking down the dip of the sheared structure. This rule appears to hold true with all the gold veins, irrespective of their strike. Evidence as to the pre-mineralization age of most of the folds is afforded by the lack of deformation of the quartz and sulphides, and by the manner in which the quartz has replaced the sheared and folded country rock (see photograph on page 50).

The gold veins were repeatedly affected by later movements, although most of them did not suffer any major displacement. Repeated release of minor tensions gave rise to fractures and cracks in the quartz, which opened channelways for the introduction of gold-bearing sulphides and native gold.

In many places, the gold deposits are cut and dislocated by barren pegmatitic quartz veins, which are associated with a later set of shear zones. Their strike differs only slightly from that of the gold veins, whereas their dip is generally to the northwest or southwest, opposite to the dip of the latter.

All quartz veins, including the gold deposits, are cut by the younger diabase intrusions. Noticeable faulting took place along the contacts of many quartz diabase dikes. A reverse fault causing a vertical displacement of nearly 100 feet coincides with a wide quartz diabase dike encountered in the underground workings of the Darwin mine.

Little if any displacement was caused by the great number of red feldspar-carbonate veins and lamprophyre dikes, both of which cut all the younger diabase dikes. Still later are numerous fracture and fault zones, which on the



Surface exposure of the Nyman vein, Darwin mine, showing vein quartz replacing the sheared and folded country rock.

surface are generally marked by swamp-covered depressions or by ravines. Some of the latter are bounded by abrupt precipices and have a width of over 300 feet. Minor faults of this kind occur in the underground workings of the various mines, where they often form water courses. Probably contemporaneous with the origin of these late fault zones were the movements that caused a deformation of the "Jubilee break" deposit along its strike. Similarly, No. 4 vein of the Parkhill mine and the east-west veins of the Darwin mine are cut by late gouge-filled fractures following the strike and dip of the quartz bodies.

Intrusive Structures

The Algoman granites and related porphyries occur in the form of cupolas, bosses, dikes, and irregular protuberances, which are believed to be derived from a continuous batholithic mass in depth. The outline of this supposed magma hearth, which Gledhill[1] named the "Wawa batholith," is roughly elliptical, its contours being suggested by the regional distribution of the single intrusions.

[1]Op. cit., p. 19.

It is interesting to note that the size of the intrusive bodies increases toward the south of the area, whereas in the west and northwest, the intrusions show an obvious decline as to number and size. This observation seems to suggest that the surface of the main mass underlying the gold area pitches toward the northwest. Since very large intrusions of granite are exposed south and east of the Michipicoten river, it is probable that the supposed Wawa batholith is not an isolated mass but forms an outward bulge of a batholith of much larger dimensions.

All intrusions of diabase and lamprophyres have the shape of dikes. As stated, certain diabase dikes have been intruded along fault planes.

ECONOMIC GEOLOGY

The Gold Deposits

General Character of the Deposits

Many quartz veins are found between Wawa lake and the Michipicoten river, but the gold veins form a relatively small proportion of them. Most of the quartz-bearing veins are either barren or carry only negligable quantities of gold, and only a few veins have a gold tenor that lies considerably above the commercial minimum values. Gold values in the workable veins vary from a few cents to several hundred dollars per ton. Differences in the gold tenor are due to the sporadic occurrence of native gold, but in general the precious metal is locked up in sulphides.

As stated, the gold veins follow two predominating directions. A number of veins, including the Minto, Grace, Deep Lake, and No. 4 vein of the Parkhill mine, strike N. 20°–40° W.; the second group has bearings from N. 50° E. to due east. The veins of the Parkhill mine are the chief representatives of the second set. The dip of the first group is moderate to steep to the northeast, whereas the east-west striking veins have a fairly flat dip to the south.

The barren or poor type of quartz vein has essentially the same strike as the gold veins, but their dip is to the southwest or northwest. It is noteworthy that the barren quartz veins are invariably younger than the gold veins. Most of the barren veins are distinguished by their pegmatite-like character. Apart from coarsely crystalline glassy quartz, many of these veins carry large aggregates of plagioclase, tourmaline, biotite, chlorite, and carbonates. In places these minerals are accompanied by small quantities of sulphides and, occasionally, by some native gold. In several instances, the writer found crystals of oligoclase up to one inch in length in the quartz, and one vein of this type contains laminated crystals of ilmenite and small crystals of titanite.

In general, the gold veins of the area consist of a succession of quartz bodies that show more or less distinct lenticular forms. The horizontal extent of single lenses may vary from a few yards to more than a hundred feet; their width ranges from a fraction of an inch to 5 feet and more. Unusually wide bodies of quartz occur in the Jubilee mine, where widths up to 25 feet and more have been observed. As a rule, the downward extension of the quartz lenses considerably exceeds their horizontal length. According to observations made at the Parkhill and Darwin mines, the ratio between horizontal and vertical dimensions of major quartz bodies seems to be in the neighbourhood of 1 to 5. The longitudinal axes of the quartz lenses generally pitch at an angle of about 60 degrees, to the right of an observer looking down the dip of the vein.

The gold-bearing quartz occurs along shear zones, and either forms a system of short stringers or is found in larger lenses. Some of the shear zones are fairly persistent along their strike, although few have a length of more than half a mile. Many of them disappear within much shorter distances. The width of the shear zones ranges from a few inches to about 10 feet; in exceptional cases, as in the Jubilee break, it may attain 50 feet. The shear zones give evidence that they



Drift face, Parkhill mine, showing the shear zone with stringers of gold-bearing quartz and carbonate.

are not confined to particular rock formations, being found alike in plutonic rocks and the older metamorphic complex. Owing to their greater rigidity, however, certain intrusive rocks play a preferred part as country rock of the veins. In some cases, shear zones follow contacts, owing to the difference in strength of the two kinds of rock. Thus it depended essentially on mechanical prerequisites where gold-bearing quartz bodies were formed along the shear zones. This explanation also accounts for the fact that in certain shear zones that extend hundreds of yards only a short section contains quartz bodies.

Underground the shear zones form a rock of surprising compactness, the strength of which rivals that of the wall rock. In such places, the strike and dip of the shear zone are indicated by insignificant-looking streaks of mica or carbonate (see photograph above). A parallel orientation of most of the mica

flakes favours the parting of the altered rock parallel to the strike and dip of the shear zone. For this reason, the prospector and miner commonly refer to the rock of the shear zones as "schist."

If a vein consists of several large quartz lenses, the latter follow one another at short intervals or overlap at their ends. The overlapping generally takes place on one definite side. This phenomenon may be observed along the strike as well as along the dip of a deposit.



Vertical section of the Grace vein in a stope above the 3rd level, Darwin mine. Note the carbonate stringers accompanying the vein.

Large bodies of quartz are generally accompanied by short parallel stringers, and the latter commonly continue beyond the end of a lens. Thus, there is, strictly speaking, no difference between deposits consisting of a system of stringers and veins with large quartz bodies. The appearance of stringers in the shear zone is frequently an indication that a quartz body is being approached.

Some of the veins have the appearance of true fissures with fairly well defined walls; the majority, however, show rather irregular outlines, owing to a partial replacement of the sheared country rock (see photograph above). Inclusions of the wall rock are common in most veins. In general such fragments have rounded outlines, although angular inclusions occur in places. Many of the inclusions have a peculiar curtain-like form, lying parallel to the strike of the quartz lenses. The gradual fading of such rock remnants into fine seams, together with the irregular outlines of the wall rock, strongly suggests that

replacement processes have played a major part in the formation of the veins (see photograph below).

Cavities with crystals are very rare in the gold veins of the area. Locally, ribbons or streaks of sulphides may present an imitation of crustified banding, but such ribbon structures owe their origin to cracks and seams in the quartz, along which sulphides were deposited (see photograph on page 55). They are most typically developed in veins carrying arsenopyrite.

Mineralogy of the Deposits

Quartz.—In most of the veins of the Michipicoten area quartz is not only the oldest and most important gangue, but it is also the main constituent of the deposits. Exceptions in which carbonates exceed quartz are rare and seem to be



Footwall section of the Jubilee vein, 4th level, Jubilee mine. Note the country rock inclusions and late faulting. Horizontal range of photograph, about 7 feet.

confined to veins poor in gold. On an average, the proportion of the quartz in the vein filling amounts to about 90 per cent., and the remaining 10 per cent. consists of varying amounts of carbonate, tourmaline, and sulphides.

The quartz of the various types of veins is fairly uniform in texture and colour. That of the poorest or barren veins is coarsely crystalline and occasionally has a somewhat milky colour (the "bull quartz" of the prospectors and miners). On the other hand, the gold veins proper, and particularly the richer vein sections, display a quartz with a somewhat greasy lustre and a greyish-white colour, which may grade into greyish-blue. A peculiar sugar-grained texture is characteristic of most of the deposits, including the veins of the Darwin, Minto, Parkhill, and Smith mines. A fairly coarse grained quartz prevails at the Jubilee mine. A massive unoriented structure of the quartz is common in all veins of the area, cavities lined with crystals being exceedingly rare.

The microscope shows that the quartz consists of subhedral or anhedral grains. The latter frequently show wavy extinction and cataclastic or mortar texture, the grade of mechanical deformation depending on the intensity of the stresses active at one time. Later it will be shown that such stresses played an important part in the introduction of gold-bearing minerals, as the formation of cracks or the brecciation of the quartz opened channels for later mineralizing solutions (see photograph on page 56).

At least two generations of quartz can be recognized in most veins. The younger quartz has a coarse crystalline texture and a glassy appearance, and can be easily distinguished in the veins with sugar-grained quartz. As for their relative quantities, the later generation plays a subordinate part. The younger quartz forms veinlets in the older quartz, or may occur in independent lenses in those sections of the shear zones in which no older quartz was deposited.



Specimen (about three-fifths natural size) of quartz from the Grace vein, Darwin mine, showing arsenopyrite ribbons (black) following cracks in the quartz. Compare the horizontal and inclined cracks formed by the trimming of the specimen.

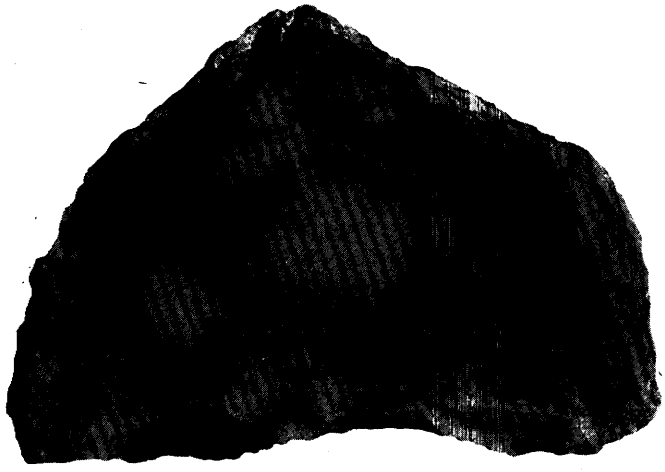
Carbonates.—Carbonates are common in most veins of the area, although they are generally of subordinate importance as compared with the quartz. In most of the veins, calcite is the representative mineral of the carbonate group, whereas ankerite occurs in a few deposits, such as the Jubilee break. In the main, only one carbonate is found in any deposit. Where both calcite and ankerite occur together, one is in minor amount and is invariably of different age.

The carbonates commonly occur in veins that run parallel to the dip and strike of the gold deposits. They vary in width from fractions of an inch to several inches, and in some cases may be traced in the vein quartz for many yards. Irregular nest-like aggregates of carbonates are found locally in the quartz, or in the country rock where they have been deposited by replacement processes.

In most gold veins the carbonates have a rather fine grained texture, whereas in barren veins they are coarse-grained. Calcite usually is pure white to yellowish. Pink calcite, coloured by an admixture of rhodochrosite ($MnCO_3$), has been

locally observed in some of the productive mines. On a fresh surface, the ankerite has a greyish colour. Owing to its iron content the mineral generally turns yellowish-brown if exposed to weathering.

In the Grace vein, there is evidence of at least three generations of calcite. The oldest one was introduced together with various sulphides. The second generation is represented by barren carbonate veins, which were probably formed contemporaneously with the carbonatization of the wall rock of the gold veins. The latest generation includes all carbonate that is associated with native gold and third-generation chalcopyrite.



Specimen of vein quartz (white) brecciated and recemented by sulphides (dark-grey), Grace vein, Darwin mine.

	Calcite from the Darwin mine	Ankerite from the Jubilee mine
	per cent.	per cent.
FeO	.....	14.34
CaO	53.78	26.24
MgO	.48	11.96
MnO	.42	.50
CO_2	43.14	42.60
Insolubles	1.12	.65
Total	98.94	96.29

Tourmaline.—Tourmaline is a characteristic gangue mineral of all the gold quartz veins, although it varies in amount. In veins with coarsely crystalline quartz, such as the Jubilee vein, tourmaline is more abundant than in veins with finely crystalline, sugar-grained quartz, as exemplified by the Grace vein. In the Jubilee vein, tourmaline occurs chiefly in large radiating aggregates, whereas narrow ribbons, a fraction of an inch wide, are common in the veins of the Parkhill and Darwin mines (see photograph on page 57). In certain parts of the veins it may be difficult to detect the mineral, although microscopical investigation usually proves its presence in the altered wall rock.

Crystals that have grown in cavities are very rare. Well-developed crystals are frequently found in the country rock close to the veins. Larger aggregates

display either a parallel or divergent orientation of crystals. Less common are irregular felted masses.

The tourmaline is of the black, iron-bearing variety, and ranks among the earliest vein constituents. Cracks in tourmaline are frequently filled with sulphides, and in rare cases with native gold.

Hornblende.—A bluish-green hornblende occurs in small quantities in most veins of the area. It forms radiating aggregates in the quartz and country rock. The lustre of the mineral is silk-like. According to its optical properties, the mineral belongs to the actinolite group.

Gold.—From a mineralogical as well as a metallurgical point of view one can distinguish:—



Specimen (two-thirds natural size) of vein and wall rock, Parkhill mine, showing tourmaline bands (black) in hydrothermally altered wall rock (grey) adjacent to vein (light-grey).

1. So-called "free-milling gold," which includes all macroscopically visible gold, as well as particles of microscopic size which after sufficient grinding of the ore can be extracted by amalgamation.

2. Gold which, in extremely fine distribution, is contained in sulphides. The size of the particles is so minute that they remain invisible under the highest magnification. In this form the precious metal is practically not amenable to amalgamation, and can only be recovered by very fine grinding and cyanidation.

From a metallurgical standpoint it is important that most of the gold is free milling. In extreme cases, laboratory tests have extracted more than 80 per cent. by amalgamation. Tellurides are absent from all deposits so far developed.

Visible gold displays colour shades ranging from light-yellow to dark gold-yellow, depending on its fineness. No distinct crystals have so far been observed. The gold occurs as flakes, leaflets, grains, and in irregular aggregates up to several ounces in weight.

The composition of the native gold of various veins is shown in the following table:—

	Parts per thousand	
	Au	Ag
Light-coloured native gold from the Darwin mine	801.1	179.2
Dark-coloured gold from the Darwin mine	928.3	62.9
Native gold from the Minto mine	923.9	73.3
Native gold from a rich pocket on the 10th level, Parkhill mine	926.5	48.3

Most of the native gold occurs in vein quartz (see photomicrograph below); in places, however, it is found in the altered wall rock close to the veins, forming flakes and leaflets along minute fractures.

Native gold is almost invariably associated with a late generation of calcite. Both minerals were deposited during the same genetic phase and were introduced along cracks and seams. Older minerals are frequently encrusted by gold,



Photomicrograph of a thin section of the Grace vein, Darwin mine, taken with a Lieberkühn mirror, showing native gold (white) in cataclastic quartz (black). (One nicol, × 30.)

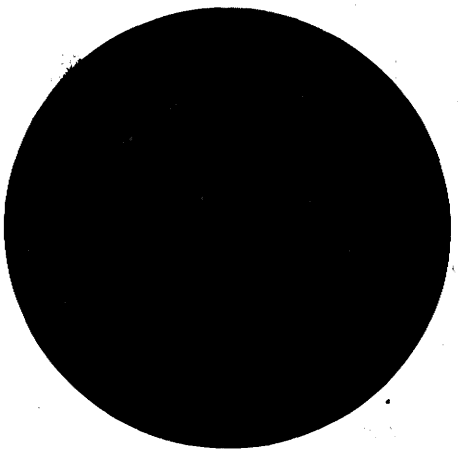
giving evidence of partial replacement by the latter. Most interesting is the occurrence of minute gold particles, along subcapillary fractures in quartz. The smallest of these particles are only a fraction of a micron in size, so that even in very thin sections, by slightly raising and lowering the objective lens of the microscope, as many as ten or more of them may be recognized lying one above another along an invisible fracture plane.

