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Box #2

LETTER OF TRANSMISSION

To the Honourable Albert Matthews,
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-eighth Annual Report, 1939, of the Department over which I have the honour to preside.

Respectfully submitted,

Paul Leduc,
Minister of Mines.

Department of Mines,
Toronto, 1939.

INTRODUCTORY LETTER

To the Honourable Paul Leduc,
Minister of Mines.

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

Part I

Statistical Review of the Mineral Industry of Ontario for 1938, by Maurice Tremblay.
List of Mines, Quarries, and Works, 1938.
Mines of Ontario in 1938, by D. G. Sinclair, A. E. Cave, W. O. Tower, J. B. Taylor, D. P. Douglass, A. S. Bayne, D. F. Cooper, E. B. Weir, A. R. Webster.
Mining Accidents in 1938, by D. G. Sinclair, A. E. Cave, W. O. Tower, J. B. Taylor, D. P. Douglass, A. S. Bayne, D. F. Cooper, E. B. Weir, A. R. Webster.
Classes for Prospectors, 1938–39, by W. D. Harding.

Part II

Geology and Ore Deposits of the Atikokan Area, with map No. 48a, by E. S. Moore.
Iron Deposits of the Steeprock Lake Area, with map No. 48b, by M. W. Bartley.
Geophysical Work at Steeprock Lake, 1938–39, by A. Brant.

Part III

Geology of Gorham Township and Vicinity, with map No. 48c, by R. D. Macdonald.

Part IV

Geology of the Eagle Lake Area, with map No. 48d, by W. W. Moorhouse.

Part V

Natural Gas in 1938, by R. B. Harkness.
Petroleum in 1938, by R. B. Harkness.

Part VI

Geology of the Keezhik-Miminiska Lakes Area, with map No. 48e, by V. K. Prest.

Part VII

Geology of the Eastern Extension of the Crow River Area, with map No. 48f, by E. L. Evans.

Part VIII

Geology of the Uchi-Slate Lakes Area, with map No. 48g, by J. D. Bateman.

Part IX

Geology of the Windigo–North Caribou Lakes area, with maps Nos. 48h and 48j, by J. Satterly.

Part X

Geology of the Ashigami Lake Area, with map No. 48m, by H. W. Fairburn.
Notes on Several Properties in the District of Sudbury, by T. C. Phemister.

Part XI

Geology of the Flack Lake Area, with map No. 48k, by W. D. Harding.

Part XII

Geology of the Bigwater Lake Area, with map No. 48n, by L. G. Berry.

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,

H. C. Rickaby,
Deputy Minister of Mines.

Department of Mines,
Toronto, 1939.

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART I, 1939

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Statistical Review of the Mineral Industry of Ontario for 1938

By Maurice Tremblay

GENERAL SUMMARY

Mineral Production

The value of Ontario's mineral production in 1938 was $219,950,476, compared to $230,173,459 in 1937. The 4.3 per cent. decrease is attributable to ower prices for copper and metals of the platinum group and also to a drop in the value of non-metallics and structural materials. The value of minerals by groups was: metals, $197,905,460; non-metallics, $9,949,317; structural materials, $10,012,203; clay products, $2,083,496.

The decrease in the value of metals, amounting to only 3.4 per cent., was indicated more particularly in copper, the price of which dropped from 13.02 cents in 1937 to 9.697 cents per pound in 1938. Platinum metals, also because of lower prices, were down in value compared to the previous year. In both these items, however, the quantity production in 1938 was the greatest ever recorded and well above the peak reached in 1937. Nickel, owing to a lowered world consumption, was down slightly in quantity and value.

The gold industry of Ontario established a new record in 1938 with a gain of over 12 per cent. in value of production. The value of the gold output was $101,945,441, compared to $90,508,689 in 1937.

Non-metallics were down 1.6 per cent. in value, indicating a slight recession in the industries dependent on these minerals in 1938. Structural materials registered the most severe drop (24.3 per cent.) and reflected conditions in the building and construction industries. Building of all descriptions in 1938 did not repeat the improvement noted in 1937. Ordinarily an immense quantity of building materials is consumed in the construction of pavements on highways. This section of the industry was not so active as in the previous year, all of which is borne out by a comparison of the figures of production for these items in 1937 and 1938. Clay products was the only group which showed any improvement, the figures for 1938 being 0.24 per cent. higher than those for 1937.

An event of outstanding importance in the mining news in 1938 was the discovery in March of that year of an ore body of hematite underlying Steeprock lake, near Atikokan, 135 miles west of Port Arthur. The ore is of Bessemer grade and is the first of its kind ever found in Ontario. The deposit, which may prove of extreme importance to the industrial life of the province and to Canada generally was outlined by diamond-drilling on behalf of the Steerola Exploration Company. Early drilling indicated a mass of ore at least 700 feet long and 150 feet wide. This grade of hematite ore requires no beneficiation prior to smelting.

The revolutionary war in Spain and strained conditions in Europe affected the market for many non-metallic minerals which occur in Ontario but which had been more or less undeveloped because of competition from overseas. Fluorspar and barite are two examples. The examination of known deposits and the search for newer sources of the minerals in demand were carried on in 1938.