In all the veins, native gold appears to be the latest mineral. It is found intergrown with all known minerals of the gold-bearing quartz veins. Sulphides, however, play an outstanding part among the accompanying minerals. In the Grace vein, native gold shows a preference for arsenopyrite (see photomicrograph on page 59), whereas in certain other veins it is chiefly associated with pyrite.

In sulphides, gold has been frequently deposited along fine cracks. In some cases, gold forms crusts around sulphide aggregates. Microscopic investigation shows that the sulphides have been replaced only to a minor extent by the gold. A noteworthy exception is pyrrhotite, which has been readily replaced.

Arsenopyrite.—Arsenopyrite is found mainly in the Grace, War Eagle, and Norwalk veins, which are located in the southern part of the gold-bearing area.

In the Grace vein, approximately 80 per cent. of the sulphide content consists of arsenopyrite. The latter either occurs in ribbons and seams (see photograph



Photomicrograph of a polished section of the Grace vein, Darwin mine, showing native gold (white), partly in cracks in cataclastic arsenopyrite (grey) and partly in quartz (black). (One nicol, × 150.)

on page 55) that follow cracks in the quartz, parallel to the vein walls, or impregnates the altered country rocks.

In the quartz the arsenopyrite occurs in poorly crystallized aggregates, but in the wall rock it forms well-developed long prisms and needles. Less common are nest-like concentrations.



Photomicrograph of a polished section of the Nyman vein, Darwin mine, showing an arsenopyrite crystal (white), the interior of which has been largely replaced by pyrrhotite (dark-grey); country rock (black). (One nicol, × 130.)

Arsenopyrite is the oldest sulphide (see photomicrograph above) and contains a comparatively high content of locked-up gold in submicroscopic particles.

Pyrrhotite.—Pyrrhotite is rather common in most of the veins but is of subordinate importance as a gold carrier. In a number of places pyrrhotite is transformed into pyrite. This process is partly due to the action of descending waters near the surface, but has also been caused by ascending solutions during a late stage of the mineralization of the gold veins.

Most pyrrhotite specimens from the outcrops of the veins indicate by their dull appearance an incipient decomposition. Microscopic investigation shows that this process starts along fine cracks in the mineral, giving rise to a peculiar-looking substance which consists essentially of extremely fine-grained pyrite. Locally one may observe the typical oval forms that have been described as "bird's eye" structures. In places where the effect of the oxidizing waters was



Photomicrograph of a polished section of the Grace vein, Darwin mine, showing pyrrhotite (dark-grey) decomposing to form pyrite (white, high relief) and being replaced by chalcopyrite (light-grey). (One nicol, × 120.)

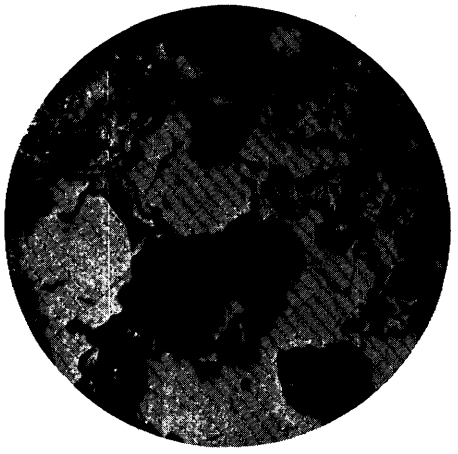
more intensive, small quantities of limonite have been formed in connection with the transformation.

As shown by microscopic evidence the hypogene alteration of the pyrrhotite is contemporaneous with the deposition of a generation of carbonate, chalcopyrite, pyrite, and some marcasite, and it seems that the last two sulphides have largely been formed at the expense of the older pyrrhotite (see photomicrographs above and on page 61). This alteration may be traced by progressive stages, the final product being irregular aggregates of pyrite, which are surrounded by carbonate. In some cases inconspicuous remainders of pyrrhotite in pyrite attest to the origin of the pyrite.

It is noteworthy that in all places where sericitization has replaced the older biotitization and chloritization of the country rock, pyrrhotite is absent and pyrite takes its place.

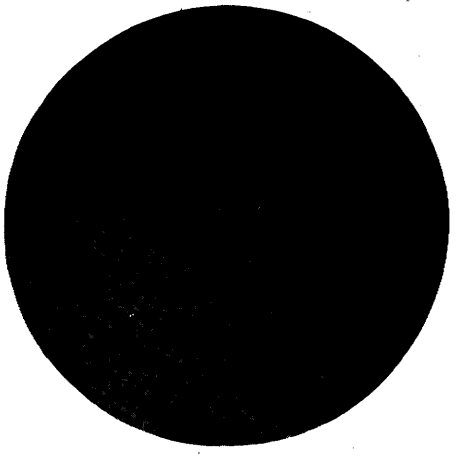
Cubanite.—A mineral strongly resembling cubanite in its optical properties is found in the form of microscopical inclusions in some pyrrhotite from the Parkhill vein. The ex-solution particles become visible at an eighty-fold magnification and form minute disks, which are arranged in consecutive parallel rows.

Pyrite.—In a great number of veins, like the Jubilee and Parkhill, pyrite is the most important sulphide. It generally occurs in irregular aggregates. Two types of pyrite can be easily recognized. One kind is distinctly crystalline and



Photomicrograph of a polished section of vein material, Parkhill mine, showing pyrrhotite (white, smooth areas) replaced by carbonate (light-grey), while pyrite (white, high relief) is formed contemporaneously; quartz (dark-grey). (One nicol, × 30.)

is difficult to etch with potassium permanganate solution, the second forms irregular aggregates, which appear to be less compact and less hard than the other variety, and which can be etched rather easily.



Photomicrograph of a polished section of the Grace vein, Darwin mine, showing streaked marcasite (light-grey) with interbedded carbonate (black). The latter is partly replaced by chalcopyrite (grey); arsenopyrite (greyish-white, smooth surface). (One nicol, × 140.)

The older generation is the distinctly crystalline pyrite, which in places is fractured and cemented with carbonate, whereas the second type may be found intact close by, thus giving evidence of its younger age. In veins without

arsenopyrite, the distinctly crystalline variety, together with pyrrhotite, are the main constituents of the sulphide mineralization. There is no conclusive evidence suggesting a difference in age between the two minerals. The field observer gains the impression that pyrite I becomes scarce in vein sections with much pyrrhotite, and *vice versa*. It seems reasonable to assume that pyrrhotite was formed at those places where a deficiency in sulphur prevented the formation of pyrite.

The younger pyrite is generally identical with the irregular aggregates formed by the previously mentioned alteration of pyrrhotite through hypogene solutions. Correspondingly, the younger pyrite generation is commonly associated with carbonate and chalcopyrite. It remains an open question whether or not all pyrite of this type owes its origin to a decomposition of pyrrhotite. This seems



Photomicrograph of a thin section of the Grace vein, Darwin mine, showing a veinlet with chalcopyrite (black), calcite (grey, high relief), and feldspar (dark-grey) cutting quartz (light-grey, smooth, with inclusions). (One nicol, × 55.)

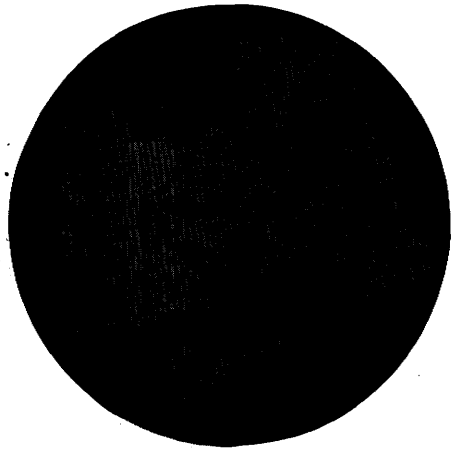
doubtful, at least in the case of the pyrite that occurs near intersections with the red feldspar-carbonate veins. Since the latter carry small amounts of pyrite at considerable distances from the gold veins, it is most likely that some pyrite has been introduced into the gold veins near intersections with the feldspar-carbonate veins. For this reason it is suggested that all the pyrite that appears to be contemporaneous with the minerals of the feldspar veins be considered as representative of a possible third generation.

Marcasite.—Marcasite has been observed under the microscope in small streaky aggregates, which occur in close connection with the hypogene breakdown of pyrrhotite (see photomicrograph on page 61). The occurrence of marcasite is of interest, as it caused milling difficulties at the Minto mine.

Chalcopyrite.—Chalcopyrite occurs in many places in certain veins, though only in minor amounts, which offer no difficulties to a cyanidation of the ores. The oldest generation of chalcopyrite is represented by minute inclusions in sphalerite, which is found under the microscope in ore from a few veins.

Small aggregates of chalcopyrite accompanied by carbonate form a second generation. It always occurs in fractures in the earlier vein minerals. In many places such chalcopyrite has partially replaced older sulphides. A third generation of chalcopyrite accompanies red feldspar-carbonate veins. Aggregates of chalcopyrite are cut by the feldspar veinlets, but the third generation is found in intimate association with their minerals (see photomicrograph on page 62). The mutual boundaries of chalcopyrite III and native gold indicate contemporaneous deposition, although there are examples that seem to suggest replacement of the chalcopyrite by the gold.

Sphalerite.—Sphalerite is a rather rare mineral in the veins of the Darwin, Jubilee, Minto, and Parkhill mines and is generally found in very small quantities,



Photomicrograph of a polished section of vein material, Minto mine, showing chalcopyrite (light-grey, main area) replacing pyrrhotite (greyish-white, high relief) and sphalerite (dark-grey); gangue (black). (One nicol, × 65.)

which easily escape detection. In the Deep Lake mine, however, which is one mile east of the Parkhill mine, sphalerite is one of the principal sulphides.

Sphalerite is commonly associated with pyrrhotite. Both minerals appear to be contemporaneous but are distinctly older than galena and the second generation of chalcopyrite (see photomicrograph above).

Galena.—In most veins except the Deep Lake vein, galena is exceedingly rare. In the Deep Lake mine, galena is found together with sphalerite, chalcopyrite, pyrrhotite, and pyrite. Under the microscope, galena appears to be the latest sulphide, although its age relation to the late chalcopyrite generation was not definitely recognized.

Hydrothermal Alteration of the Wall Rock

The formation of the gold quartz veins was accompanied by an intensive alteration of the wall rock. Although the majority of the unaltered country rocks do not show any oriented pattern, a parallel texture is common close to the veins. The growth of newly formed minerals, such as biotite and chlorite, was

undoubtedly influenced by innumerable parallel shear planes which had developed in the sheared zones.

Field studies as well as microscopic examination show that the wall-rock alteration is not uniform. Apart from certain differences between different deposits, variations are observable along the same vein. Characteristic alteration products are biotite, chlorite, and a pale-greenish sericite, each of which may predominate. Tourmaline is present as small black needles in the wall rock of most deposits, but occurs as a conspicuous constituent only along a few veins, such as the Hornblende and Mackey Point veins.

An accompanying feature of the hydrothermal metamorphism is the impregnation of the country rock with sulphides. In certain veins this mineralization is of great importance, as some of the sulphides carry gold. Although the



Photomicrograph of a thin section of the Grace vein, Darwin mine, showing an arsenopyrite crystal (black) in country rock, partly replaced by biotite (dark-grey with distinct cleavage). (One nicol, × 80.)

sulphide impregnation commonly extends as far as the general alteration of the country rock, notable gold values are rarely found more than three inches from the vein proper.

The hydrothermally altered part of the rocks is generally about as wide as the shear zones. This is particularly evident in places where the shear zones do not contain any quartz bodies. The effects of the hydrothermal processes are quite plain here, although the sulphide impregnation is slight. On the average, the alteration of the country rock extends about two feet from the vein walls, but in some places it can be traced four feet or more.

Apart from sulphides, the list of alteration products as revealed by the microscope includes the following minerals: albite, biotite, chlorite, epidote, clinozoisite, leucoxene, rutile, sericite, serpentine, tourmaline, and carbonates. Certain of these minerals are characteristic of definite phases of the hydrothermal process, their age relations being proved by distinct replacement phenomena.

The oldest stage of the hydrothermal alteration is marked by the formation of albite, which is generally accompanied by biotite. The amount of the latter is usually large, and in places it may obscure the albite. In many cases tourmaline is noted as an additional component.

The writer detected a partial albitization of the country rock of the Grace, Nyman, Minto, and Parkhill veins. Although albite, biotite, and tourmaline are essentially contemporaneous, biotite in certain cases replaces the two other minerals, suggesting that the deposition of biotite outlasted the formation of albite and tourmaline. The only sulphide deposited during this phase is arsenopyrite, which frequently displays evidence of replacement by tourmaline and biotite (see photomicrograph on page 64).

The albite forms aggregates that rarely exhibit typical twinning. The newly formed feldspar is practically free of decomposition products, thus clearly distinguishing itself from the feldspars of the unaltered country rocks. Small grains of rutile and clinozoisite crystals with beautifully zoned structure are common associates of the albite.

In nearly all places where albitization was recognized, plagioclase-rich rocks, such as diorite, porphyrite, or amphibolitized diabase, form the country rock. This fact led to the conjecture that the soda contained in the albite might be derived from the plagioclase of the unaltered rocks. Chemical analyses of unaltered and altered rocks from the Darwin mine showed, however, a considerable increase in soda, and a decrease of potash, lime, and silica.

ANALYSES OF UNALTERED AND ALTERED ROCKS FROM THE DARWIN MINE

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Silica	57.10	54.91	55.06	50.68	51.17	50.09
Alumina	18.81	20.49	18.33	19.34	15.22	16.48
Ferric oxide	7.00	7.19	1.90	7.47	2.46	.23
Ferrous oxide	[1]	[1]	5.99	2.91	9.46	11.66
Lime	6.31	3.40	5.65	4.35	10.62	4.12
Magnesia	2.75	3.90	4.23	1.02	6.40	6.28
Potash	3.65	2.80	1.87	.89	.31	1.75
Soda	1.11	3.35	2.96	5.86	1.47	1.73
Titanium dioxide	.....	.....	.74	.91	.72	.81
Phosphorus pentoxide	.....	.....	.11	.10	.06	.05
Carbon dioxide	3.48	2.84	1.30	.18	.15	2.32
Water	.08	.22	2.03	.72	2.22	4.22
Sulphur	.....	.52	.10	3.44	.07	.50
Arsenic	.....	.....	.....	3.62	.....	.....
Total	100.29	99.62	100.28	[2]99.93	100.33	100.24
Specific gravity	2.78	2.77	2.85	3.00	3.08	2.84

Sample No. 1—Unaltered diorite, 10 feet from the Grace vein, 3rd level, Darwin mine. Analyst, Dr. A. Benthin, Freiberg, Saxony.

Sample No. 2—Albitized diorite, adjacent to the Grace vein, 3rd level, Darwin mine. Analyst, Dr. A. Benthin, Freiberg, Saxony.

Sample No. 3—Metamorphosed tuff, 6 feet from the footwall of the Grace vein, 5th level, Darwin mine. Analyst, T. E. Rothwell, Provincial Assay Office.

Sample No. 4—Albitized tuff, adjacent to the Grace vein, 5th level, Darwin mine. Analyst, T. E. Rothwell, Provincial Assay Office.

Sample No. 5—Older diabase, 10 feet from the hanging wall of the Nyman vein, Darwin mine. Analyst, T. E. Rothwell, Provincial Assay Office.

Sample No. 6—Biotitized older diabase, adjacent to Nyman vein, Darwin mine. Analyst, T. E. Rothwell, Provincial Assay Office.