SUMMARY OF MINERAL STATISTICS, 1938

Product	Quantity[1]	Value	Employees	Wages
METALLIC				
Gold ..... oz.	2,896,477	$59,875,211	16,491	$27,970,573
Exchange equalization	.....	42,070,230	.....	.....
Silver ..... oz.	4,316,558	1,865,798	306	328,477
Copper in matte exported[2] ..... lbs.	13,828,487	967,994		
Copper, metallic and in concentrates, exported ..... lbs.	295,201,619	29,437,506		
Nickel in matte,[2] in speiss, and in ore exported; metallic nickel; and nickel content of oxides and salts ..... lbs.	210,572,738	53,914,494	[3]10,797	[3]18,319,011
Platinum metals ..... oz.	292,203	8,873,621		
Selenium ..... lbs.	54,577	94,691		
Bismuth ..... lbs.	9,516	9,754		
Cobalt in metal, oxides, salts, ores, and residues ..... lbs.	459,226	790,913	[4]185	[4]182,464
Lead in concentrates exported ..... lbs.	22,363	748		
Molybdenite, concentrates ..... lbs.	13,000	4,500	6	1,566
Total	.....	$197,905,460	27,785	$46,802,091
NON-METALLIC				
Arsenic, white ..... lbs.	2,175,646	$56,538	([5])	([5])
Asbestos ..... tons	.....	.....	8	$7,464
Feldspar, crude and ground ..... tons	8,106	65,964	40	17,682
Fluorspar ..... tons	217	3,906	3	1,800
Graphite, crude and refined ..... tons	.....	41,590	33	17,137
Gypsum ..... tons	57,503	242,470	194	208,269
Mica ..... lbs.	504,739	6,445	10	1,107
Mineral waters ..... Imp. gals.	28,416	2,586	.....	.....
Natural gas ..... M cu. ft.	10,952,806	6,460,764	[6]759	[6]750,892
Nepheline syenite	.....	142,737	57	45,587
Peat ..... tons	620	3,500	.....	.....
Petroleum, crude ..... bbls.	172,642	359,268	248	135,707
Quartzite and quartz ..... tons	1,173,259	597,037	51	44,812
Silica brick ..... M	595	50,592	24	18,792
Salt ..... tons	388,130	1,637,140	286	384,784
Sulphur[7] ..... tons	16,897	168,970	.....	.....
Talc ..... tons	10,853	109,810	29	26,688
Total	.....	$9,949,317	1,742	$1,660,721
STRUCTURAL MATERIALS				
Cement, Portland ..... bbls.	1,818,032	$2,555,214	343	$425,818
Hydrated lime ..... tons	27,849	297,032	212	200,837
Quicklime ..... tons	242,631	1,692,228		
Sand and gravel ..... tons	8,531,281	3,046,043	433	265,239
Sand-lime products[8]	.....	98,521	.....	.....
Stone: limestone, marble, trap, granite, sandstone, slate ..... tons	2,513,291	2,323,165	923	598,713
Total	.....	$10,012,203	1,911	$1,490,607
CLAY PRODUCTS				
Brick, face ..... No.	37,106,030	$704,669		
Brick, common ..... No.	27,632,190	379,647		
Brick, fancy and ornamental ..... No.	62,835	4,175		
Brick, sewer ..... No.	216,638	3,581		
Tile, drain ..... No.	10,747,653	252,444	1,033	$687,630
Tile, structural, roofing, and floor	.....	318,839		
Sewer pipe, copings, flue-linings, etc.	.....	342,549		
Pottery	.....	59,092		
Haydite and clay	.....	18,500		
Total	.....	$2,083,496	1,033	$687,630
TOTAL	.....	[9]$219,950,476	32,471	$50,641,049

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

[2]Copper in matte valued at 7 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]Employment figures for the natural gas industry in previous years included salaried employees. These figures are for wage-earners only.

[7]Tonnage given is sulphur content of sulphuric acid.

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

[9]Canadian funds.

COMPARATIVE VALUE OF MINERAL PRODUCTION, 1934–1938

Product	1934	1935	1936	1937	1938
METALLIC					
Gold (Canadian value)	$72,808,688	$78,068,169	$83,308,179	$90,508,689	$101,945,441
Silver	2,600,393	4,068,906	2,325,850	2,093,764	1,865,798
Platinum metals	6,187,992	5,407,392	7,802,997	9,931,556	8,873,621
Cobalt[1]	592,497	512,705	803,580	848,145	790,913
Nickel[2]	32,139,425	35,345,103	43,876,525	59,469,423	53,914,494
Copper, metallic and in matte	14,822,704	19,295,965	26,898,920	41,717,053	30,405,500
Selenium	91,286	144,697	188,151	201,884	94,691
Tellurium	25,599	28,550	18,049	11,506	.....
Lead, in ore	525	706	682	1,525	748
Bismuth	3,444	6,796	3,516	5,654	9,754
Chromite	480	9,576	5,070	39,964	.....
Molybdenite	.....	.....	.....	8,147	4,500
Zinc	.....	.....	.....	5,883	.....
Total	$129,273,033	$142,888,565	$165,231,519	$204,843,193	$197,905,460
NON-METALLIC					
Actinolite	$365	.....	.....	.....	.....
Arsenic, white	56,412	$75,326	$42,491	$41,032	$56,538
Asbestos	.....	.....	.....	250	.....
Diatomite	1,920	4,600	2,000	1,868	.....
Feldspar, crude and ground	61,665	75,003	70,840	72,610	65,964
Fluorspar	2,100	900	900	2,550	3,906
Graphite, crude and refined	64,998	78,500	88,812	125,343	41,590
Gypsum	141,389	164,807	182,783	233,895	242,470
Mica	9,059	7,144	11,433	9,137	6,445
Mineral waters	1,622	1,477	1,177	889	2,586
Natural gas	4,741,368	4,894,353	6,054,294	6,588,798	6,460,764
Nepheline syenite	.....	.....	37,426	121,481	142,737
Peat fuel	7,343	5,761	7,122	4,923	3,500
Petroleum, crude	299,874	346,156	348,767	356,358	359,268
Phosphate	.....	60	.....	.....	.....
Quartzite and quartz	134,572	111,074	216,037	633,073	597,037
Silica brick	14,730	22,976	26,715	59,980	50,592
Salt	1,734,196	1,698,500	1,557,078	1,539,599	1,637,140
Sulphur[3]	145,980	132,920	141,520	140,090	168,970
Talc and soapstone	135,978	138,161	143,701	123,301	109,810
Total	$7,553,571	$7,766,657	$8,933,036	$10,055,177	$9,949,317
STRUCTURAL MATERIALS					
Cement, Portland	$2,403,590	$1,752,148	$2,180,895	$3,657,067	$2,555,214
Lime, hydrated and quicklime	1,536,288	1,705,303	1,946,060	2,152,644	1,989,260
Sand and gravel	1,714,569	2,095,610	2,227,620	3,613,854	3,046,043
Sand-lime products[4]	146,009	138,555	178,868	153,910	98,521
Stone: limestone, granite, etc.	1,965,507	1,863,892	2,396,376	3,661,511	2,320,696
Slate	600	.....	2,080	2,258	2,469
Total	$7,766,563	$7,555,508	$8,931,899	$13,241,244	$10,012,203
CLAY PRODUCTS					
Brick, face	$479,850	$545,231	$532,018	$751,045	$704,669
Brick, common	227,276	275,835	367,642	356,727	379,647
Brick, fancy and ornamental	835	728	1,295	2,972	4,175
Brick, sewer	5,992	970	6,723	2,777	3,581
Tile, drain	137,699	125,593	131,041	233,258	252,444
Tile, structural, roofing, and floor	120,981	168,128	238,885	276,813	318,839
Sewer pipe, copings, flue-linings, etc.	226,005	196,647	235,238	338,895	342,549
Pottery	52,578	50,000	51,507	54,581	59,092
Haydite and clay	9,790	7,093	9,587	16,777	18,500
Total	$1,261,006	$1,370,225	$1,573,936	$2,033,845	$2,083,496
GRAND TOTAL	$145,854,173	$159,580,955	$184,670,390	$230,173,459	$219,950,476

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

The aggregate value of metals from the time production began in Ontario is shown in the following table. The values for other minerals are compiled from 1891 to the end of 1938.