The second stage of the alteration consists of the chloritization of the first-formed biotite. This is a rather common phenomenon, and can be followed from an incipient stage to a complete chloritization of the biotite. The alteration

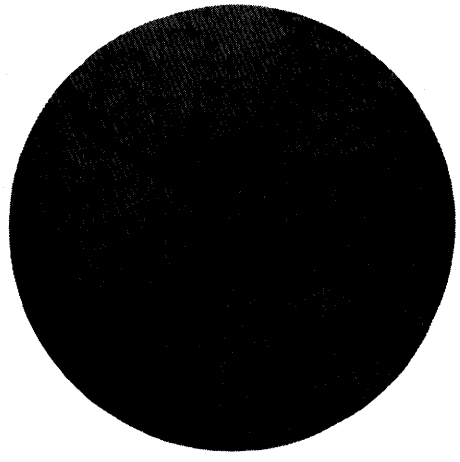
[1] All iron is reported as ferric oxide.

[2] This total is after deducting the oxygen equivalent of sulphur and arsenic (1.56 per cent.)

generally proceeds along the cleavage 001. Thus a parallel intergrowth of biotite and chlorite along 001 is probably not a primary feature but rather a selective replacement of certain biotite *lamellae* by chlorite. In some cases, no remnants of biotite are visible, and it is possible that the chlorite found is an original product.

The deposition of chlorite is closely connected with the introduction of certain sulphides. It is noteworthy that in most places where pyrrhotite or pyrite is found in the wall rock, the adjacent biotite is altered to chlorite, and epidote or clinozoisite have been generally changed to serpentine. A little carbonate sometimes accompanies these sulphides.

The final stage of the hydrothermal process is followed by sericitization and carbonatization. The older products of alteration, albite and chlorite, have been



Photomicrograph of a thin section of vein material, Parkhill mine, showing a veinlet with native gold, carbonate, and feldspar, traversing vein quartz and sericitized country rock. (One nicol, × 36.)

more or less replaced by sericite, whereas in the case of biotite, some serpentine was formed as an intermediate product. The latter, however, disappears where sericitization was very intense.

Completely sericitized country rock consists of a fine aggregate of sericite scales, which generally exhibit a common orientation, giving a slightly schistose texture to the hand specimen.

Manifold flexures and distortions of the sericite scales indicate mechanical effects, which in the quartz resulted in the formation of fine cracks. Fractures in sericite in many places have favoured the deposition of late minerals, such as native gold (see photomicrograph above). It is important to note that no gold was observed which was deposited contemporaneously with the sericite.

Much of the tourmaline has been attacked by the sericite-forming solutions, although there are crystals which fail to exhibit any signs of corrosion and which give the impression of younger crystals in sericite. Means,[1] who investigated material from the Hornblende and Mackey Point veins, considered such examples

[1]A. H. Means, "Tourmaline-bearing Gold Quartz of the Michipicoten District, Ont.," Econ. Geol., Vol. 9, 1914, pp. 122-135.

as evidence for a later age of the tourmaline. Gledhill[1] also seems to favour the opinion that arsenopyrite and tourmaline replace the sericitized country rock. Apart from the fact that the late age of the tourmaline appears doubtful from a theoretical standpoint, this opinion is disproved by the microscopic evidence that all sulphides except arsenopyrite are younger than the tourmaline. The same solutions that brought about the chloritization of the biotite, in many cases deposited pyrite and pyrrhotite in broken tourmaline. If, indeed, tourmaline and arsenopyrite had been deposited during or after sericitization, these minerals should cut or replace the other sulphides here and there. This, however, is not the case; with whichever sulphide arsenopyrite and tourmaline are intergrown, the latter invariably are the older. The microscopic evidence proves that arsenopyrite and tourmaline have been preserved as relics in the later hydrothermal products, owing to their relatively great resistance.

Analytical evidence that the sericitization was caused by solutions bearing potash has been presented by Gledhill.[2]

ANALYSES OF GRANODIORITE PORPHYRY FROM THE MINTO MINE

	Unaltered porphyry	Sheared and altered porphyry
	per cent.	per cent.
Silica	67.91	66.32
Alumina	14.25	15.27
Ferric oxide	.58	.90
Ferrous oxide	2.12	1.80
Lime	2.52	1.79
Magnesia	1.52	1.59
Potash	2.35	3.88
Soda	4.18	3.55
Titanium dioxide	.38	.47
Carbon dioxide	2.67	3.34
Water	1.33	1.30
Iron sulphide	.11	trace
Total	99.92	100.21
Specific gravity	2.713	2.737

During the late carbonatization varying quantities of sericite were replaced. The carbonatization is, however, grouped with the sericitization as the final stage of alteration, because there is little of one without the other. Tourmaline was most easily attacked by the carbonate-forming solutions. Likewise all sulphides except the latest generation of chalcopyrite, pyrite, and native gold give evidence of replacement. The carbonatization appears to be closely related in origin to the barren carbonate veins and stringers found both in the vein quartz and the adjacent country rock. This last hydrothermal stage is older than the red feldspar-carbonate veins described in the following section.

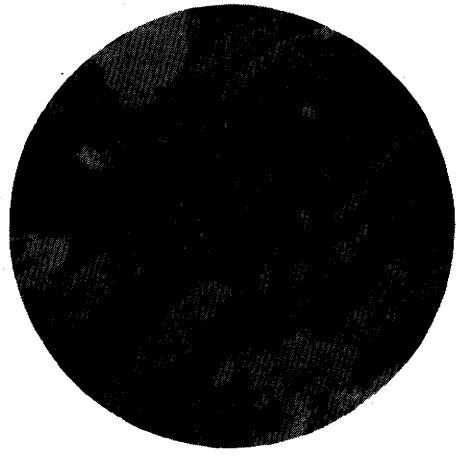
Summarizing all evidence, the hydrothermal alteration of the wall rock was a process of unusual extent. It exhibits a change from high temperature conditions, as suggested by the combination of tourmalinization, albitization, and biotitization, to a final stage of lower temperatures, as marked by the sericitization and carbonatization. Chemically, the process is characterized by an introduction of boron and alkalies.

[1]Op. cit., p. 27.
[2]Ibid. p. 24.

The Feldspar-Carbonate Veins

An unusual feature of the gold deposits is the presence of red felspar-carbonate veins. They occur in narrow zones striking northeast and dipping steeply northwest. Within the zones the individual veinlets form a complicated network. Depending on their strike, the gold veins are intersected by the feldspar veins either at nearly right or rather acute angles.

As has been established by development work at the various mines, the feldspar veins cut the younger set of diabase dikes but are older than the lamprophyre dikes. The lamprophyre dikes are rather frequently found in the feldspar zones. Presumably, the tectonic stresses preceding the intrusion of the lamprophyres caused a reopening of older lines of weakness that had been healed by the feldspar veins.



Photomicrograph of a thin section of the Jubilee vein, showing an aggregate of broken tourmaline (grey, high relief) corroded by ankerite (greyish-white, in part with twinning *lamellae*) and recemented by pyrite (black); quartz (white, smooth surface). (One nicol, × 21.)

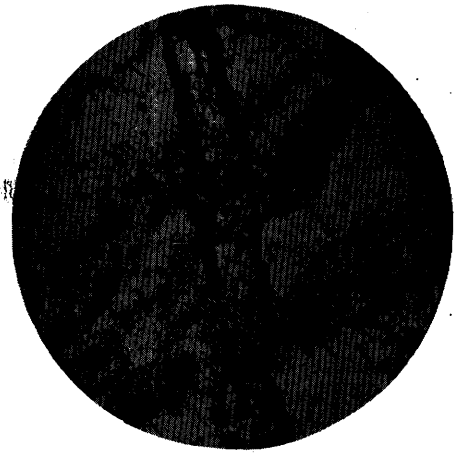
Macroscopically the feldspar-carbonate veins give the impression of felsitic bands, the colour of which ranges from a brilliant brick-red to pinkish shades. Closely examined, however, it is easily seen that the bands consist of a narrow central veinlet flanked by relatively wide bands of altered country rock. At their outer edges these bands grade rather rapidly into unaltered rock. The alteration causing the red colour starts on both sides of the central fissure and gradually fades out laterally.

These relations are best developed in the old metamorphosed rocks. In quartz, no replacement of the wall takes place, and the veinlets are merely narrow fracture fillings, slightly pink in tinge (see photomicrograph on page 69). In granite and porphyry, replacement of the walls is slight.

The microscope reveals carbonate, orthoclase, and albite as the chief components of the veinlets. Rutile and octahedrite are common but occur only in negligible amounts. In places purple fluorite and some colourless apatite are found as accessory constituents. Considerable quantities of feldspar have been replaced by the carbonate, so that the latter generally predominates.

The feldspar invariably contains a cloud of minute inclusions of iron oxide. These transparent particles vary in colour from reddish-brown to cherry-red, forming the pigment of the red veins. Part of the inclusions are barely visible under the strongest oil immersions and approach colloidal dimensions, others have a diameter up to 50 microns. The distribution of the pigment particles is generally irregular. In some places, however, a linear arrangement is discernible, which in albite runs parallel to the twinning.

Replacement has been particularly intense in the sericitized country rock of the gold veins. There the beginning of feldspar development can be traced in places to a distance of 20 inches from the original fracture, though in other rocks the width of alteration rarely exceeds one inch. In the initial stage of the alteration of sericite, isolated scales show the optical characteristics of orthoclase



Photomicrograph of a thin section of the Grace vein, Darwin mine, showing red feldspar-carbonate veinlets (grey) cutting ribbons of arsenopyrite (black); quartz (white). (One nicol, × 12.)

rather than of sericite. At the same time the replaced individuals are marked by newly developed particles of iron oxide.

Carbonate plays an important rôle in the feldspar veins. In places, so much carbonate has been formed that the older components are largely replaced and only small remnants remain. The iron oxide particles originally in the feldspar aggregates have suffered but little replacement and remain as inclusions in the carbonate.

The carbonate consists chiefly of $CaCO_3$ with small admixtures of magnesium and iron carbonate. It is probable that the chemical character of the minerals replaced determined the composition of the carbonate.

Rutile occurs rather commonly as tiny crystals or granular aggregates of dark-brown colour. In contrast to rutile, which is visible only under the microscope, the presence of octahedrite is frequently noticeable, due to its sky-blue or sapphire-blue colour.

Fluorite can be observed in small quantities in many red veins. In several cases deep purple fluorite occurred at intersections of the red veins and the gold quartz veins, where it had migrated a short distance into the vein quartz. The

mineral was originally deposited as well-developed little cubes, which later, however, were more or less corroded by carbonate.

Apatite was found in typical prismatic crystals in various thin sections of red veins. A qualitative analysis proved it to be a chlorine apatite, which contains only traces of fluorine. The apatite is more easily attacked by carbonate than the feldspar, so that in the presence of both minerals apatite seems to be the first one to be replaced.

A reopening of the original fissures has taken place in some red zones. This fact is evidenced by red fragments, which are cemented by a later mineral generation, which includes dolomite, quartz, calcite, pyrite, and stibnite. Cavities are commonly lined with small rhombohedrons of dolomite or quartz crystals, which in turn may be coated with crystals of calcite, pyrite, or tiny needles of stibnite.

The origin of the feldspar-carbonate veins is marked by two successive phases. Feldspar, apatite, fluorite, as well as octahedrite and rutile, were formed during the first phase, and carbonate was deposited later. Although both phases are parts of a continuous process they indicate a distinct change of the chemical composition of the solutions as well as of the physical conditions.

In rocks of low chemical resistance the feldspar was deposited in the wall rock and only to a subordinate extent in the fissures serving as channelways for the solutions. It is probable that the fractures were not closed by the deposition, as the later carbon-dioxide-bearing solutions found easy access. In quartz, however, where the solutions of the earlier stage did not meet with replaceable wall rock, deposition of feldspar took place only in the fractures. This explanation is in accord with the fact that the red fissures in the quartz were almost entirely healed with feldspar, so that circulation of the later carbonate-forming solutions was rendered difficult or completely obstructed.

The general character of the red veins, the combination feldspar-apatite-fluorite, as well as the alteration of the wall rocks, are conclusive evidence that the feldspar-carbonate veins do not represent dikes of liquid-magmatic origin.

The presence of the volatile elements phosphorus, chlorine, and fluorine, as well as the considerable chemical activity and the exceedingly low viscosity of the solutions which most easily proceeded along subcapillary fractures, strongly suggests that the first stage of mineralization of the red veins was controlled by temperature and pressure conditions characteristic of Niggli's[1] pneumatolytic stage.

According to recent investigations by Koenigsberger and Mueller,[2] the lower temperature limit for the formation of orthoclase from hydrothermal solutions lies above 350° C., i.e. near the critical temperature of water. In a system with water and carbon dioxide, orthoclase is not stable below 350° C. On the strength of older investigations by Baur,[3] which showed analogous conditions of formation for orthoclase and albite, it may be assumed that albite forms under conditions that closely approach those established experimentally by Koenigsberger and Mueller for orthoclase.

The results of these two investigators allow conclusions to be drawn about the probable temperature at which the red veins were formed and in regard

[1]Paul Niggli, "Ore Deposits of Magmatic Origin" (trans. by H. C. Boydell), Thos. Murby & Co., London, 1929.

[2]Königsberger und Müller, Beschreibung einiger synthetischer Silikatmineralien und synthetischer Versuche nebst Folgerungen für die natürlichen Vorkommen, N. Jb. Min., Beil.-Bd. 44, 1921, pp. 425, 428.

[3]E. Bauer, Bildung der Feldspäte aus wässerigen Lösungen bei hohem Druck; In Doelter, Handbuch der Mineralchemie, Vol. II, sect. 2, p. 556.

to the beginning of the carbonate phase. From the fact that in places feldspar crystals are surrounded by carbonate without displaying any evidence of corrosion, it may be concluded that some carbonate was formed while feldspar was still being deposited. The temperature at this time was obviously still above the stability limit of the feldspar. With the gradual sinking of the temperature of the solutions below 350° C. during the carbonate phase, the feldspar has been replaced, more or less depending on the local conditions.

Considered as a whole the feldspar-carbonate veins represent a formation reaching from pneumatolytic to hydrothermal stages.

Genetic Considerations

Mineral Sequence

Microscopic investigation shows that mineral deposition in the gold-quartz veins has taken place in a definite sequence. The main deposition of quartz antedates the introduction of albite, biotite, etc., as shown by the occurrence of arsenopyrite and tourmaline in cracks in the quartz. Albite, arsenopyrite, tourmaline, and biotite followed in the order named, though in some veins arsenopyrite is absent. Where this is the case the deposition of pyrrhotite and pyrite I apparently began contemporaneously with the chloritization of biotite. It may be assumed that apart from temperature and pressure, the amount of sulphur available determined which sulphide was formed.[1]

Although small amounts of carbonates are found with the oldest pyrite, noticeable quantities were first deposited with pyrite II, marcasite, and chalcopyrite II. The deposition of these sulphides probably took place contemporaneously with the sericitization of the country rock. It is the belief of the writer that the latest stage of alteration, namely the carbonatization, was contemporaneous with the formation of the barren carbonate veins in the quartz. The calcite of such veins has locally replaced chalcopyrite II.

A very late generation of quartz forms barren veins in the older sulphide-bearing quartz. As this quartz is not mineralized, it must be concluded that it was formed after the deposition of the sulphides. This conclusion is in accord with the observation that in some cases the late quartz cuts the late barren carbonate veins in the older quartz.

Tourmaline, carbonate, and small amounts of sulphides poor in gold are found as associates of the younger quartz, with which they were probably formed contemporaneously. The veins and lenses of the later quartz give the impression that they belong to a later vein formation, as represented by the so-called bull quartz veins. Both, indeed, show a strong resemblance in texture and mineralogical content.

Native gold was deposited after the main period of the mineralization of the gold veins with sulphides. It is generally accompanied by small quantities of calcite and occasionally by some chalcopyrite III. This later mineral generation commonly occurs along cracks and fine fissures cutting the older veins.

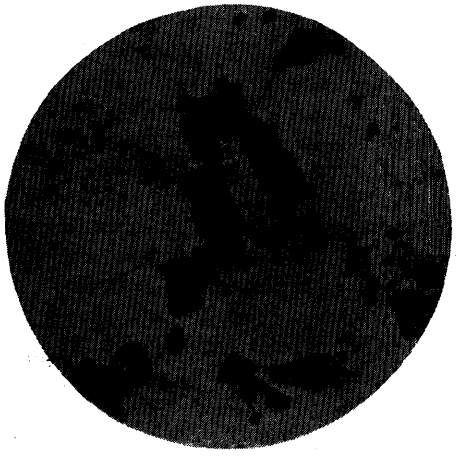
In places native gold is observed in the middle of red feldspar veinlets traversing the vein quartz, and in a number of cases the microscope reveals an intimate association of the gold with the feldspar carbonate veins although this fact is not obvious in the hand specimen.

At intersections of the feldspar veins with the gold-quartz veins, the minerals of both formations occur in close association. Feldspar and carbonate are found

[1]P. Ramdohr, Neue Beobachtungen über die Verwendbarkeit opaker Erze als "geologische Thermometer," Z. prakt. Geol., 1931, pp. 65-80.

cementing cataclastic vein quartz, and sulphides of the gold veins are frequently replaced by minerals of the feldspar veins. Both native gold and chalcopyrite III, however, appear to be contemporaneous, or later than all the minerals of the red feldspar veins. This fact is borne out by instructive replacement phenomena observable under the microscope (see photomicrograph below).

The intimate association of part of the native gold with minerals of the feldspar veins suggests a genetic relationship with the latter. Noteworthy is the close association of native gold with carbonate and feldspar in cracks which frequently are less than 0.02 millimetres wide (see photomicrographs on pages 59 and 68). The age sequence is invariably feldspar, carbonate, gold. It is



Photomicrograph of a thin section of the Grace vein, Darwin mine, showing native gold (black) corroding an apatite crystal (white, high relief). A veinlet with feldspar and carbonate traverses quartz (white, smooth) in a nearly horizontal direction. (One nicol, × 70.)

difficult to conceive how the gold might have been introduced at a later time without a reopening of the cracks. No evidence, however, can be detected under the microscope indicating a reopening.

Feldspar veins frequently contain small amounts of sulphides, such as pyrite, chalcopyrite, and galena. They are not known, however, to carry gold at a distance from quartz veins. In one case only the writer found some native gold in a feldspar vein about 6 inches from the Grace vein. Furthermore, it is difficult to explain why in many places where feldspar veins intersect the quartz veins no native gold is observed. Large portions of the Jubilee vein, for instance, do not display any visible gold, although they are cut by numerous red feldspar veins.

There is sufficient evidence to conclude that at least part of the native gold has been introduced into the quartz veins at the intersections with feldspar veins and that older sulphides present in the quartz veins have perhaps exerted a favourable influence on their deposition. As for the source of the native gold associated with the feldspar veinlets, it appears doubtful that the precious metal formed an original constituent of the solutions rising in the red zones. The writer is inclined to believe that the solutions that formed the feldspar-

carbonate veins dissolved some gold in depth where they came in contact with gold-bearing quartz.

Ore Shoots

The workable portions of the veins generally have lenticular outlines, similar to the shape of the quartz bodies. Like the quartz lenses, all ore shoots pitch at angles of 40 to 60 degrees to the right of an observer looking down the dip of the vein. In general, single quartz lenses show a better mineralization than others. So far, no definite rule regarding the localization of ore shoots has been recognized. Some of the ore bodies at the Parkhill and Darwin mines were found in the vicinity of vein junctions. Some small ore lenses occurred where inconspicuous shear zones joined the vein structure proper. In other cases, small ore shoots were located along flat-pitching folds of pre-mineralization age. On the other hand, vein intersections have invariably been found to be unfavourable to ore concentrations. At such places, the gold-bearing shear zones are commonly ill defined and without large quartz lenses.

A prerequisite for the mineralization of the veins has been a mechanical deformation of the quartz as well as of the country rock, which opened channels for later mineral-bearing solutions. In barren quartz veins, such signs of deformation are absent.

Deformation of the quartz in extreme cases consists of a brecciated texture, but commonly is indicated by cracks varying in size down to subcapillary dimensions. The true width of most of these cracks rarely exceeds 0.5 millimeters, if allowance is made for those introduced minerals that outgrew the boundaries of the cracks. The fissures that form late carbonate veins in the quartz are of considerably larger dimensions.

Although these is ample evidence that mineralization was largely controlled by mechanical deformation, it is possible that in places the chemical composition of the country rocks had an influence upon the deposition of gold-bearing sulphides.

The question as to whether the lamprophyre dikes are responsible for the better quality of the gold ore, has to be answered in the negative on the strength of laboratory investigations as well as of field observations. Supporting this statement are numerous analyses of samples of coarse sulphides which were occasionally found at and near the walls of lamprophyre dikes. These sulphide aggregates, which were obviously deposited during a period of hydrothermal infiltrations along the dike walls after the intrusions of the lamprophyres, do not even carry traces of gold. A microscopic investigation of fragments of the Grace vein in a lamprophyre dike afforded conclusive evidence that all minerals that were deposited along cracks in the quartz fragments after the intrusion of the dike were later than the gold mineralization proper.

An interesting observation attesting to the primary origin of the gold of the Grace vein was made by the writer. Vein fragments containing native gold, sulphides, and red feldspar veinlets were found within a large lamprophyre dike cutting the Grace vein. Fractures in the quartz, which had originated during the disruption of the vein, under the microscope contain abundant needles of a bluish hornblende, which is frequently noticed as a late hydrothermal product along the walls of lamprophyre dikes. As shown in the photomicrograph on page 74, the hornblende needles form idioblastic needles in the gold, proving that the gold was present in the vein quartz before the intrusion of the lamprophyre dikes.

less conformable to the original shear zones, locally branches and stringers cut across the sheared rocks. This is particularly evident in places where the quartz was deposited in folded sections of the shear zones (see photograph on page 50). In general the quartz has a very irregular outline. The adjacent wall rock as well as country rock inclusions have indistinct boundaries and give the impression that they have been eaten into by the quartz (see photograph on page 54). Narrow curtain-like inclusions parallel to the strike and dip of the vein commonly fade into fine seams which can be traced for some distance.

These phenomena indicate that the veins owe their origin largely to replacement of the sheared rocks by solutions which were probably forced under high



Photomicrograph of a polished section of the Grace vein, Darwin mine, showing native gold (light-grey) with inclusions of chalcopyrite (grey) and a veinlet and crystals (black) of blue hornblende (riebeckite). (One nicol, × 630.)

pressure into the shear zones. The solutions are believed to have been given off during the differentiation of the Wawa batholith. According to Lindgren's classification,[1] the early phase of the formation of the veins is characteristic of the hypothermal group of deposits, whereas the later stages correspond to mesothermal conditions. Certain stages of the mineralization of the gold veins are separated by the intrusion of dike rocks.

DESCRIPTION OF PROPERTIES

The following description of properties in the Michipicoten area is confined to those on which underground work was carried out between 1934 and 1936. Most of the mineral properties that are not included here have been described in the reports by T. L. Gledhill[2] and E. S. Moore.[3]

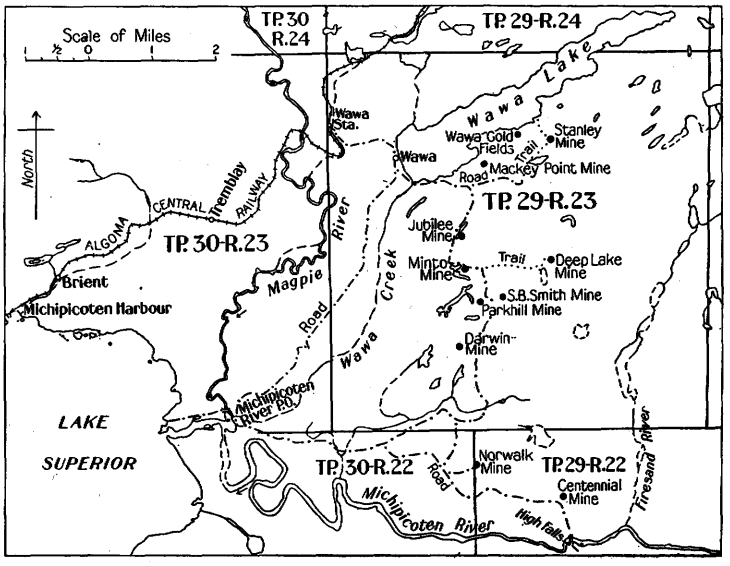
Mackey Point Gold Mines, Limited

The property of Mackey Point Gold Mines, Limited, comprises a group of 11 claims extending along the south shore of Wawa lake, township 29, range

[1]Waldemar Lindgren, "Mineral Deposits," McGraw-Hill Book Co., 1928.
[2]Op. cit.
[3]Op. cit.

23, and includes the original discovery in the Michipicoten district on Mackey point. From 1933 to 1935 the claims were optioned by the Consolidated Mining and Smelting Company of Canada, Limited, which carried out a considerable amount of exploratory work. In 1936, the property was taken over by Mackey Point Gold Mines, Limited.

The following notes on the Mackey Point claims are in part based on observations made by E. M. Burwash, of the Ontario Department of Mines, who visited the property in 1934 while most of the test pits and shafts were free of water. The principal work in progress at that time was on claim Y. 104, on two



Index map showing the location of the mines in the Michipicoten area.

veins outcropping on a steep, westward-facing cliff. These veins lie one above the other and dip into the cliff at 25° to 30° E., their strike being approximately N. 15° E. A shaft 41 feet deep was sunk on the lower vein, not far north of the road leading from Wawa to Gold Park. The upper vein, which was opened up by a shaft about 375 feet farther north, lies about 40 feet above the lower. This shaft follows the vein down about 90 feet, at which point the vein appeared to be cut off by a fault. Below this point, the slope of the shaft was increased to 60 degrees, in expectation of locating the vein at greater depth. Work in the shaft was continued to a depth of 250 feet along the incline but failed to encounter the extension of the vein.

The veins in both shafts are between 3 and 6 feet wide and are composed of a glassy type of quartz, with which are associated carbonate, black tourmaline, and feldspar. The quartz contains numerous inclusions of country rock and in many places is cut by red feldspar-carbonate veinlets. The mineralization of the veins consists of pyrite, pyrrhotite, and chalcopyrite. Visible gold is said to have occurred in the shaft on the upper vein not far from the surface.

Another eastward-dipping vein called the "Root lens" is located some distance to the northwest. It strikes about N. 30° E. and has been exposed for over 100 feet. Most of the quartz is granulated in appearance and is cut by

a later generation of quartz. Pyrite and tourmaline are conspicuous constituents.

On the point, two pits have been sunk on flat-dipping veins, 1 to 2 feet in thickness. The quartz carries tourmaline, pyrite, pyrrhotite, chalcopyrite, galena, sphalerite, and visible gold.

The rock formations on this property are made up of highly metamorphosed Keewatin volcanics, which are intruded by granitic rocks. According to Dr. Burwash, a granular type, containing biotite, highly metamorphosed feldspar (represented by a granular mass of quartz and kaolin), primary quartz, apatite, zircon, and iron oxides, appears to be close to a soda-granite in composition. A sheared granodiorite porphyry is found at the inclined shaft and has phenocrysts of quartz and anorthoclase in a groundmass of quartz, feldspar, hornblende, and biotite, with accessory ilmenite. Among the secondary minerals are kaolin, sericite, chlorite, carbonate, leucoxene, and limonite.

Wa Wa Gold Fields, Limited

The eight claims of the Wa Wa Gold Fields, Limited, situated in township 29, range 23, adjoin the Mackey Point group on the east. Several parallel veins striking northwest and dipping eastward are known on this property. Vein A has a width of 2 to 3 feet and carries pyrrhotite, pyrite, chalcopyrite, sphalerite, and galena in a gangue consisting of quartz with some carbonate and tourmaline. The vein has been stripped for more than 200 feet and dips 50° N.E. Visible gold has been found on the surface. Veins B and C lie parallel to and within a short distance south of vein A. Vein B shows a mineralization similar to that of vein A but is not as wide. Vein C, the most southerly of the three veins, has been traced for nearly 2,000 feet on the property of Wa Wa Gold Fields and is known to continue on the Mackey Point claims. The vein is rather wide and is made up of quartz with much carbonate and varying amounts of pyrite, pyrrhotite and chalcopyrite.

An inclined shaft has been sunk to a depth of 70 feet on the Figgus vein, and several hundred feet of drifting is said to have been carried out on that horizon. A second level has been opened up on the same vein 115 feet below the shaft collar, by an adit about 100 feet long. The Figgus vein strikes N. 30° W. and dips 45° N.E. It is about 2 feet wide and has a mineralization similar to that of vein C.

In 1934, a new vein was discovered on claim S.S.M. 7,445. It consists of a granular type of quartz and carries pyrite, pyrrhotite, chalcopyrite, and visible gold.

Stanley Gold Mines, Limited

The property of Stanley Gold Mines, Limited, in township 29, range 23, consists of a group of 8 claims, which adjoin the Wa Wa Gold Fields group on the east. Underground work was commenced in 1934. By the end of 1936, an inclined shaft had been sunk to a depth of over 400 feet and three levels had been established at inclined depths of 138 feet, 275 feet, and 380 feet. A 50-ton mill started to operate late in 1936.

Most of the development work has been done on the Smith vein, which strikes N. 50° W. and dips about 35° N.E. A parallel vein called the Compressor vein lies about 60 feet west of the Smith but dips at a slightly steeper angle. The Mickelson vein, which outcrops a little over 100 feet northwest of the shaft, strikes in a northeasterly direction and dips about 40° S.E. Since

the Mickelson vein has not been found to extend east of the Smith vein or west of the Compressor vein, it is probable that it represents a connecting branch between the two parallel veins. The veins range in width from a few inches to as much as 6 feet. The quartz is of the sugary type and carries pyrite, pyrrhotite, chalcopyrite, and sphalerite. In general, there is little conspicuous gold, although some rich vein material is said to have been found on the surface, near the junction of the Mickelson and Smith veins.

The country rock consists essentially of a fine-grained, dark-greenish rock of volcanic origin. A narrow band of conglomerate with well-rounded pebbles was noted on the old road, a short distance west of the camp. Its strike is roughly to the northeast.

Minto Gold Mines, Limited

The properties controlled by Minto Gold Mines, Limited, include the Minto and Jubilee mines and the Cooper claims in township 29, range 23. Production has been in progress since June, 1931. By the end of 1936, the output had reached a total of 32,488 ounces, of which 20,756 ounces were extracted from ore mined at the Minto mine. Operations at the Minto mine came to a close in June, 1934, and since that time the mill has treated ore hauled by truck from the Jubilee mine.

The geology of the various Minto properties has been described by Gledhill[1] and Moore.[2] The Jubilee deposit forms a large quartz body lying in a wide, sheared and fractured zone, referred to as the "Jubilee break." It strikes N. 20° E. and dips at an angle of 35° S.E. While development work had led to the belief that the deposit consisted of several quartz lenses, stoping operations proved the existence of one large continuous quartz body over 600 feet long and ranging in width from 10 to over 40 feet. As an average, the stoping width exceeds 20 feet. The quartz has its a maximum width on the bottom level, which is at an inclined depth of 640 feet. Here the quartz body is more compact than on the upper levels, but gold values show a decline.

In contrast to the sugary quartz of the Minto, Parkhill, and Darwin veins, the quartz of the Jubilee mine is of a coarse, glassy-looking type and is accompanied by large aggregates of tourmaline and ankerite. The sulphides include pyrite, pyrrhotite, and chalcopyrite. As a rule, native gold is observed only in rare instances. The quartz contains abundant inclusions of country rock, most of which gives evidence of replacement phenomena (see photograph on page 54). The country rock and the quartz are traversed by an intricate network of red feldspar-carbonate veins, and in certain sections of the mine the sheared country rock is coloured flaming red, owing to replacement phenomena caused by the red veinlets. The quartz body and the accompanying sheared zone are broken up by a series of late strike faults. Major gouge-filled fractures with smooth walls occur close to the hanging wall and footwall of the gold-bearing zone.

The rock formations in the vicinity of the Jubilee mine consist chiefly of greenstone and a highly altered dioritic rock. Both are intruded by a fairly fresh granodiorite. A tongue-shaped intrusion of this rock has been exposed in the escape raise driven from the 285-foot level, through the hanging wall of the deposit, to the surface.

A dense, greyish to pinkish rock, of unusual hardness, was encountered in the footwall of the Jubilee break on the 3rd and 4th levels. This rock forms a

[1]Op. cit., pp. 34-39, 42.
[2]Op. cit., pp. 36-39.

mass of rather limited extent and is later than the shear zone accompanying the deposit. It is cut, however, by red feldspar-carbonate veins, lamprophyre dikes, and late faults. There is no evidence that this rock is a silicified wall rock. According to J. Knox, Jr., a small body of the same material was encountered in the hanging wall of the Jubilee deposit near the north end of the 4th level. The microscope reveals quartz with minor amounts of orthoclase and plagioclase as constituents. In some slides, both feldspars form phenocrysts, but in general all components are very uniform in size. From its structural relations and its microscopic characteristics the rock is believed to be an acid type of aplite.