It should be noted in this table and the one following that since 1914 the province has been credited with the value of the pig iron made from domestic ore only. Credit is also given from Ontario iron ores exported or shipped to other provinces.

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	280,196	44,076,660	8,511,786	13,139,757	6,269,140	72,277,539
1924	196,750	52,130,314	7,555,283	12,398,465	5,137,865	77,418,677
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	.....	62,631,255	7,638,605	14,160,552	5,853,035	90,283,447
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	36,703	83,356,365	8,492,263	16,571,626	5,221,214	113,678,171
1931	1,926,221	72,452,544	7,642,308	11,995,556	3,552,799	97,569,428
1932	6,134,157	63,997,017	7,361,897	7,295,917	1,690,505	86,479,493
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
1935	32,169,797	110,718,768	7,766,657	7,555,508	1,370,225	159,580,955
1936	34,139,92	131,091,593	8,933,036	8,931,899	1,573,936	184,670,390
1937	37,028,708	167,814,485	10,055,177	13,241,244	2,033,845	230,173,459
1938	42,070,230	155,835,230	9,949,317	10,012,203	2,083,496	219,950,476
Total	$202,857,930	$2,064,266,121		$716,795,459		$2,983,919,510

[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

From the time of the earliest records to the end of 1938 the total value of production by the Ontario metal mines amounted to $2,267,124,051. The following table indicates the importance of metal mining in the economy of the nation. The most useful metals to man are to be found in Ontario.

METAL PRODUCTION TO DECEMBER 31, 1938

Metal or product	To December 31, 1937	1938	To December 31 1938
Gold	$678,149,326	$59,875,211	$738,024,537
Exchange equalization	160,787,700	42,070,230	202,857,930
Nickel, including nickel oxides and salts	530,214,091	53,914,494	584,128,585
Silver	268,775,536	1,865,798	270,641,334
Copper[1]	247,960,514	30,405,500	278,366,014
Pig iron from domestic ore	84,775,556	.....	84,775,556
Cobalt[2]	28,686,196	790,913	29,477,109
Platinum metals	54,136,129	8,873,621	63,009,750
Iron ore[3]	9,463,516	.....	9,463,516
Lead	4,488,752	748	4,489,500
Zinc, in ore and concentrates	541,579	.....	541,579
Molybdenite	218,162	4,500	222,662
Bismuth	170,869	9,754	180,623
Selenium	711,871	94,691	806,562
Tellurium	83,704	.....	83,704
Chromite	55,090	.....	55,090
Total	$2,069,218,591	$197,905,460	$2,267,124,051

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

Dividends.—During 1937 dividends were paid by 23 gold, 2 nickel-copper, and 2 silver-cobalt mining companies. Those included are the actively engaged or producing companies only. Investment or holding companies, of which there are several, have been excluded.

DIVIDENDS PAID BY METAL MINES TO DECEMBER 31, 1938

Industry	To end of 1937	1938	To end of 1938
Gold	$270,790,493	$32,321,929	$303,112,422
Nickel-copper	233,336,787	32,091,513	265,428,300
Silver-cobalt	99,724,781	385,000	100,109,781
Total	$603,852,061	$64,798,442	$668,650,503

Metal Prices and Exchange

Quotations of metal prices and exchange for 1937 and 1938 are included here for reference. It will be noted that the price of silver dropped from the average 44.881 cents per ounce in 1937 to 43.477 cents in 1938 but that the average for gold rose from $34.99 in 1937 to $35.175 in 1938. The most severe setback was suffered by copper, which Ontario produces in large quantities. From an average of 13.018 cents per pound in 1937 the price dropped to a low of 8.5 cents in June of 1938 but gradually improved towards the end of the year. The average price in 1938 was 9.695 cents per pound.

Month	Average exchange rate U.S. dollars in Canadian funds	£ Sterling in Canadian funds	Silver, cents per oz.		Copper, cents per lb.		Gold in Canadian dollars per fine oz.
			New York market, U.S. funds	in Canadian funds	New York export, U.S. funds	London in Canadian funds	
1937							
January	1	4.909	44.913	44.926	12.112	12.337	35.01
February	1	4.895	44.75	44.759	13.828	13.99	35.01
March	.999	4.882	45.13	45.12	16.59	16.603	34.98
April	.998	4.91	45.46	45.397	14.692	14.601	34.95
May	.998	4.93	45.025	44.961	13.999	14.008	34.94
June	1.001	4.937	44.818	44.839	13.492	13.541	35.02
July	1.001	4.974	44.75	44.808	13.817	13.956	35.02
August	1.001	4.982	44.75	44.754	13.926	14.146	35
September	1	4.952	44.75	44.752	12.984	13.014	35
October	.999	4.954	44.75	44.74	11.207	11.169	35
November	.999	4.99	44.75	44.714	9.85	9.787	34.98
December	1	4.998	44.75	44.769	9.714	9.793	34.93
Average[1] (12 months)	0.9998	4.9438	44.883	44.881	13.018	13.078	34.99
1938							
January	1	5	44.75	44.754	9.908	10.131	34.99
February	.999	5.016	44.75	44.736	9.525	9.756	35
March	1.002	4.998	44.44	44.569	9.496	9.725	35.05
April	1.005	5.005	42.75	42.983	9.443	9.701	35.15
May	1.007	5.008	42.75	43.091	8.801	9.162	35.22
June	1.01	5.011	42.75	43.213	8.5	8.832	35.36
July	1.005	4.954	42.75	42.972	9.573	9.846	35.24
August	1.003	4.895	42.75	42.893	9.844	10.034	35.12
September	1.006	4.832	42.75	43.022	9.943	10.184	35.12
October	1.009	4.81	42.75	43.149	10.713	11.002	35.32
November	1.007	4.741	42.75	43.06	10.569	10.801	35.25
December	1.009	4.714	42.75	43.146	10.023	10.31	35.28
Average[1] (12 months)	1.005	4.916	43.225	43.477	9.695	9.972	35.175

[1]Computed from daily quotations.

Diamond-Drilling

In 1938 some 57 companies made returns respecting their drilling operations. The number of machines active was 326, in the operation of which 1,389 men were employed, who were paid $1,883,495 in wages. The corresponding figures for 1937 were 370 drills, 1,850 wage-earners, and $2,721,540 in wages. The figures by provinces are shown below, and it should be pointed out that the statistics for provinces other than Ontario may be more or less incomplete, as they refer to work done by Ontario firms only.