Parkhill Gold Mines, Limited

Most of the property of Parkhill Gold Mines, Limited, which is situated in township 29, range 23, was originally staked during the early days of the region and was later known as the Longbottom. The main group of claims includes S.S.M. 3,129, 3,124, 3,493, 3,109, 1,107, 1,090, 7,389, 3,470, 3,471, 3,301, 360. These lie immediately northeast of the Darwin (Grace) mine and adjoin the Jubilee-Minto property on the south.

Active development work at the Parkhill mine[1] commenced in the spring of 1930, and production has been in progress since July, 1931. According to information kindly supplied by Mr. R. D. Caylor, mine manager, the total production of the mine to the end of 1936 amounted to 48,040 ounces of gold and 2,586 ounces of silver.

The mine is served by an inclined shaft located on claim S.S.M. 3,124. Dipping at an angle of 42 degrees, the shaft in its uppermost section follows the main vein and then continues in the hanging wall of the original vein to an inclined depth of 1,750 feet. In 1936, thirteen levels had been established, the deepest one at a vertical depth of 1,150 feet.

Four of the veins have strikes ranging from N. 60° E. to due east; one strikes approximately N. 20° W. The dip of the veins varies from 30 to 60 degrees, the average being about 45 degrees. Only three of these veins were located on the surface, the other two being discovered during underground work. The north-south vein has not been found to extend above the 5th level, although its barren shear zone seems to continue toward the surface.

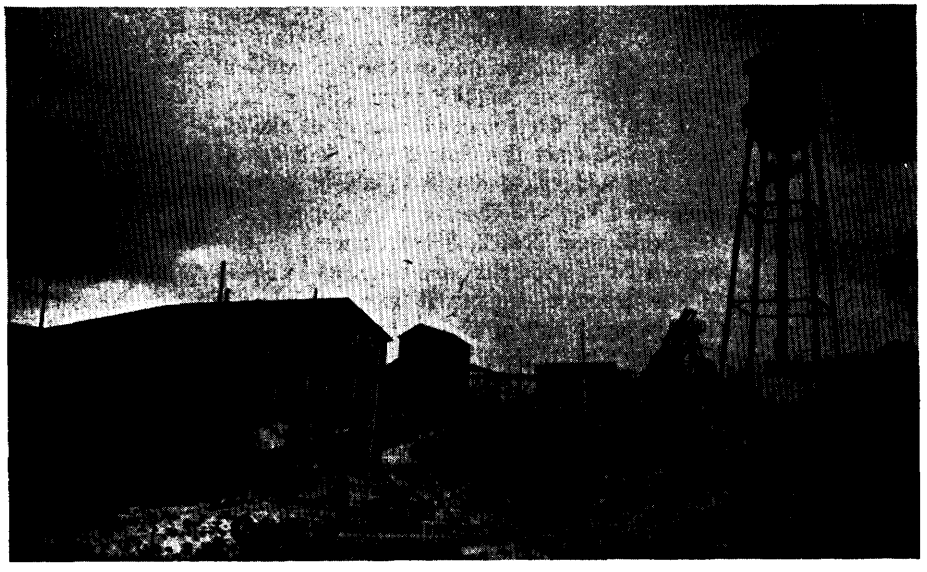
The east-west veins form a system converging toward the west. No. 1 vein, on which the shaft was started, appears to be the most persistent; the other veins are headed to join No. 1 vein and disappear in the western part of the mine. Similarly, the east-west veins seem to converge downward, as only two of them have been definitely recognized in the deep levels. Near the north-south vein, the east-west veins show a slight deflection, which was probably caused by a late fault zone accompanying the north-south vein in the hanging wall.

The veins consist of a succession of lenticular quartz bodies, which occur along shear zones. The horizontal extent of the quartz lenses varies greatly and in some places reaches 125 feet; the width of the quartz averages little over 2 feet, with a maximum of about 6 feet. There are three major ore zones along the east-west vein system and one ore shoot on the north-south vein. The axes of the ore zones pitch at an angle of about 60 degrees to the right of an observer looking down the dip of the vein. Thus, the stopes of the east-west veins rake toward the west and those on the north-south vein to the south. As

[1]For an earlier description of the Parkhill mine see Ont. Dept. Mines, Vol. XL, pt. 4, 1931, pp. 39-41.

compared with their relatively short horizontal length, nearly all the ore shoots are remarkably persistent in vertical dimension. The so-called "West" ore shoot was followed from the 3rd level downward to the 9th level, where it was found to be cut off by a wide diabase dike. As a rule, junctions of two or more veins are favourable locations for ore bodies. In a few cases, "rolls" or minor foldings of the veins seem to have controlled the mineralization of certain quartz lenses.

The mineralization of the veins consists essentially of pyrite, pyrrhotite, chalcopyrite, and gold. In general, the quartz carries little visible gold. Pockets containing spectacular aggregates of coarse gold have been found occasionally, and some of them are said to have yielded more than 400 ounces of gold.



View of the Parkhill mine.

The veins of the Parkhill mine occur in a series of Keewatin volcanics, which strike roughly northeast and dip steeply to the northwest. A characteristic member of these rocks is a band of agglomerate, which can be traced from Mariposa hill across the Parkhill property and claim S.S.M. 301. In places the agglomerate grades into fine-grained lavas and others of porphyritic type. A biotite schist with leucoxene, which is found in close association with the above rocks, according to Dr. Burwash is apparently an altered andesite. In the western part of the mine, a pink-coloured granite intrudes the Keewatin formation. A diabase dike 80 feet wide, a great number of narrow lamprophyre dikes, and numerous red feldspar-carbonate veins are later than the gold veins.

S. B. Smith Mine

The S. B. Smith mine in township 29, range 23, is located on claim S.S.M. 301, which adjoins the Parkhill claim, S.S.M. 3,124, on the east. The discovery of the vein that became known as the Smith was made in September, 1933, by L. A. Van Sickle, who gave an option to Dr. S. B. Smith of Cleveland, Ohio. Shaft-sinking on the new vein was commenced in the spring of 1934, and subsequently two levels were opened up at 100-foot intervals. A 50-ton amal-

gamation mill was erected in 1935 and was in operation from May, 1935, until February, 1936. During this period, bullion amounting to slightly more than $53,000 was shipped to the Mint at Ottawa. Mining operations came to a complete standstill in February, 1936, and a short time later the property was acquired by Michipicoten Gold Mines, Limited, which is holding under option a group of claims immediately north of the Smith mine.

Striking approximately N. 60° E., the Smith vein dips southward at an angle of 45 degrees from the surface to a point about 20 feet above the 1st level and then steepens to over 55 degrees. In the shaft and the drifts the vein is seen to consist of a series of quartz lenses, which range in width from a few inches to almost 4 feet. The length of the ore zone as established on the stripped surface is over 200 feet, although the vein has been traced as a barren shear zone for a considerably greater distance. As indicated by the stopes between the 1st level and the surface, the quartz bodies have a moderate rake to the west. A limited amount of drifting was carried out on the 2nd level but apparently failed to locate the downward extension of the vein. Since the horizontal distance from the mouth of the shaft to the south boundary of claim S.S.M. 301 is about 800 feet, it is to be expected that the Smith vein will enter claim S.S.M. 1,107 of Parkhill Gold Mines at a vertical depth of about 900 feet. If the strike of the Smith vein is projected toward the west, it appears to be in line with the surface outcrop of Parkhill vein No. 2, 300 feet west of the shaft. The Smith vein, however, is faulted by a wide diabase dike, and this fact, as well as other intervening lines of disturbance, makes it impossible at present to correlate definitely the Smith vein with any of the easterly veins of the Parkhill mine.

The rock west of the Smith shaft is the same volcanic series as occurs at the Parkhill mine. A band of coarse agglomerate, which grades into a greyish-green, fine-grained tuff can be seen a short distance west of the shaft. Both rocks are intruded by quartz porphyry, which forms the country rock of the vein east of the shaft. Later than the vein are red feldspar-carbonate veins and diabase and lamprophyre dikes.

The quartz is finely granulated and carries pyrrhotite, chalcopyrite, and fine native gold. Locally some calcite and small amounts of tourmaline are found in the gangue.

Deep Lake Mine

The Deep Lake mine is located on a group of 9 claims, about one mile northeast of the Smith mine, in township 29, range 23. A discovery was made, in the spring of 1934 near the south boundary of claim S.S.M. 6,969, a quarter of a mile north of Deep lake. Two years later, the owners, J. C. Canfield and W. Hocking, sank a shaft on the new vein to a depth of 125 feet and carried out a limited amount of lateral work on the 100-foot horizon.

The shaft was started at a point where a small pocket containing much coarse native gold had been found and was continued in rich ore with much visible gold to a depth of 85 feet. On the 1st level a short ore section, about 35 feet long, that was exposed immediately north of the station appears to be the continuation of the ore shoot followed by the shaft.

The broken rock derived from the sinking operations was treated in a small amalgamation mill of 12 tons daily capacity and, according to W. Hocking, yielded more than $43,000 in gold. Although the recovery did not exceed 80 per cent., these returns were sufficient to pay for the sinking and for the lateral development work.

The Deep Lake vein strikes roughly N. 40° W. and dips 33° N.E. It has been traced on the surface for over 600 feet. The country rock is a very fine grained, recrystallized rock of volcanic origin. In the shaft, the vein has an average width of nearly 18 inches and consists of fine-grained, bluish-white quartz. Carbonate and tourmaline occur in subordinate amounts. The quartz is mineralized with pyrite, pyrrhotite, chalcopyrite, sphalerite, and galena. Native gold is generally observed in fine particles, but in places very coarse gold has been found in close association with sphalerite and galena.

Darwin Gold Mines, Limited

The Darwin property, known originally as the Grace,[1] comprises a total of 40 claims, covering approximately 1,240 acres in township 29, range 23. The mining plant is located on claim D.J. 7, on the main group of claims adjoining the Parkhill property on the west.

The history of the mine dates back to the early days of the Michipicoten gold camp. Actual underground operations began in July, 1900. During this early period, an inclined shaft was sunk on the Grace vein to a depth of 304 feet, and three levels were established at 100-foot intervals. An output of gold was commenced in 1902. According to P. E. Hopkins,[2] production during 1902, 1903, 1907, 1908, and 1910 totalled $71,124. After 15 years of idleness, during which the property changed hands repeatedly, underground exploration work was resumed in 1926 by the Power and Mines Syndicate, which took an option on the property. The old inclined shaft was deepened to 440 feet and lateral work carried out on a fourth level. In 1927 the Power and Mines Syndicate was succeeded by the Power and Mines Corporation, Limited, which late in 1929 started milling operations. Owing to financial difficulties, however, operations came to a standstill in March, 1930, and later during the same year the entire property, including all titles, reverted to the owners, United Algoma Mines, Limited. In 1934, the Grace mine was taken over by Darwin Gold Mines, Limited. The new company extended the old inclined shaft to 500 feet and sank a new vertical shaft to a depth of 830 feet, adding three new levels at vertical depths of 600, 700, and 800 feet. Production has been in progress since November, 1935. From that time to the end of 1936, the total output amounted to 7,287 ounces of gold and 639 ounces of silver.

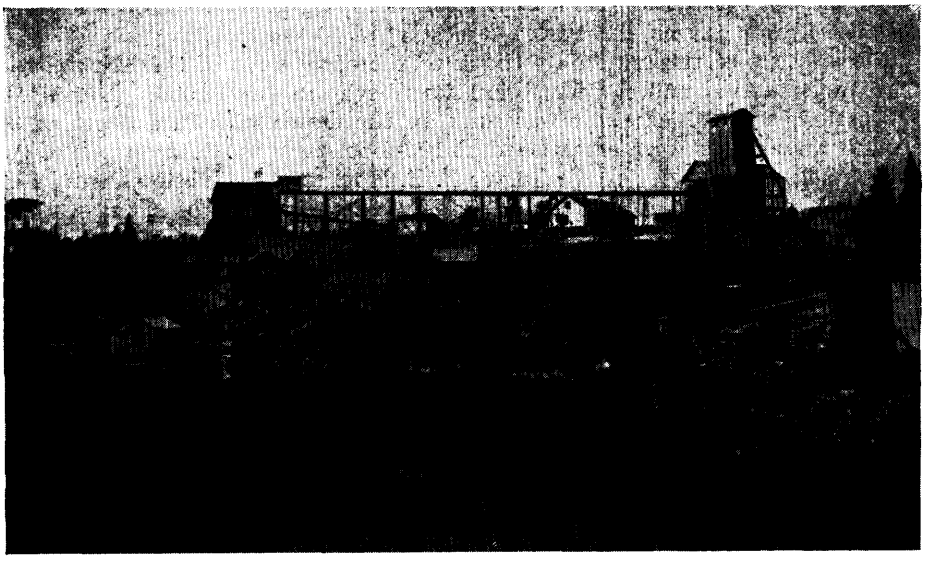
The rocks in the vicinity of the Darwin mine are made up of a series of old volcanics, which are intruded by small masses of porphyries, diorite, and granodiorite. Prominent in the volcanic group is a band of agglomerate, striking roughly N. 30° E., of which outcrops can be seen on the main road near the Darwin cook camp. The agglomerate dips about 35° N.W. between the surface and the 3rd level and steepens considerably between the 3rd and 4th levels. Outcropping near the two shafts is a diorite porphyry, which is locally referred to as the "Grace porphyrite." It forms a rather irregular mass, pitching at a moderate angle toward the north. Although it is distinctly intrusive into the Keewatin volcanics, it is of interest that in a number of places the agglomerate contains fragments of a porphyry that closely resembles the "Grace porphyrite." Both the diorite porphyry and an intrusion of fine-grained diorite, which occurs immediately south of the Grace camp, are cut by dikes of older diabase. The latter, in turn, are intruded by small masses of granodiorite, a short distance west of the old inclined shaft.

[1]For good descriptions of the Grace mine, see Geol. Surv. Can., Mem. 147, 1926, pp. 126-128; Ont. Dept. Mines, Vol. XXXVI, pt. 2, 1927, pp. 30-34.

[2]P. E. Hopkins, "Ontario Gold Deposits," Ont. Dept. Mines, Vol. XXX, pt. 2, 1921, p. 19.

The Darwin veins traverse all rocks except dikes of late quartz diabase and lamprophyre. They are also cut by red feldspar-carbonate veins. A late diabase dike over 60 feet wide displaces the Grace vein in the northern part of the mine. Striking N. 40° E. and dipping at a steep angle to the southeast, this diabase intrusion coincides with a reverse fault causing a vertical displacement of nearly 100 feet.

There are two veins at the Darwin, the Grace vein, which has a general strike of N. 30° W. and a dip of 70° N.E., and an east-west vein dipping 40° S. Like the veins of the Parkhill mine, the Darwin veins occur along definite shear zones and consist of a succession of lenticular quartz bodies, most of which are less than 100 feet long, their width varying from a few inches to more than 5 feet.



View of the Darwin mine.

The vein quartz is of a granular type and is accompanied by subordinate quantities of carbonates and tourmaline. In contrast to the Grace vein, which is mineralized chiefly with arsenopyrite and minor amounts of pyrrhotite, pyrite, and chalcopyrite, the east-west vein is practically free of arsenopyrite; pyrrhotite and pyrite are the prevailing sulphides. As a rule, native gold is visible in ore containing more than half an ounce of gold per ton. Spectacular coarse gold has been found repeatedly in the Grace vein.

Underground operations have located three ore zones along the Grace vein and two ore shoots on the east-west vein. The only ore zone extending to the surface was the original discovery of the Grace vein, on which the old inclined shaft was sunk. The quartz bodies of the east-west vein apex a short distance above the 6th level, and above this horizon the vein is represented by a barren shear zone devoid of any quartz or mineralization. The ore shoots of the Grace vein have a rake of about 60° S. The ratio of horizontal to vertical extent of the ore bodies of the Grace vein was found to be approximately 1 to 3, the horizontal length being about 100 feet. Below the 500-foot horizon, gold values in the Grace vein showed a general decline below the economic limit, although the vein, as such, continues structurally unaltered.

As a rule, junctions of parallel branches of the gold-bearing shear zones are favourable locations for ore concentrations, whereas intersections are without any noticeable enrichment.