DIAMOND-DRILLING OPERATIONS, 1937 AND 1938

Province	1937		1938	
	Holes	Core footage	Holes	Core footage
Ontario	10,943	2,385,026	10,062	2,018,591
Quebec	3,050	833,651	2,129	607,116
Other provinces and N.W.T.	592	137,596	812	151,677
Total	14,585	3,356,273 (635.6 miles)	13,003	2,777,384 (526 miles)

The total consumption of borts, ballas, and carbons in 1938 was 157,537.48 carats, as shown below:—

CONSUMPTION OF DIAMONDS BY REPORTING FIRMS, 1938

Period	Borts	Ballas	Carbons	Ready set bits
Diamonds on hand December 31, 1937	54,703.64	506.26	2,725.69	.....
Purchased in 1938	161,689.24	80.19	360.04	8,164.78
	216,392.88	586.45	3,085.73	8,164.78
Diamonds on hand December 31, 1938...deduct	67,348.71	433.15	2,156.29	654.21
Diamonds consumed (157,537.48 carats) in 1938	149,044.17	153.30	829.44	7,510.57

Prospecting

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

MINING CLAIMS RECORDED, 1907–1938

Year	No.	Year	No.	Year	No.
1907	13,996	1918	1,534	1929	8,207
1908	4,634	1919	2,918	1930	3,886
1909	9,746	1920	2,160	1931	5,779
1910	5,792	1921	2,459	1932	4,945
1911	9,001	1922	5,686	1933	8,077
1912	3,104	1923	6,092	1934	16,888
1913	4,320	1924	5,222	1935	9,460
1914	1,913	1925	4,751	1936	17,280
1915	2,519	1926	13,496	1937	15,292
1916	2,470	1927	15,554	1938	9,047
1917	1,936	1928	15,046		

METALLICS

Gold

General Summary

For the first time in the history of mining in Ontario the value of gold from all primary sources exceeded $100,000,000. In 1938 gold mines and the nickel-copper industry yielded 2,896,477 ounces of gold, valued at $101,945,441 in Canadian funds, as against 2,587,094 ounces, worth $90,508,689, in the previous year.

Gold mines alone milled 9,583,590 tons of ore, from which gold and silver worth $99,351,493 was extracted. In the previous year 8,426,898 tons were treated, which contained crude bullion valued at $88,095,110. In 1938, auriferous quartz mines recovered 2,816,249.399 ounces of gold, and the nickel-copper industry and other sources added 80,227.317 ounces.

During the year 62 mills of a daily capacity of 30,032 tons were operated, and eight plants capable of treating 1,500 tons of ore per day were under construction. Although 35 smaller units were idle, plans were under way for the installation of 6 new mills.

The gold industry of Ontario employed 17,770 wage-earners, who received $29,392,519 for their year's work, or an average of $1,654 per wage-earner.

The estimated average price of a troy ounce of gold in Canadian funds in 1938 was $35.175, compared with $34.99 in 1937. Gold mining received a great

DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES TO DECEMBER 31, 1938

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 1937	Dividends and bonuses paid during 1938	Rate per cent., or per share 1938	Total dividends and bonuses paid to Dec. 31, 1938	Date when last dividend or bonus was paid
Anglo-Huronian, Ltd.	Oct. 16, 1933	2,000,000	1,500,000	No par	$1,575,605.00	$150,000.00	10c.	$1,725,605.00	Jan. 3, 1938
Buffalo Ankerite Gold Mines, Ltd.	Oct. 5, 1932	$1,000,000	$701,679	$1.00	896,542.54	701,679.00	$1.00	1,598,221.54	Nov. 15, 1938
Central Patricia Gold Mines, Ltd.	April 20, 1931	$2,500,000	$2,500,000	1.00	500,000.00	450,000.00	18c.	950,000.00	Sept. 30, 1938
Coniaurum Mines, Ltd.	July 4, 1929	3,000,000	2,766,743	No par	353,968.11	411,381.85	15c.	765,349.96	Dec. 21, 1938
Dome Mines, Ltd.[1]	July 7, 1923	2,000,000	2,000,000	No par	33,624,522.15	3,893,336.00	$3.00	37,517,858.15	Oct. 20, 1938
Hollinger Consol. Gold Mines, Ltd.[2]	May 25, 1916	$25,000,000	$24,600,000	5.00	88,242,400.00	5,412,000.00	$1.10	93,654,400.00	Dec. 31, 1938
Howey Gold Mines, Ltd.	Mar. 12, 1926	5,000,000	5,000,000	1.00	1,050,000.00	200,000.00	4c.	1,250,000.00	Dec. 1, 1938
Kirkland Lake Gold Mining Co., Ltd.	Nov. 19, 1915	5,500,000	5,326,699	1.00	1,110,724.95	532,669.90	10c.	1,643,394.85	Dec. 1, 1938
Lake Shore Mines, Ltd.	Feb. 25, 1914	2,000,000	2,000,000	1.00	65,020,000.00	8,000,000.00	$4.00	73,020,000.00	Dec. 15, 1938
Leitch Gold Mines, Ltd.	July 23, 1935	$3,000,000	$2,850,005	1.00	.....	57,000.10	2c.	57,000.10	Nov. 15, 1938
Little Long Lac Gold Mines, Ltd.	Jan. 26, 1933	2,000,000	1,833,000	No par	1,283,100.00	549,900.00	30c.	1,833,000.00	Dec. 22, 1938
Macassa Mines, Ltd.	April 12, 1926	3,000,000	2,678,068	1.00	1,465,437.40	669,517.00	25c.	2,134,954.40	Dec. 15, 1938
McIntyre-Porcupine Mines, Ltd.[3]	Mar. 16, 1911	$4,000,000	$3,990,000	5.00	18,873,162.43	1,596,000.00	$2.00	20,469,162.43	Dec. 1, 1938
McKenzie Red Lake Gold Mines, Ltd.	Feb. 1, 1933	$3,000,000	$2,900,000	1.00	464,000.00	348,000.00	12c.	812,000.00	Dec. 15, 1938
Moneta Porcupine Mines, Ltd.	Oct. 14, 1910	$3,000,000	$2,543,860	1.00	.....	76,315.80	3c.	76,315.80	Oct. 1, 1938
Northern Empire Mines Co., Ltd.	July 28, 1932	$500,000	$400,000	1.00	341,250.00	290,750.00	80c.	632,000.00	Dec. 12, 1938
Pamour Porcupine Mines, Ltd.	Mar. 7, 1934	5,000,000	5,000,000	No par	.....	600,000.00	12c.	600,000.00	Nov. 1, 1938
Paymaster Consolidated Mines, Ltd.	Feb. 15, 1930	$9,000,000	$8,629,000	1.00	.....	86,290.00	1c.	86,290.00	Sept. 15, 1938
Pickle Crow Gold Mines, Ltd.	Jan. 8, 1934	$3,000,000	$3,000,000	1.00	1,650,000.00	1,200,000.00	40c.	2,850,000.00	Dec. 31, 1938
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	3,497,470.00	824,875.00	25%	4,322,345.00	Dec. 30, 1938
Teck-Hughes Gold Mines, Ltd., The	Mar. 2, 1923	5,000,000	4,807,144	1.00	27,807,435.20	2,163,214.80	45c.	29,970,650.00	Oct. 1, 1938
Toburn Gold Mines, Ltd.[6]	Jan. 24, 1931	2,000,000	1,850,000	1.00	610,500.00	259,000.00	14c.	869,500.00	Nov. 22, 1938
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 15, 1927
Wright-Hargreaves Mines, Ltd.[7]	June 16, 1916	5,500,000	5,500,000	No par	21,106,250.00	3,850,000.00	70c.	24,956,250.00	Oct. 1, 1938
Total	.....	.....	.....	.....	$270,790,492.78	$32,321,929.45	.....	$303,112,422.23	.....

[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. In 1936, 20,000 shares were paid in part payment for the Schumacher claims and 26,666 shares were then held in trust for the company. On June 20, 1938, the share capital was doubled from one to two million shares, and the shares held in trust then became 53,332.

[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 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.

impetus in 1934 when President Roosevelt pegged the price of gold at $35.00 per ounce, and since that time the development of the industry has progressed steadily. The value of gold produced in Ontario to December 31, 1938, including exchange equalization, amounts to $940,882,467.

Prospecting suffered a considerable setback in 1938 as compared to 1937: Only 9,047 claims were staked in 1938, whereas in the preceding year 15,292 claims were recorded.

Dividends and Production

The following tables show the dividends paid by the various gold-mining companies and the yearly dividends by areas to the end of 1938, the total gold production from 1866 to 1938, the production by areas in 1938, and the annual production by mines in each area up to and including 1937. The total production by mines to the end of 1938 can be found by adding the 1938 figures contained in the table facing page 10 to the totals in the tables of the various areas.

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES IN THE KIRKLAND LAKE AREA, 1915–1938

Year	Tough-Oakes Gold Mines	Toburn Gold Mines	Lake Shore Mines	Wright-Hargreaves Mines	Teck-Hughes Gold Mines	Sylvanite Gold Mines	Kirkland Lake Gold Mining Co.	Macassa Mines	Total
	$	$	$	$	$	$	$	$	$
1915..	132,875	.....	.....	.....	.....	.....	.....	.....	132,875.00
1916..	265,750	.....	.....	.....	.....	.....	.....	.....	265,750.00
1917..	.....	.....	.....	.....	.....	.....	.....	.....	.....
1918..	.....	.....	100,000	.....	.....	.....	.....	.....	100,000.00
1919..	.....	.....	100,000	.....	.....	.....	.....	.....	100,000.00
1920..	.....	.....	80,000	.....	.....	.....	.....	.....	80,000.00
1921..	.....	.....	120,000	.....	.....	.....	.....	.....	120,000.00
1922..	.....	.....	80,000	.....	412,500.00	.....	.....	.....	492,500.00
1923..	.....	.....	160,000	.....	206,250.00	.....	.....	.....	366,250.00
1924..	.....	.....	380,000	206,250	.....	.....	.....	.....	586,250.00
1925..	.....	.....	600,000	550,000	.....	.....	.....	.....	1,150,000.00
1926..	.....	.....	1,000,000	893,750	474,714.40	.....	.....	.....	2,368,464.40
1927..	.....	.....	1,400,000	1,237,500	713,571.60	.....	.....	.....	3,351,071.60
1928..	.....	.....	2,000,000	825,000	2,860,286.40	.....	.....	.....	5,685,286.40
1929..	.....	.....	2,200,000	.....	2,866,286.40	.....	.....	.....	5,066,286.40
1930..	.....	.....	3,000,000	.....	2,872,286.40	65,990	.....	.....	5,938,276.40
1931..	.....	.....	4,800,000	825,000	3,118,143.60	131,980	.....	.....	8,875,123.60
1932..	.....	.....	6,000,000	962,500	2,884,286.40	164,975	.....	.....	10,011,761.40
1933..	.....	.....	6,000,000	1,512,500	2,884,286.40	164,975	.....	.....	10,561,761.40
1934..	.....	148,000	7,000,000	3,025,000	2,643,929.20	824,875	157,173.69	131,403.40	13,930,381.29
1935..	.....	148,000	8,000,000	3,300,000	1,922,857.60	659,900	157,173.69	396,710.20	14,584,641.49
1936..	.....	148,000	10,000,000	3,300,000	2,163,214.80	659,900	316,974.66	401,710.20	16,989,799.66
1937..	.....	166,500	12,000,000	3,850,000	2,403,572.00	824,875	479,402.91	535,613.60	20,259,963.51
1938..	.....	259,000	8,000,000	3,850,000	2,163,214.80	824,875	532,669.90	669,517.00	16,299,276.70
Total	398,625	869,500	73,020,000	24,956,250	29,970,650.00	4,322,345	1,643,394.85	2,134,954.40	137,315,719.25

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES IN NORTHWESTERN ONTARIO, 1934–1938

Year	Central Patricia Gold Mines	Howey Gold Mines	Little Long Lac Gold Mines	McKenzie Red Lake Gold Mines	Northern Empire Mines Co.	Pickle Crow Gold Mines	Leitch Gold Mines	Total
1934.....	.....	$500,000	.....	.....	.....	.....	.....	$500,000
1935.....	.....	250,000	.....	.....	$170,500	.....	.....	420,500
1936.....	$200,000	100,000	$549,900	$203,000	.....	$600,000	.....	1,652,900
1937.....	300,000	200,000	733,200	261,000	170,750	1,050,000	.....	2,714,950
1938.....	450,000	200,000	549,900	348,000	290,750	1,200,000	$57,000	3,095,650
Total....	$950,000	$1,250,000	$1,833,000	$812,000	$632,000	$2,850,000	$57,000	$8,384,000

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES IN THE PORCUPINE BELT, 1912–1938