Centennial Mine

The Centennial mine, which is located on a group of claims including the old Kitchigami mine, lies about half a mile north of the High Falls power plant in township 29, range 22. Underground work on the original discovery, the Kitchigami vein, started during the early days of the camp but ceased soon after a mill had been erected. Following a long period of idleness, underground exploration was resumed in 1935 by the L. B. United Mines, Limited, which had taken over the property from Centennial Gold Mines, Limited. A new mill was built in 1935 and commenced operations late during the same year. Gold-bearing quartz was milled for some time, but there is no official record of the amount of gold recovered. During the summer of 1936, mining operations came to a temporary standstill.

There are a number of shafts on the property, of which three follow the main vein. Two levels have been established from the main shaft at inclined depths of 115 feet and 225 feet. On the surface, four veins are in evidence, all of which strike approximately northwest and dip 40° to 45° N.E. Two veins have been opened up on the 1st level, and a third vein, lying farther west, has been followed for some distance on the 2nd level. The veins consist of a somewhat glassy quartz, with which are associated small amounts of carbonate and tourmaline. Mineralization shows pyrite, pyrrhotite, and chalcopyrite, but gold is only rarely visible.

The country rock of the veins is a granodiorite which locally encloses small pendants of greenstone. Later than the quartz veins are red feldspar-carbonate veins and lamprophyre dikes.

INDEX, PART VIII

A

PAGE

A.C. 2,067 gold claim..... 19
A.C. 2,301 gold claim..... 18
Access.
See also Canoe routes; Roads.
Lochalsh-Missinaibi area..... 29
Michipicoten area..... 39
Acid volcanics.
Michipicoten-Missinaibi area..5-7, *facing* 8
Lochalsh-Missinaibi area.....32, 33
Michipicoten area.....41, 42
Acidic intrusives.
See also Quartz porphyry.
Michipicoten-Missinaibi area..5-7, *facing* 8
Lochalsh-Missinaibi area.....32-34
Michipicoten area.....41, 45
Acknowledgments.....4, 28, 48
Adams, O. H..... 4
Adkins, Mr..... 28
Agassiz, Louis..... 20
Agglomerates.
Michipicoten area.....42, 81
quartz veins near.....79, 80
Agricultural land. *See* Soil.
Alaskite.....*facing* 8
Albitization of wall rocks.....64, 65
Alden station, gold mg. near..... 19
Algoma Central Ry.....3, 27, 39
Algoma Commercial Co..... 3
Algoma Exploration Co.
Property, geology and workings..... 14-17
quartz lode, age..... 37
Algoma Summit Gold Mines, Ltd.
Photomicrograph of vein material... 10
Property, geology and workings..... 10-12
Algoman intrusives.
See also Diorite; Granite; Lamprophyre; Porphyry.
Michipicoten-Missinaibi area...6, *facing* 8
Lochalsh-Missinaibi area.....32-34
Michipicoten area.....41, 44, 45
granodiorite, analysis..... 43
structure.....49, 50
Algonquin, glacial lake..... 48
Alluvial deposits.....*facing* 8, 30, 31
Altitudes..... 39
Analyses.
Ankerite, Jubilee g.m..... 56
Calcite, Darwin g.m..... 56
Diorite, Laurentian..... 43
Granodiorite, Algoman..... 43
Granodiorite porphyry, Minto g.m... 67
Wall rocks, Darwin g.m..... 65
Andesite.....*facing* 8, 42
Altered to biotite schist..... 79
Ankerite.....55, 56
Jubilee g.m., analysis..... 56
photomicrograph..... 68
Anticline..... 49
Aplite.....*facing* 8, 45, 78
Archer, E. G..... 4
Archer-Crawford gold claims.....13, 14
Arkose.....*facing* 8, 40, 41

PAGE

Armstrong vein..... 19
Arsenopyrite.....54, 71
Gold associated with.....58, 59
photomicrographs.....59, 64
In quartz, photo..... 55
Ash lake.
Canoe routes.....29, 38
Gold claims near..... 38
Rocks, Algoman..... 34

B

Balsam..... 28
Barrett, R. E..... 4, 40
Basalt .....*facing* 8
Lochalsh-Missinaibi area, gold in... 38
See also Greenstone.
Basic intrusives.
See also Diabase; Diorite; Lamprophyre.
Michipicoten-Missinaibi area.....5-7, *facing* 8, 12
Lochalsh-Missinaibi area.....33-37
Michipicoten area.....42, 45-48
Basic volcanics.
See also Greenstone.
Michipicoten-Missinaibi area..5-7, *facing* 8
Lochalsh-Missinaibi area..... 31
Michipicoten area.....41-43
Batholiths.....6, 7, 50
See also Wawa batholith.
Beaver..... 30
Bell, J. Macintosh.....15, 22
Bell, Robt.....5, 20, 21, 30
Benthin, A..... 65
Bibliographies.....21, 40
Biotite-hornblende schists..... 33
Biotite schist..... 79
See also Biotite-hornblende schists.
Blacksmith vein..... 19
Blue, A.....20, 21
Bolkow lake..... 29
Bolton, L. L..... 24
Borron, E. B..... 21
Boundary Lake gold claims.....13, 14
Boyd, Inspector D. G.....2, 21, 22
Bracken tp..... 27
Brandt, F. A..... 4, 10
Breccia.....41, 42
"Bull quartz"..... 54
Burrows, A. G..... 24
Burwash, E. M.
Report by, on Lochalsh-Missinaibi area.....27-38
on Michipicoten-Missinaibi area... 1-26
B. Y. 80 gold claim..... 43

C

Calcite..... 5
Darwin g.m., analysis..... 56
Canadian Pacific Ry.....1, 27, 29, 34

PAGE
Cancrinite ..... *facing* 8
Canfield, J. C. 4, 80
Canoe routes 1, 29
Carbonate.
See also Ankerite; Calcite; Feldspar-carbonate veins.
Michipicoten-Missinaibi area..10-12, 14, 18
Michipicoten area.....42, 55, 67
origin.....45, 47
photos.....52, 53
Carbonate schist 18
See also Sericite-carbonate schist.
Carry station 29
Carter, O. S. 28
Cat portage, rocks 5
Caylor, R. D. 78
Centennial gold m. 46
Geology; workings 83
Map showing location 75
Chalcopyrite.
Michipicoten-Missinaibi area....10, 14, 17
gold associated with 18
Localsh-Missinaibi area 38
Michipicoten area.....62, 63, 71
Charlebois, H. 28, 38
Charlebois-Cristakos gold claims.
Mineralization 38
Chlorite 11
Deposition of 66
Chlorite schist 5, 6, 12
See also Chlorite-sericite schist.
Quartz veins in 13, 14
Chlorite-sericite schist 10, 33
Chubb, F. W. 4
Claims. *See* Mining claims.
Clay 30, 48
Climate, Lochalsh-Missinaibi area 30
Cline, J. 4
Cline Canadian gold m. 4
See also Cline Lake Gold Mines.
Cline Lake Gold Mines, Ltd.
Property, geology and workings 14
map, sketch .....*facing* 14
Cockshutt, C. F. 4, 15
Cole, G. E. 25
Coleman, A. P. 1, 5-7, 21, 22, 24, 30
Collins, W. H. .....3, 6, *facing* 8, 24, 25, 40
Compressor vein 76
Conglomerate .....6, *facing* 8, 48, 77
See also Doré series.
Connor, A. J. 30
Consolidated Mining & Smelting Co. 75
Cooke, H. C. 40, 41
Cooper gold claim 39, 77
Copper.
See also Chalcopyrite.
Lochalsh-Missinaibi area, native 38
Corkill, E. T. 22, 23
Covellite 10
Cowie, G. S. 25
Cowslip station.
Gold claims near 28
Crawford, Mr. 4
Cristakos, N. 38
Crooked lake.
Brulé 29
Canoe routes 29, 38
portage, photo 2
Survey lines near 28
Water power 29
Cubanite 60

D

PAGE
Dacite ..... *facing* 8
Dalton 1, 29
Darwin gold m.
See also Grace g.m.; Nyman vein.
Geology and workings 81-83
calcite, analysis 56
rocks, age 43
lamprophyre, photo 47
structure 49, 50
Map showing location 75
Photo 82
Darwin Gold Mines, Ltd.
See also Darwin g.m.
Operations; production 81
Deep Lake gold m. 51
Map showing location 75
Mineralization 63, 81
Workings 80
Diabase.
See also Keweenawan; Olivine diabase; Quartz diabase.
Michipicoten-Missinaibi area...5, *facing* 8
Lochalsh-Missinaibi area 35
quartz veins in 38
Michipicoten area 44
Darwin g. m., analyses 65
Dingman creek 1
Diorite.
See also Granodiorite; Quartz diorite.
Michipicoten-Missinaibi area...5, *facing* 8
Michipicoten area 45
analyses 43, 65
Diorite porphyry.
See also Quartz diorite porphyry.
Michipicoten area 45, 81
D. J. 7 gold claim 81
Diorite, analysis 43
See also Grace g. m.
D. J. 13 gold claim.
Granodiorite, analysis 43
Dog lake.
See also Emily bay.
Canoe routes from 29
Fault 35
Rocks 5, 32
Survey lines near 28
Water power 29
Dog Lake river 29, 30
Dog Tooth lake 7
Doré river.
Rocks, thickness 5
see also Doré series.
Doré series 5, 48
Correlated with Timiskaming .....7, *facing* 8, 41, 43, 44
Structure 41
Thickness 5, 40
Drag folds.
Michipicoten area 49
Dyer, W. S. 9
Dyment Mg. and Investments, Ltd. 14
Dysey farm, clay 48

E

Easey lake.
"Drowned" land 28
Rocks 34
granite, age 31, 37
Economic geology.
See Geology, economic.

PAGE
Edwards Gold Mines, Ltd.
Property, geology and workings..... 12
sketch map..... 13
Eleanor lake..... 1
Eleanor slates.....*facing* 8, 32
Age; stratigraphy..... 6
Ellipsoidal lava. *See* Pillow lava.
Ely mining claims, staked..... 3
Emily bay, Dog l., gold discovery..... 2, 30
Emmons, W. H..... 26
Explorations, geological, early.
Michipicoten-Missinaibi area, review 4-8
Lochalsh-Missinaibi area..... 30

F

Faults.
Michipicoten-Missinaibi area..... 14
in quartz veins, photo..... 15
Lochalsh-Missinaibi area..... 35-37
Michipicoten area.....49, 50, 82
Feldspar-carbonate veins.
Michipicoten area.....41, 50, 77, 82
mineralogy..... 68-71
native gold in..... 72
Feldspar porphyry.....*facing* 8, 10, 34
Figgus vein..... 76
Firesand river..... 43
Fish, Lochalsh-Missinaibi area.....29, 30
Fisher, A..... 4
Float ore.....15, 17
Flows. *See* Lava flows.
Folding.
Michipicoten-Missinaibi area..... 6, 8
Lochalsh-Missinaibi area.....32, 35
Michipicoten area.....41, 48, 49
Formations, tables of
Michipicoten-Missinaibi area, comparative.....*facing* 8
Lochalsh-Missinaibi area.....31, 32
Michipicoten area..... 41
Fracture zones, mineralized.
Lochalsh-Missinaibi area..... 37
photo..... 36
Michipicoten area..... 49
Fragmental rocks. *See* Pyroclastics.
Fraleck, E. L..... 22
Frohberg, M. H.....*facing* 8, 8, 26, 33, 37
Report by, on Ore Deposits, Michipicoten Area..... 39-83
Fur-bearing animals..... 30

G

Galena.
Michipicoten-Missinaibi area.10, 17, 18, 63
gold associated with..... 81
Game, Lochalsh-Missinaibi area.....29, 30
Ganley gold claim..... 39
Geology, economic.
See also Gold, mg. properties.
Michipicoten area..... 51-74
Geology, general.
Michipicoten-Missinaibi area, review. 4-8
Lochalsh-Missinaibi area..... 31-37
Michipicoten area..... 40-48
Geology, structural.
See also Faults; Folding.
Michipicoten area..... 48-51
Gibson, Thos. W.....20, 22, 23, 24
Gibson gold claims..... 43

PAGE
Glacial deposits.....*facing* 8
Lochalsh-Missinaibi area, thickness.. 28
See also Pleistocene.
Glaciation. *See* Pleistocene.
Glasgow tp..... 28
Gledhill, T. L.....2, 7, 10, 25, 40, 67
Gneiss.
Michipicoten-Missinaibi area...5, *facing* 8
Lochalsh-Missinaibi area.....33, 34
Godon lake.
Gold discovery..... 4
Mg. claims.....13, 14
Gold.
Deposits, nature of:
Michipicoten area..... 51-63
genetic considerations..... 71-74
rocks favourable to.....48, 49, 52
veins, age.....*facing* 8, 41
see also Quartz veins, mineralized.
Discoveries.
Michipicoten-Missinaibi area.2, 4, 14, 15
Lochalsh-Missinaibi area.....30, 38
Michipicoten area.....76, 79, 80
In gossan..... 19
Mg. properties described:
Goudreau-Lochalsh area..... 9-17
Hawk Junction..... 17-19
Lochalsh-Missinaibi area..... 38
Michipicoten area..... 74-83
Native:
Michipicoten-Missinaibi area.....10, 12, 17, 18
Michipicoten area.....49, 51, 71
composition.....57, 58
photomicrographs.....58, 59, 72, 74
Production, Michipicoten area..... 39
Gold Park P.O..... 39
Golden Reed gold claim..... 39
Gossan, gold in..... 19
Göthite..... 3
Goudreau..... 1
Gold near..... 3
Pyrite mg..... 4
Goudreau iron range..... 3
Goudreau lake, gold mining near..... 15
Goudreau-Lochalsh area.
Gold mining properties..... 9-17
Goudreau-Lochalsh road..... 1, 29
Quartz veins on..... 11
Grace gold m.
See also Darwin g. m.; Grace vein.
Production..... 81
Staked..... 3, 39
"Grace porphyrite"..... 81
Grace vein, Darwin gold m.
Arsenopyrite.....49, 59, 82
Rocks, analyses..... 65
photomicrographs...58-62, 64, 69, 72, 74
quartz, photos.....55, 56
Vertical section, photo..... 53
Granite.
See also Soda-granite.
Michipicoten-Missinaibi area..5, 6, *facing* 8
Lochalsh-Missinaibi area.....33, 34
Keweenawan..... 37
Michipicoten area..... 45
Granite gneiss..... 6
Granite porphyry.
See also Monzonite.
Gold veins in..... 10
Lochalsh-Missinaibi area.....34, 38

PAGE
Granodiorite ..... *facing* 8
Lochalsh-Missinaibi area 32-34
Michipicoten area 45
analysis 43
gold veins in 83
Granodiorite porphyry 45, 76
Minto g. m., analysis 67
Gravel. *See* Pleistocene.
Great Northern Mining Co. 3
Greenstone 6, 8, 13
Gold associated with 11, 15, 18, 19
Greywacké ..... *facing* 8, 40, 41
Gros Cap 1
Rocks, early notes on 5
Gros Cap greenstones.
Age; stratigraphy ..... 6, *facing* 8
Grout, F. F. 26
Gutelius 1

H

Haileyburian ..... *facing* 8
Lochalsh-Missinaibi area 32, 33
Michipicoten area 44
Halliday, John 30
Harcourt, G. A. 28
Harcourt lake, rocks 34
Hasselbring, A. 23
Hawk Junction.
Gold mining near 17-19
Hawk lake 1
Hawk river 1
Hawkins, J. J. 4
Helen iron formation.
Age; stratigraphy ..... 6, *facing* 8, 32
Helen iron m. 3
Helen mountain.
View from summit, photo 35
Herrick, C. L. 20
Herrick, T. W. 20
Historical notes 1-4, 39
See also Explorations, geological, early.
Hocking, W. 80
Holdsworth, John 17
Holdsworth gold claims 37
Mineralization 17, 18
Hopkins, P. E. 9, 15, 24, 81
Hornblende gold claim 39, 64
Hornblende schist 38
Hudson bay.
Canoe route from L. Superior 1
Hudson's Bay Co. 1, 29
Humphries, Mr. 4
Huronian ..... 5, 6, *facing* 8
Hydrothermal alteration.
Michipicoten area 45, 47, 63-67

I

Inclusions.
Country rock in lamprophyre 48
Darwin g. m., photo 47
in Jubilee veins, photo 54
Index map.
Mines, Michipicoten area 75
Iron, prospecting for 1, 3
Iron formation.
Michipicoten-Missinaibi area ..... 6, *facing* 8
Lochalsh-Missinaibi area 32
photo 35
Michipicoten area 42, 43

J

PAGE
Jamieson, J. W. 28
J. D. 1, 2, 3, 4 gold claims 3
See also Mariposa g. m.
Johnston (prospector) 1
Jones, H. L. 20
Jubilee gold m. 3, 39
Fault 50
Map showing location 75
Mineralization 55, 56, 77
ankerite, analysis 56
photomicrograph 68
veins, width 51

K

Keewatin series.
See also Lava flows; Schists.
Michipicoten-Missinaibi area ..... 5, 7, *facing* 8
Lochalsh-Missinaibi area 31
Michipicoten area 41-43, 76
structure 49
thickness 7
Kersantite 48
Keweenaw point 36
Keweenawan series.
See also Diabase.
Michipicoten-Missinaibi area ..... 5, *facing* 8
Lochalsh-Missinaibi area 31
petrology and structure 34-37
quartz veins in 33, 37
Michipicoten area 41, 45-48
see also Feldspar-carbonate veins.
Killarney granite 6
Kitchigami gold claim 39
See also Centennial g. m.
Knox, J., Jr. 40, 78
Kolbeck, Dr. F. 40
Kozak gold m.
Geology; workings 9, 10
Headframe, photo 8
Sketch map 9
Kozak lake 9
Kremzar, Patice 4, 15
Kremzar gold claims, sketch map 16
See also Algoma Exploration Co.