Year	Hollinger Consol. Gold Mines	Porcupine Crown Mines	Dome Mines	McIntyre-Porcupine Mines	Buffalo Ankerite Gold Mines	Anglo-Huronian	Moneta Porcupine Mines	Pamour Porcupine Mines	Paymaster Consol. Mines	Coniaurum Mines	Rea Consol. Gold Mines	Total
	$	$	$	$	$	$	$	$	$	$	$	$
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	1,560,000	240,000	400,000.00								12,000	2,212,000.00
1916	3,286,000	240,000	800,000.00									4,326,000.00
1917	738,000	120,000	300,000.00	541,542.45								1,699.542.45
1918	1,230,000			543,042.45								1,773,042.45
1919	1,722,000			364,028.30								2,086,028.30
1920	2,214,000		416,886.00	546,042.45								3,176,928.45
1921	3,198,000		478,947.75	546,042.45								4,222,990.20
1922	3,198,000		715,000.50	546,042.45								4,459,042.95
1923	3,198,000		1,430,001.00	548,542.45								5,176,543.45
1924	3,198,000		1,906,668.00	774,125.00								5,878,793.00
1925	4,378,800		1,906,668.00	798,000.00								7,083,468.00
1926	5,805,600		1,906,668.00	798,000.00								8,510,268.00
1927	6,396,000		1,191,667.50	798,000.00		[1]67,500						8,453,167.50
1928	5,412,000		953,334.00	798,000.00								7,163,334.00
1929	3,198,000		953,334.00	798,000.00								4,949,334.00
1930	3,444,000		953,334.00	798,000.00								5,195,334.00
1931	3,444,000		953,334.00	798,000.00								5,195,334.00
1932	3,690,000		1,239,334.20	997,499.86						80,923.41		6,007,757.47
1933	4,182,000		1,716,001.20	1,496,254.57	42,571.29							7,436,827.06
1934	6,888,000		3,336,669.00	1,596,000.00	89,371.77	501,042						12,411,082.77
1935	4,428,000		3,813,336.00	1,596,000.00	115,546.40	250,521						10,203.403.40
1936	5,412,000		3,873,336.00	1,596,000.00	140,335.80	524,042						11,545,713.80
1937	5,412,000		4,380,003.00	1,596,000.00	508,717.28	300,000				273,044.70		12,469,764.98
1938	5,412,000		3,893,336.00	1,596,000.00	701,679.00	150,000	76,315.80	600,000	86,290	411,381.85		12,927,002.65
Total	93,654,400	840,000	37,517,858.15	20,469,162.43	1,598,221.54	1,793,105	76,315.80	600,000	86,290	765,349.96	12,000	157,412,702.88

[1]Vipond Consolidated Mines.

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES BY AREAS, 1912–1938

Year	Porcupine	Kirkland Lake	Northwestern Ontario	Total
1912	$270,000.00	.....	.....	$270,000.00
1913	1,170,000.00	.....	.....	1,170,000.00
1914	1,410,000.00	.....	.....	1,410,000.00
1915	2,212,000.00	$132,875.00	.....	2,344,875.00
1916	4,326,000.00	265,750.00	.....	4,591,750.00
1917	1,699,542.45	.....	.....	1,699,542.45
1918	1,773,042.45	100,000.00	.....	1,873,042.45
1919	2,086,028.30	100,000.00	.....	2,186,028.30
1920	3,176,928.45	80,000.00	.....	3,256,928.45
1921	4,222,990.20	120,000.00	.....	4,342,990.20
1922	4,459,042.95	492,500.00	.....	4,951,542.95
1923	5,176,543.45	366,250.00	.....	5,542,793.45
1924	5,878,793.00	586,250.00	.....	6,465,043.00
1925	7,083,468.00	1,150,000.00	.....	8,233,468.00
1926	8,510,268.00	2,368,464.40	.....	10,878,732.40
1927	8,453,167.50	3,351,071.60	.....	11,804,239.10
1928	7,163,334.00	5,685,286.40	.....	12,848,620.40
1929	4,949,334.00	5,066,286.40	.....	10,015,620.40
1930	5,195,334.00	5,938,276.40	.....	11,133,610.40
1931	5,195,334.00	8,875,123.60	.....	14,070,457.60
1932	6,007,757.47	10,011,761.40	.....	16,019,518.87
1933	7,436,827.06	10,561,761.40	.....	17,998,588.46
1934	12,411,082.77	13,930,381.29	$500,000.00	26,841,464.06
1935	10,203,403.40	14,584,641.49	420,500.00	25,208,544.89
1936	11,545,713.80	16,989,799.66	1,652,900.00	30,188,413.46
1937	12,469,764.98	20,259,963.51	2,714,950.00	35,444,678.49
1938	12,927,002.65	16,299,276.70	3,095,650.00	32,321,929.35
Total	$157,412,702.88	$137,315,719.25	$8,384,000.00	$303,112,422.13

GOLD PRODUCTION, 1866–1938

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

Year	Total production, value	Porcupine belt		Kirkland Lake belt[1]		N.W. Ontario[2]	
		Value	Per cent.	Value	Per cent.	Value	Per cent.
1866–1891[3]	$190,258	.....	.....	.....	.....	.....	.....
1892–1909[4]	2,509,492	.....	.....	.....	.....	.....	.....
1910–1919	58,822,292	$54,074,696	.....	2,977,462	.....	.....	.....
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
1935	45,898,372	20,021,622	43.6	19,597,809	42.7	4,851,950	1.5
1936	49,168,253	21,154,555	43	19,951,731	40.5	6,545,127	1.3
1937	53,479,981	23,163,296	43.3	20,660,377	38.6	8,096,616	15.1
1938	58,216,765	26,019,011	44.6	21,309,165	36.6	10,888,589	18.7
Total	$736,366,091	$438,082,031	59.4	$247,826,403	33.6	.....	.....

[1]Includes Larder Lake area.

[2]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.

[3]Estimated. [4]Maximum yearly output was $424,568 in 1899.

Gold Mines of Southeastern Ontario.—At the *Cordova* mine, the Consolidated Mining and Smelting Company developed the 4th and 9th levels and sunk an inclined winze from the 9th to the 10th level to permit development of the 10th level. After some development work the *Ackerman* mine was closed down in May. The *Addington* mine, which is operated under the control of the Consolidated Mining and Smelting Company, reported development work on the 350- and 500-foot levels. A vertical inside shaft from the 500- to the 750-foot level was sunk. This will permit development of the 625- and 750-foot levels.

SOUTHEASTERN ONTARIO

PRODUCTION STATISTICS OF GOLD MINES, 1891–1937[1]

(Value includes gold and silver, and exchange and equalization have been added since 1920)

Mine	Year	Quantity	Value
		tons	
Atlas Arsenic	1900, 1902, 1903	6,114	$44,667
Bannockburn	1895	.....	58
Belmont. *See* Cordova.			
Big Dipper	1907, 1909	52	340
Boerth	1900	.....	208
Canadian Goldfields. *See* Deloro.			
Cleveland	1908	239	5,475
Cobalt Frontenac	1919, 1922	.....	1,356
Cook Land	1901, 1902, 1904	1,483	6,989
Cordova (Belmont)	1892, 1893	560	5,450
	1898–1903	70,185	289,517
	1912–1917	16,194	45,426
Craig	1905, 1906	1,850	5,760
Crescent	1891, 1892	1,700	6,780
Deloro (Canadian Goldfields)	1897–1902	39,143	213,973
Gatling Pearce	1893	.....	1,918
Gilmour	1909, 1910	550	3,669
Golden Fleece. *See* Cobalt Frontenac.			
Ledyard	1893, 1894	55	236
Little Doris	1898	400	2,500
Sophia	1900	1,500	850
Sovereign	1900	262	861
Star of the East	1905, 1907	976	1,941
Miscellaneous[2]	1937	.....	238
Total	.....	141,263	$638,212

[1]The Department has no records of any gold produced in Southeastern Ontario subsequent to 1922, with the exception of that recorded under "Miscellaneous."