L

Lacustrine deposits 31, 48
Lake Algonquin 48
Lake Superior.
Canoe route to Hudson bay 1
Lamble, B. C. 4, 48
Lamprophyre ..... *facing* 8
Lochalsh-Missinaibi area 34, 37
Michipicoten area 50, 68
age 46
inclusions in, photo 47
relation to gold deposits 73
Lang, J. 4
Lang tp. 27, 29
Laurentian series.
Michipicoten-Missinaibi area ..... 5, *facing* 8
Michipicoten area 41, 43
diorite, analysis 43
Lava flows.
See also Greenstone; Pillow lava.
Michipicoten-Missinaibi area ..... 5, 6, *facing* 8
Lochalsh-Missinaibi area 33
Michipicoten area 41
quartz veins in 15

PAGE
Lawson, A. C. 5, 20
L. B. United Mines, Ltd. 83
Leeson tp. 27, 28
Rocks 32
Leith, C. K. 22, 23
Lindeman, E. 24
Loch Katrine.
Forest 29
Rocks, Algoman 34
Lochalsh area.
See Goudreau-Localsh area; Localsh-Missinaibi area.
Lochalsh lake 28
Lochalsh-Missinaibi area.
Geology, report by E. M. Burwash 27-38
Map, geological, coloured (No. 44c) *in pocket*
Lochalsh station.
Gold discovery near 38
Lode deposits 37
Photo 36
Logan, Sir William 5, 20
Long portage, rocks 5
Longbottom gold claims 3, 78
See also Parkhill g. m.
Lumbering.
Lochalsh-Missinaibi area 28, 29

M

McCarthy-Webb gold claims 4
See also Algoma Summit Gold Mines.
McCarthy-Webb-Goudreau Mines, Ltd. 10
MacDonald, S. 4
Macfarlane, T. 1, 5, 20
McKechnie, D. C. 4
McKee creek 29
Mackenzie, G. C. 22
McKewen lake 29
Mackey point, Wawa l.
Gold discovery 2, 3, 39
Mackey Point gold m. 3, 64
Geology; workings 74-76
Map showing location 75
Mackey Point Gold Mines, Ltd. 74, 75
McLeod, C. W. 25
McVeigh creek, gold near 3
Magnetite 12, 38, 42, 47
Magpie iron m. 3
Magpie river 1, 39
Manitowik lake.
Canoe routes; roads 1, 29
Fault 35
Manxman gold claim 39
Map, geological, coloured.
Lochalsh-Missinaibi area (No. 44c) *in pocket*
notes on 27, 28
Map, index, showing mines, Michipicoten area 75
Map, key, Lochalsh-Missinaibi area 27
Maps, sketch.
Cline Lake g. m. *facing* 14
Edwards g. m. 13
Kozak g. m. 9
Kremzar g. claims 16
Marcasite 47, 60, 62
Photomicrograph 61
Mariposa gold claims 3, 39
See also Parkhill g. m.
Mariposa hill 79
Mariposite schist 17
Markes, Wm. E. 4
Markes gold claims.
Geology; workings 13
Matchinameigus lake 31
Matheson, A. F. 26, 40
Means, A. H. 23, 66
Meath tp. 28
Access to 29
Melkman, A. C. 4
Michael-Boyle gold claims 19
Michael Syndicate.
Lode deposit, photo 36
Michipicoten area.
See also Michipicoten-Missinaibi area.
Gold production 39
Ore deposits, report by M. H. Frohberg 39-83
Michipicoten bay, rocks 5, 7
Michipicoten Gold Mines, Ltd. 80
Michipicoten Harbour 40-42, 50
Michipicoten island 36
Michipicoten mining division 2, 3
Michipicoten-Missinaibi area.
See also Lochalsh-Missinaibi area; Michipicoten area.
Bibliography 20-26
Report by E. M. Burwash 1-19
Michipicoten Mission 39
Michipicoten river 1, 29, 39
Rocks 5, 42
Mickelson vein 76, 77
Miller, W. G. 22
Mining claims.
See also A.C., B.Y., D.J., J.D., S.S.M., Y. gold claims.
33-36 3
68 3
75 3
98 3
2,271 14
2,927-2,930 18
3,041-3,046 18
3,904 17
3,909 15
3,951 17
Minto gold m. 3, 39, 62
Closed down 77
Map showing location 75
Porphyrite, analysis 67
Staked 3
Veins, character 51
photomicrograph 63
Minto Gold Mines, Ltd. 77
See also Jubilee, Minto g. mines.
Missanabie 1, 29
Missinaibi area.
See Lochalsh-Missinaibi area; Michipicoten-Missinaibi area.
Missinaibi lake 28
Portage to Crooked l., photo 2
Missinaibi river 1, 29
Monadnocks 28
Monzonite *facing* 8, 10
Moore, E. S. 1, 7, 10, 25, 30, 40
Moorhouse, W. W. 28
Moorhouse lake, granite 34
Mountain lake 43
Murray, A. 20
Murray-Algoma Mining Co., Ltd.
Property; geology 18, 19

N

PAGE

Natural resources.
Lochalsh-Missinaibi area..... 28-30
Nepheline syenite.....*facing* 8
Nichols Chemical Co..... 4
Niven base line..... 28
Nomenclature, geological.
Variations in..... 5
Norwalk gold m..... 3
Map showing location..... 75
Nyman vein, Darwin g. m.
Photo..... 50
Photomicrograph..... 59
Rocks, analysis..... 65

O

Oba lake..... 29
Oba river..... 29
O'Brien Gold Mines, Ltd..... 14
O'Brien, M. J., Ltd..... 15
Octahedrite..... 69
Ogasiwi lake..... 29
Ohio Gold Syndicate..... 18
Older diabase.....*facing* 8, 31, 35, 36, 41, 44
Analyses..... 65
Olivine diabase.
Michipicoten area.....*facing* 8, 45, 46

P

Parkhill..... 39
Parkhill gold m.....3, 39, 47
Geology and workings.....78, 79
structure.....49, 50, 79
veins, character..... 51
photo..... 52
photomicrographs.....61, 66
Map showing location..... 75
Photo..... 79
Production..... 78
Parkhill Gold Mines, Ltd..... 78
Parsons, A. L..... 23
Pegmatite..... 32
Pematitic quartz veins.....*facing* 8, 50, 51
Peneplain, ancient..... 39
Peridotite.....*facing* 8, 38
Peters gold claims.
See Ohio Gold Syndicate.
Photomicrographs of vein material.
Algoma Summit g. m..... 10
Grace vein, Darwin
g. m.....58-62, 64, 69, 72, 74
Jubilee vein..... 68
Minto g. m..... 63
Nyman vein, Darwin g. m..... 59
Parkhill g. m.....61, 66
Pic road.
Gold claims on..... 14-17
Pic station..... 1
Pickerel..... 30
Pickle lake..... 29
Picrite.....46, 47
Pike..... 30
Pillow lava.
Michipicoten-Missinaibi area..*facing* 8, 15
Lochalsh-Missinaibi area..... 32
Michipicoten area.....41, 42
Pine..... 28
Pleistocene.....*facing* 8
Lochalsh-Missinaibi area.....31, 37
Michipicoten area.....41, 48

PAGE

Poplar..... 28
Porphyrite. *See* Diorite porphyry.
Porphyry.
See also Diorite, Feldspar, Granodiorite, Quartz porphyries.
Keewatin..... 42
Post-Doréan formations.
Age; stratigraphy.....7, *facing* 8, 8
Petrology.....32, 33
Power and Mines Corp'n, Ltd..... 81
Power and Mines Syndicate..... 81
Pre-Cambrian.
See Formations, tables of.
Pre-Doréan formations.
Age; stratigraphy.....7, *facing* 8, 40
Proctor, Mr..... 4
Pyrite.
Michipicoten-Missinaibi area....10, 11, 17
gold in..... 12
Lochalsh-Missinaibi area.....33, 38
Michipicoten area.....61, 62
mining of..... 4
Pyroclastics.
See also Agglomerate; Tuff.
Michipicoten-Missinaibi area...7, *facing* 8
Lochalsh-Missinaibi area..... 33
Pyrrhotite.
Michipicoten-Missinaibi area. 11, 12, 14, 17
Lochalsh-Missinaibi area..... 38
Michipicoten area.....60, 62
decomposition, photomicrograph 60

Q

Quartz diabase.....*facing* 8, 12, 46
Quartz diorite.....*facing* 8, 34, 45
See also Quartz diorite porphyry.
Quartz diorite porphyry..... 45
Gold veins in..... 18
Quartz porphyry.....*facing* 8, 10, 12, 45
Gold veins in.....13, 17, 18, 80
Quartz-sericite schist.
Photomicrograph..... 10
Quartz veins, barren.
Lochalsh-Missinaibi area..... 33
Michipicoten area.....50-55, 71, 73
Quartz veins, mineralized.
See also Gold, mg. properties.
Michipicoten-Missinaibi area...5, *facing* 8
Algoma Summit g. m., photo..... 11
faulted, photo..... 15
Lochalsh-Missinaibi area.....31-33, 37
Michipicoten area.....49, 51, 54
genetic considerations..... 71-74
photos.....50, 52-57
Quartz veins, pegmatitic.....*facing* 8, 50, 51
Quartzite.....*facing* 8
Quirke, T. T.....3, 6, *facing* 8, 8, 25, 40

R

Rabbit island. *See* Waboose is.
Racicot, David..... 4
Recent deposits.....*facing* 8, 37, 41
Reed-Booth gold claims.
Mineralization; workings..... 18
Rennie tp..... 28
Access to..... 29
Rocks..... 32-34
Rhodochrosite..... 55
Rhyolite.....*facing* 8, 33, 42

PAGE
Rickaby, H. C. ... 40
Riebeckite ... 47
Photomicrograph ... 74
Roads ... 1, 14, 29
Robinson, A. H. A. ... 24
Rogers, W. R. ... 23-26
"Rolls." *See* Drag folds.
"Root lens." *See* Mackey Pt. g. m.
Rothwell, T. E. ... 65
Roussac, J. A. S. ... 12

S

Sand plains ... 48
S. B. Smith gold m. ... 3
Geology and workings ... 79, 80
Map showing location ... 75
Production ... 80
Schists.
See also Biotite, Carbonate, Chlorite, sericite schists.
Michipicoten-Missinaibi area . 5, 7, *facing* 8
Algoma Summit g. m., photo ... 11
gold veins in ... 12, 28
Schumacher, Dr. F. ... 40
Seelye, R. W. ... 23
Sericite-carbonate schist ... 33
Sericite schist ... 14
See also Chlorite-sericite schist; Quartz sericite schist; Sericite-carbonate schist.
Shear zones, mineralized.
See also Gold, mg. properties.
Lochalsh-Missinaibi area ... 33, 34
Michipicoten area ... 49, 52, 53
Parkhill g. m., photo ... 52
Shikwamkwa river ... 29
Shumka lake ... 29
Siderite ... 3, 7, *facing* 8
Silver ... 10
Darwin g. m., production ... 78
Parkhill g. m., production ... 81
Sinclair, D. G. ... 25, 26
Slate ... *facing* 8
See also Eleanor slates.
Smith, S. B. ... 79
See also S. B. Smith g. m.
Smith lake, gold mg on ... 19
Smith vein, Stanley g. m. ... 76
Soda-granite ... 76
Soil ... 30, 48
Soocana Mining Co., Ltd.
Property, geology and workings ... 17, 18
Sphalerite.
Michipicoten-Missinaibi area ... 10, 18
Michipicoten area ... 62, 63
gold assoc. with ... 81
Spruce ... 28
S.S.M. gold claims:
301 ... 79
360 ... 78
1,090 ... 78
1,109 ... 78, 80
2,591 ... 19
3,109, 3,124, 3,129, 3,301 ... 78
3,303, 3,304 ... 12
3,470, 3,471, 3,493 ... 78
3,553-3,559, 3,804, 3,805, 3,846, 3,862, 4,013 ... 12
6,969 ... 80
7,262, 7,263 ... 13
7,389 ... 78
PAGE
S.S.M. gold claims—*Continued*
7,445 ... 76
7,647, 7,648, 7,680, 7,681 ... 13
7,923, 7,994, 7,995 ... 14
22,095-22,099 ... 38
Stanley Gold Mines, Ltd. ... 3
Property, geology and workings ... 76, 77
map showing location ... 75
Stony portage, rocks ... 5
Stover tp ... 29
Rocks ... 32, 33
Striae ... 48
Stuart, D. A. ... 28, 29
Sulphides.
See also Chalcopyrite; Galena; Pyrite; Pyrrhotite; Sphalerite.
Michipicoten area, origin ... 45, 47, 54, 64
Sulphur from pyrite ... 4
Surveys, early.
See also Explorations, geological.
Lochalsh-Missinaibi area ... 28
Sutherland, T. F. ... 23-25
Syenite ... 5, *facing* 8, 34
Syncline ... 41

T

Taylor, F. B. ... 21
Teddy, William ... 2
Temperatures, Lochalsh-Missinaibi area 30
Tent vein ... 15, 17
Terraces, Michipicoten area ... 48
Thomson, Ellis ... 1, 24, 25, 27, 30
Tight, W. G. ... 20
Till. *See* Pleistocene.
Timber, Lochalsh-Missinaibi area ... 28
Timiskaming series.
See also Doré series.
Correlated with Doré . . 7, *facing* 8, 41, 43, 44
Topography.
Lochalsh-Missinaibi area ... 28
Michipicoten area ... 39
Tourmaline.
Michipicoten-Missinaibi area 11, 14, 17, 18
Algoma Summit g. m., photo ... 11
Michipicoten area ... 56, 64, 71, 77
age ... 67, 71
gold assoc. with ... 57
photo ... 57
photomicrograph ... 68
Township 27, range 25.
Gold mg ... 19
Township 28, range 24.
Gold mg. properties ... 17-19
Township 28, range 26 ... 9
Township 29, range 22.
Gold mg ... 83
Township 29, range 23.
Gold mg. properties ... 3, 74-83
Township 29, range 26 ... 3
Townships 41, 42.
Access to ... 29
Township 44, gold claims ... 38
Township 46 ... 29
Township 48, gold mg. claims ... 12-14
Township 49.
Gold mg. *See* Algoma Exploration Co.; Algoma Summit Gold Mines.
Transportation ... 1
See also Canoe routes; Roads.
Trout, lake ... 30

PAGE
Tuffs....6, *facing* 8, 32, 42
Darwin g. m., analysis.... 65

U

United Algoma Mines, Ltd.... 81

V

Van Hise, C. R.... 23
Van Sickle, L. A.... 79
Volcanics. *See* Keewatin series.
von Philipsborn, Dr. H.... 40

W

Wabatongushi lake.... 28
Access to.... 29
Rocks.... 5, 34
Water power.... 29
Waboose island, Dog l.... 5
Water power.
Lochalsh-Missinaibi area.... 29
Wawa batholith....50, 51
Mineralizing solutions from.... 74
Wa Wa Gold Fields, Ltd.
Property, geology and workings.... 3, 76
map showing location.... 75

PAGE
Wawa lake.
See also Mackey pt.
Carbonate veins near.... 43
Gold claims near....3, 74-76
Roads on.... 1
Rocks.... 46
Wawa tuffs.
Age; stratigraphy....6, *facing* 8, 32
Weeks, L. J....25, 40
White, G. L., gold discovery.... 38
Whitehead, I. L.... 4
Williams, H. F. I.... 4
Willmott, A. B....1, 5-7, 21-23, 30
Wilson, A. W. G.... 23

Y

Y. 103 gold claim.... 3
See also Mackey Point g. m.
Y. 104, gold claim.... 75
See also Mackey Point g. m.
Young, A. C....25, 26
Younger
diabase..*facing* 8, 31, 35-37, 41, 44-46, 48

Z

Zinc blende. *See* Sphalerite.

COMPARISON OF GEOLOGICAL TABLES OF THE MICHIPICOTEN-MISSINAIBI AREA

Insert to face page 8.

Coleman and Willmott, 1902	Collins and Quirke, 1926	Gledhill, 1927	Moore, 1932	Burwash, 1937	Frohberg, 1937
PLEISTOCENE: Drift.	PLEISTOCENE: Drift.	QUATERNARY: Sand, gravel, clay, and peat.	RECENT: Alluvium. PLEISTOCENE: Glacial drift and lake deposits.	RECENT: Alluvium and peat. PLEISTOCENE: Lake deposits. Drift.	RECENT: Alluvial deposits. PLEISTOCENE: Glacial drift and lake deposits.
				Unconformity	
	LATE PRE-CAMBRIAN: Younger diabase. Older quartz diabase.	KEWEENAWAN: Quartz and normal diabase dikes. Masses of peridotite.	KEWEENAWAN: Olivine diabase and peridotite. Diabase and quartz diabase.	KEWEENAWAN: Olivine diabase and peridotite. Granite and quartz veins. Quartz diabase.	KEWEENAWAN: Lamprophyre dikes. Red feldspar carbonate veins. Younger diabase dikes.
		Intrusive contact		*Intrusive contact*	
LAURENTIAN: Granite. Gneiss.	EARLY PRE-CAMBRIAN: Granite. Gneiss.	ALGOMAN-LIKE INTRUSIVES: Granodiorite, quartz diorite, quartz porphyry, syenite, cancrinite-nepheline syenite.	ALGOMAN: Lamprophyre and aplite dikes. Gold-bearing veins. Granite, granodiorite, porphyrite, monzonite, alaskite, syenite (including nepheline and cancrinite varieties), quartz porphyry, feldspar porphyry.	ALGOMAN: Lamprophyre(?) and aplite dikes. Gold-bearing veins. Younger granite and other plutonic and hypabyssal rocks in like intrusive relations, as described by the various authors.	ALGOMAN: Pegmatitic quartz veins. Gold-bearing quartz veins. Granite, granodiorite, diorite and related porphyries, aplite.
		Intrusive contact		*Intrusive contact*	
UPPER HURONIAN: Acid and basic eruptives. Doré conglomerate.	EARLY PRE-CAMBRIAN: Post-Doréan schists: Local sediments (Eleanor slates). Interstratified iron formation (Helen iron formation). Volcanics. Doré series.	TIMISKAMING-LIKE SEDIMENTS (DORÉ): Slate, arkose, greywacké, conglomerate.	TIMISKAMING(?): Doré series: conglomerate, arkose, greywacké, tuff, and basic lavas.	POST-DORÉ (HAILEYBURIAN?): Gros Cap greenstone. Iron formation. Wawa acid lavas and tuffs. Sediments at various horizons. TIMISKAMING(?): Doré sediments and pyroclastics.	HAILEYBURIAN: Older diabase dikes. TIMISKAMING: Doré series: conglomerates, greywacké, arkose, tuffs.
		Great unconformity		*Unconformity*	
LOWER HURONIAN: Eleanor slates. Helen iron formation. Wawa tuffs. Gros Cap greenstones.	[Gneiss?]	LAURENTIAN-LIKE GNEISS: Boulders in the Timiskaming.	LAURENTIAN(?): Granite and gneiss.	LAURENTIAN(?): Granite and gneiss.	LAURENTIAN: Granite, diorite, various porphyries.
		Intrusive contact		*Intrusive contact*	
	Pre-Doréan volcanics, presumably including iron formation.	KEEWATIN (Post-Doréan of Collins and Quirke): Altered and schistose basalt, rhyolite, dacite, slates, carbonate beds, quartzite, and banded iron formation.	KEEWATIN (Post-Doréan of Collins and Quirke): Basic and acid volcanics (basalt, andesite, rhyolite, quartz porphyry, feldspar porphyry), Banded iron formation, siderite, dolomite, and limestone.	KEEWATIN: Pre-Doré schists, partly meta-sedimentary, mainly meta-igneous (probably including also the post-Doréan of Collins).	KEEWATIN: Basic and acid volcanics (flows, tuffs, breccias, agglomerates) with local sedimentary material and iron formation.

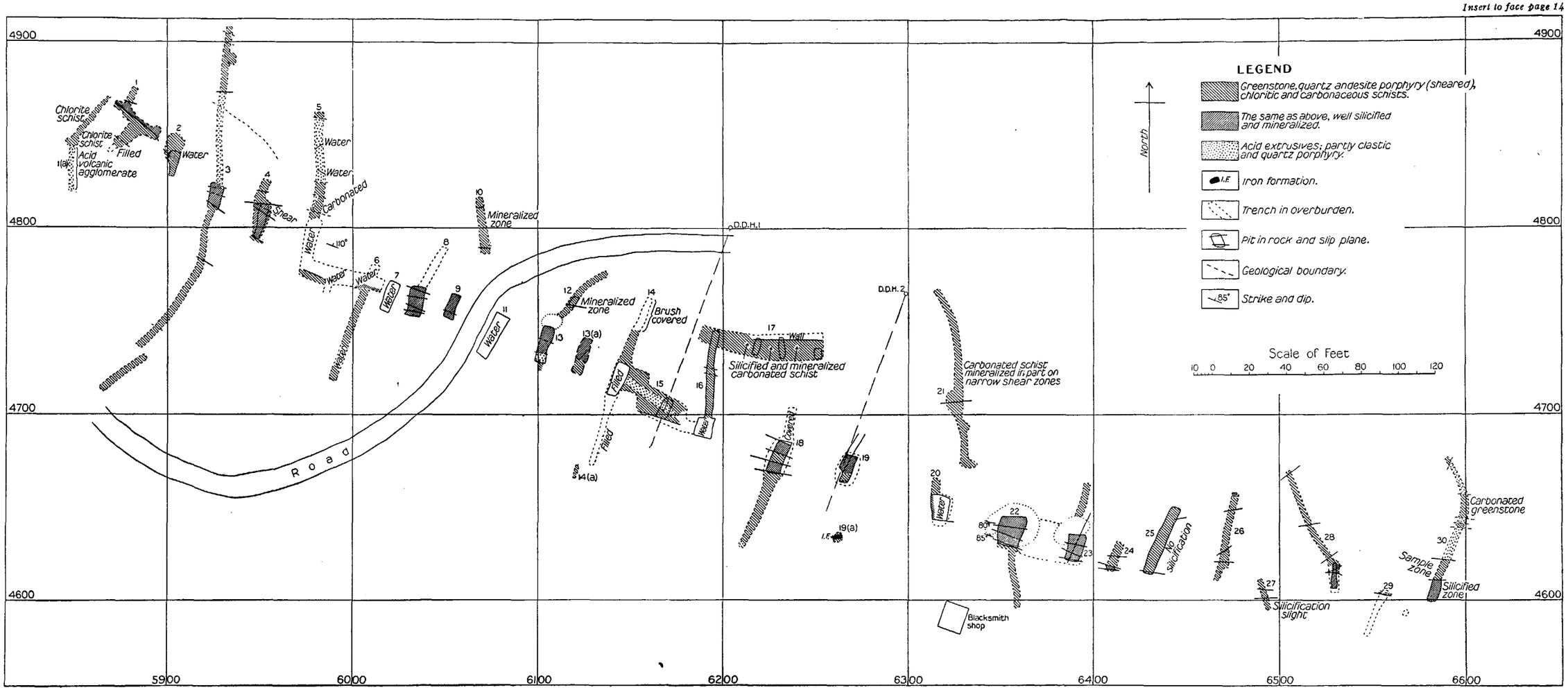
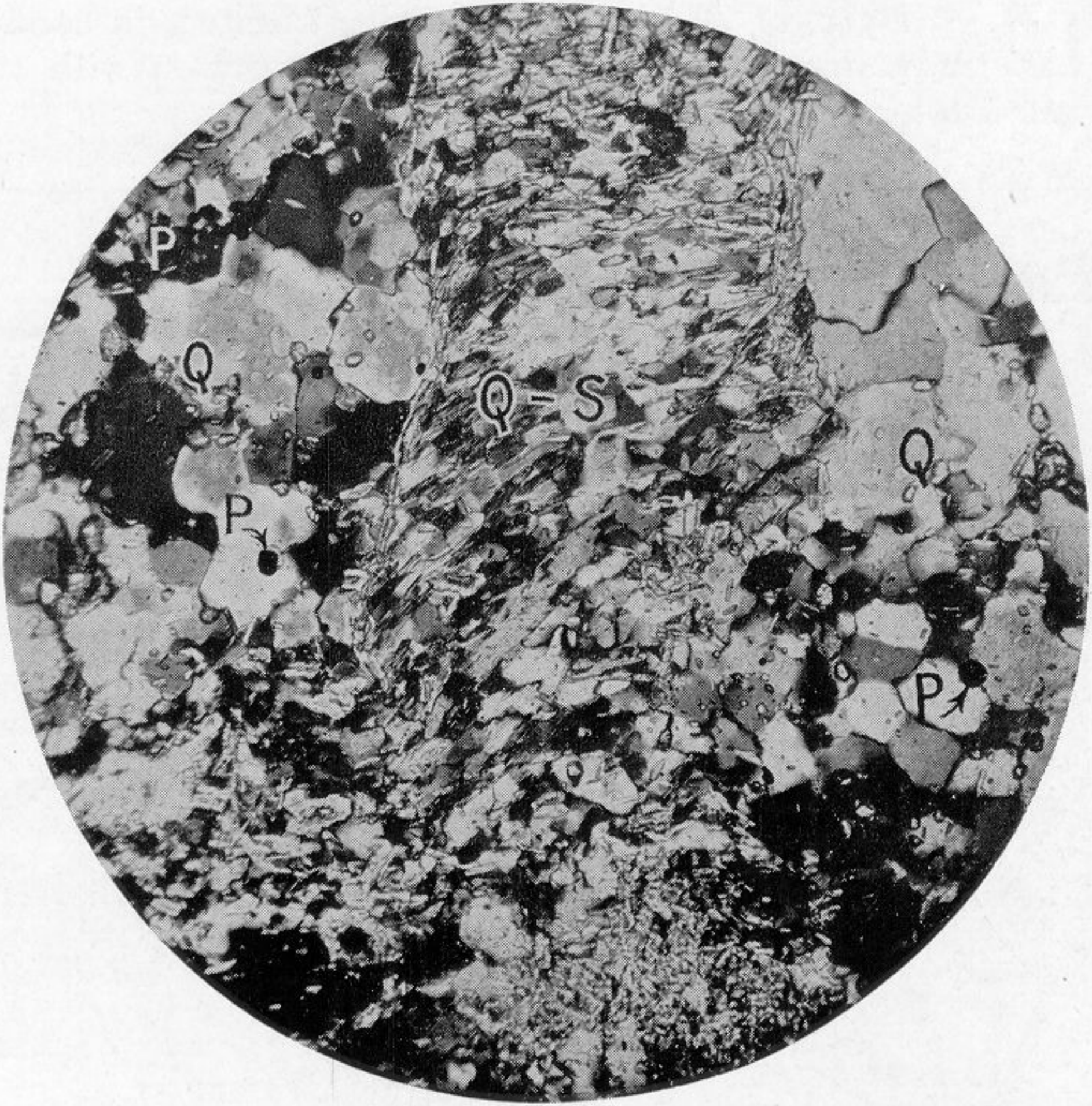
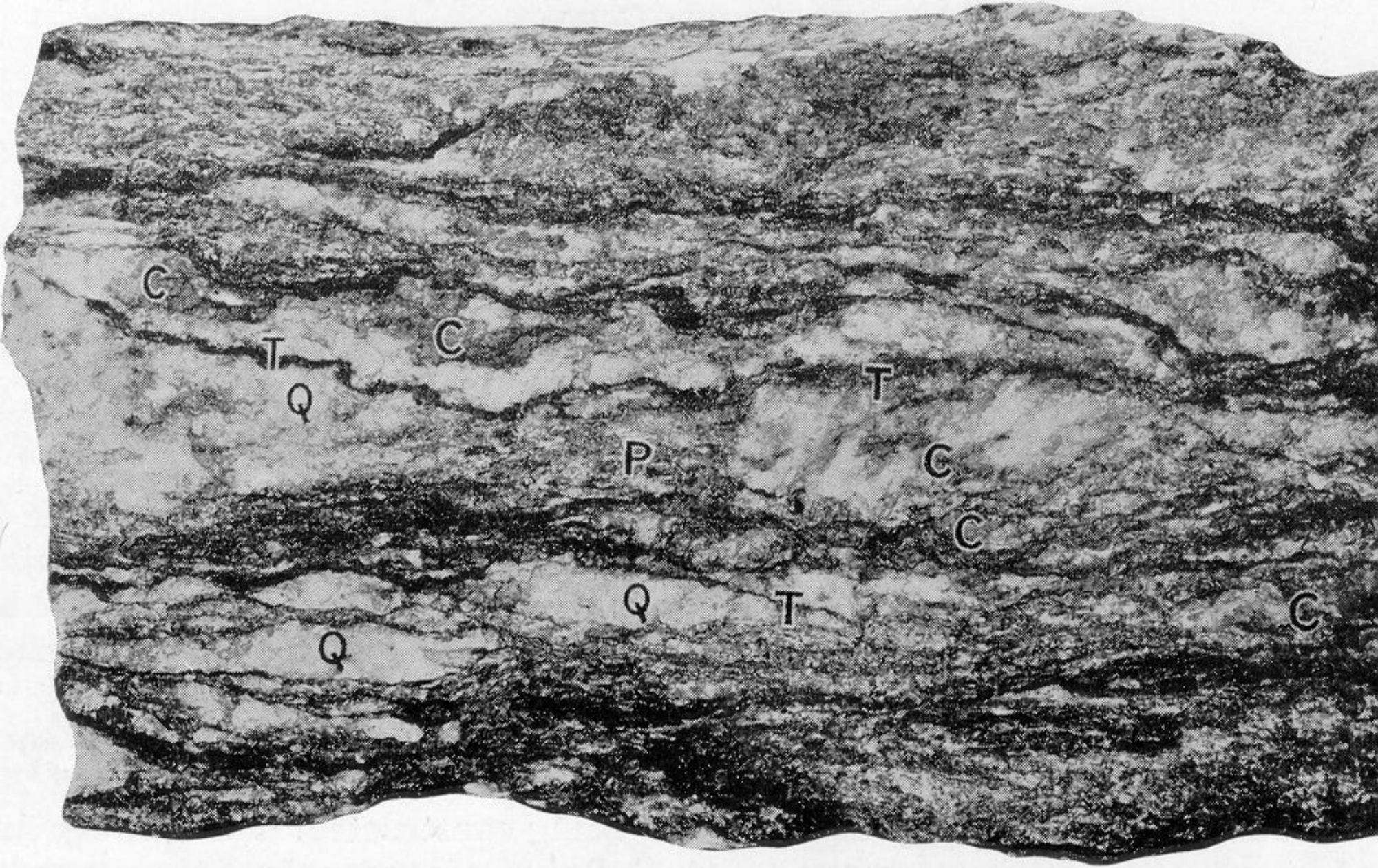


FIG. 4—GEOLOGICAL SKETCH MAP OF THE CLINE LAKE PROPERTY SHOWING TRENCHING COMPLETED IN 1935.


P
Q
Q=S
Q
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