[2]In 1937, a total of 6.795 fine ounces, worth $238, was shipped to the Ontario Refining Company from Arden in Frontenac county by G. E. Fielding. This shipment could not be credited to any particular property.

Gold Mines of Larder Lake Area.—The Larder Lake area lies immediately east of the Kirkland Lake area proper and runs to the Quebec boundary. There were three producers in the area in 1938, of which the *Kerr-Addison* was a new addition. Production was maintained at the other two mines, the *Omega* and *Raven River*. *Fernland, Cheminis, Barber-Larder, Chesterville, Martin-Bird,* and *Anoki* proceeded with shaft-sinking operations and other development work. Work was also done on other properties.

Gold Mines of Kirkland Lake Belt.—The Kirkland Lake area proper embraces Teck and Lebel townships and parts of the townships on the east, north, and west. For convenience, adjoining areas in the district of Timiskaming (exclusive of the Larder Lake and Matachewan areas) are grouped together under the designation Kirkland Lake "belt." There was much activity at the second most

LARDER LAKE GOLD AREA

Annual Production Statistics by Mines, 1911–1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Year	Barry-Hollinger		Argonaut[1]		Omega[2]		Telluride (Minaura)[3]		Raven River		Miscellaneous		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[4]125	314	125	314
1912	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1913	.....	.....	480	4,005	.....	[5]10,000	.....	.....	.....	.....	.....	.....	480	14,005
1914	.....	.....	.....	5,204	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,204
1915	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1916	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1917	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1918	[6]1,502	10,051	.....	.....	.....	.....	.....	.....	.....	.....	.....	[7]1,283	1,502	11,334
1919	.....	.....	735	2,631	.....	.....	.....	.....	.....	.....	.....	.....	735	2,631
1920	.....	.....	4,637	29,888	.....	.....	.....	.....	.....	.....	.....	.....	4,637	29,888
1921	.....	.....	.....	549	.....	.....	.....	.....	.....	.....	.....	.....	.....	549
1922	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1923	.....	.....	4,818	73,262	.....	.....	.....	.....	.....	.....	.....	.....	4,818	73,262
1924	.....	.....	24,178	152,072	.....	.....	.....	.....	.....	.....	.....	.....	24,178	152,072
1925	8,136	56,978	28,515	214,183	.....	.....	.....	.....	.....	.....	.....	.....	36,651	271,161
1926	13,680	86,263	35,081	143,387	.....	.....	.....	.....	.....	.....	.....	.....	48,761	229,650
1927	25,714	175,692	27,873	127,448	11,966	34,595	.....	.....	.....	.....	[8]39	865	65,592	338,600
1928	23,060	111,767	5,219	32,430	10,619	17,700	.....	.....	.....	.....	[8]4,377	12,784	43,275	174,681
1929	22,343	151,758	.....	9,959	.....	.....	.....	.....	.....	.....	.....	.....	22,343	161,717
1930	31,725	217,835	13	1,891	.....	.....	.....	.....	.....	.....	.....	.....	31,738	219,726
1931	31,958	234,512	.....	.....	.....	.....	80	835	.....	.....	.....	.....	32,038	235,347
1932	34,977	181,585	.....	.....	.....	.....	24	468	.....	.....	.....	.....	35,001	182,053
1933	5,459	71,766	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,459	71,766
1934	33,445	152,076	12	1,872	.....	.....	.....	.....	.....	.....	.....	.....	33,457	153,948
1935	35,172	143,698	24	978	.....	.....	.....	.....	.....	.....	[7]31	3,590	35,227	148,266
1936	570	8,311	.....	.....	113,897	461,934	.....	.....	.....	.....	[7]5	262	114,472	470,507
1937	.....	.....	.....	.....	160,272	740,555	22	38	2,425	12,731	[9]21	702	162,740	754,026
Total	267,741	1,602,292	131,585	799,759	296,754	1,264,784	126	1,341	2,425	12,731	4,598	19,800	703,229	3,700,707

[1]The production shown for 1913 and 1914 was from La Mine D'Or Huronia, which has been known as the Argonaut since 1919. The values shown are exclusive of copper.

[2]Canadian Associated Goldfields (production of which is shown in the figures for 1927 and 1928) went into bankruptcy in 1928 and the property was acquired by Proprietary Mines, Limited, in 1930. In 1934, Canadian Reserve Mines, Limited, acquired the 3 Costello claims and the Raven Falls power plant from Proprietary and transferred them to Omega Gold Mines, Limited.

[3]Acquired on 99-year lease by Minaura Mines, Limited, from Smelters Corporation of Canada, Limited, in November, 1935.

[4]Reddick mine, which was bought by Associated Goldfields in 1914, and acquired from Proprietary Mines, Ltd., by Kerr-Addison Gold Mines, Ltd., in 1936.

[5]Associated Goldfields, which was acquired by Canadian Associated Goldfields in 1921. [6]Patricia mine, afterwards called Barry-Hollinger.

[7]Miller Independence. [8]Gold Hill. [9]Britcana.

important gold camp in Ontario. Some drifting was carried on at the *Melba*, and *Mesabi* ran its mill for three weeks in the spring but closed down in May. The *Goldbanks* was diamond-drilled, and *Lois Lake* did some surface-trenching. At *Lucky Kirkland*, the development programme consisted of some underground work, surface diamond-drilling, and bulk sampling. Production was started at the *Golden Gate* in June with a 100-ton mill. Mine examination and some surface diamond-drilling was reported from *Trout Creek*. *Macassa* increased its milling capacity from 275 tons to 400 tons in September. The winze was developed to the 3,725-foot level, and the new No. 2 shaft was started and sunk 500 feet. *Kirkland Lake Gold* milled at the rate of 250 tons per day, development was well ahead of schedule, and the mill building was reconstructed. Milling 1,000 tons per day, *Teck-Hughes* was still assured of ore reserves sufficient to keep the mine in operation for five years. *Lake Shore* reported completion of the No. 5 shaft to 3,950 feet. The No. 3 shaft was out of service, and the No. 6 shaft was started as a downward extension of No. 5 from the 3,950-foot level. The mill was operating at the daily rate of 2,500 tons. A roasting plant for concentrates with a capacity of 50 tons was in operation. The No. 5 winze at the *Wright-Hargreaves* was deepened to 6,400 feet, and the mine produced 1,200 tons per day. At the *Sylvanite* and *Toburn* ore was treated at 530 and 150 tons per day, respectively. Drifting, crosscutting, and diamond-drilling featured the year's work at the *Continental Kirkland*. The winze was sunk 125 feet below the 800-foot level. The *Goodfish* (Miles-Martin) mine was examined and diamond-drilled.

Lakeside-Kirkland completed sinking to 600 feet, and some crosscutting was done at that depth. The mine closed down in May. The No. 2 winze at the *Bidgood* was deepened to the 1,525-foot level. The mill produced at the rate of 150 tons per day. Only surface diamond-drilling was reported from the *Moffatt-Hall*. Mining and milling operations at the *Morris Kirkland* were stopped in July. Sinking below the 1,200-foot level was started in December. *Upper Canada*, which increased its shaft from two to three compartments to 500 feet, milled at the rate of 100 tons per day during November and December, using the Morris Kirkland unit.

Gold Mines of Porcupine Belt.—The Porcupine belt starts west of Mountjoy on the Mattagami river and runs east to the T. and N. O. railway and beyond. The diamond-drilling programme which was started at the *Augite* in 1937 was completed in 1938, and a mining plant using hydro power was installed in the spring. Shaft-sinking to 1,000 feet was commenced in April. This was completed in November and crosscutting on the 1,000- and 875-foot levels was started. *Broulan* completed a drilling programme in the early part of 1938, and an electric mining plant was installed in the latter part of the year. In December shaft-sinking with the electric plant was started. During the winter and spring months of 1938 a plant, including a steam-operated hoist and a Diesel compressor, was installed at the *Faymar* mine, and shaft-sinking got under way in April. Two levels were established at 225 and 350 feet. At the end of the year more than 1,600 feet of crosscutting on both levels combined had been done, as well as 1,000 feet of drifting. Raising was started from both levels before the year ended. The combined footage in both raises was 156 feet. *Hallnor*, whose grade of ore was exceeded only by the Sachigo, in the province of Ontario, came into production in June. Open square sets, used as the mining method in approximately half of the stopes, although not a new development, added to the variety of methods employed in the Porcupine area. A relatively deep shaft was commenced at the *Hoyle* (*Lang*) on the east end of the producing area of

MATACHEWAN GOLD AREA[1]

ANNUAL PRODUCTION STATISTICS BY MINES, 1922 AND 1932–1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Year	Ashley		Young-Davidson		Matachewan Consolidated		Atlas[2]		White Rock[2]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1922	.....	.....	.....	.....	.....	.....	.....	.....	.....	987	.....	987
1932	6,805	70,142	.....	.....	.....	.....	.....	.....	.....	.....	6,805	70,142
1933	37,975	495,364	.....	.....	.....	.....	12	201	17	419	38,004	495,984
1934	43,532	456,830	51,842	134,511	4,680	23,568	.....	.....	.....	.....	100,054	614,909
1935	47,366	440,531	229,793	713,380	48,362	356,818	.....	.....	.....	.....	325,521	1,510,729
1936	[3]21,958	158,533	301,163	892,713	55,797	425,259	.....	.....	.....	.....	378,918	1,476,505
1937	.....	.....	337,556	1,127,247	132,754	709,607	.....	.....	.....	.....	470,310	1,836,854
Total	157,636	1,621,400	920,354	2,867,851	241,593	1,515,252	12	201	17	1,406	1,319,612	6,006,110

[1]Includes West Shiningtree area (Atlas and White Rock mines). [2]Acquired by Bilmac Gold Mines, Limited, in 1934. [3]Clean up material.

SUDBURY DISTRICT[1]

ANNUAL PRODUCTION STATISTICS OF GOLD MINES, 1897–1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Year	Crystal		Gomak		Halcrow-Swayze		Long Lake[2]		New Golden Rose		McMillan		Shakespeare		Bousquet		Miscellaneous		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1911	[3]730	4,998	.....	.....	.....	.....	[4]3,294	18,553	.....	.....	.....	.....	[5]8,590	50,984	.....	.....	.....	.....	12,614	74,535
1911	.....	.....	.....	.....	.....	.....	1,750	9,828	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,750	9,828
1913	.....	.....	.....	.....	.....	.....	20,646	114,833	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20,646	114,833
1914	.....	.....	.....	.....	.....	.....	45,458	217,103	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45,458	217,103
1915	.....	.....	.....	.....	.....	.....	44,271	282,123	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44,271	282,123
1916	.....	.....	.....	.....	.....	.....	26,846	187,103	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26,846	187,103
1932	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[6]22	2,993	22	2,993
1934	.....	.....	.....	.....	.....	.....	7	1,256	.....	.....	12,313	67,344	.....	.....	.....	.....	.....	.....	12,320	68,600
1935	.....	.....	.....	.....	211	1,372	.....	.....	.....	.....	40,218	273,315	.....	.....	.....	.....	[7]45	293	40,474	274,980
1936	.....	.....	1,387	3,446	.....	.....	.....	.....	.....	.....	.....	3,139	.....	.....	9,168	74,030	.....	.....	10,555	80,615
1937	.....	.....	.....	.....	.....	.....	23,687	150,422	16,811	135,541	7,608	26,874	.....	.....	7,961	88,910	.....	.....	56,067	401,747
Total	730	4,998	1,387	3,446	211	1,372	165,959	981,221	16,811	135,541	60,139	370,672	8,590	50,984	17,129	162,940	67	3,286	271,023	1,714,460

[1]Exclusive of West Shiningtree area (Atlas and White Rock mines), which is included in the Matachewan gold area above.
[2]Acquired by Lebel Oro Mines, Limited, in 1920.
[3]1897, $189.6 from 300 tons; 1898, $1,602 from 160 tons; 1908, $1,500 from 270 tons. [4]Production for 1910.
[5]1905, $37,963 from 4,550 tons; 1906, $8,641; 1907, $4,380 from 4,040 tons. [6]T.B. 69 (R. Downey). [7]Mac-Auer.

the camp. Sinking was started from 220 feet below the surface, the objective being 1,900 feet. The shaft was down about 1,500 feet at the end of the year. The Hoyle is adjacent to the Pamour on the east. At the *Naybob* better ore disclosures than usual for this mine encouraged the company to rebuild and enlarge milling facilities during 1938. The *Porcupine Lake* joined the ranks of producers in June, 1938. Several shipments of high-grade ore made at the end of the year classed *Preston East Dome* as a producer. Erection of a 300-ton mill was begun.

Gold Mines of Matachewan and West Shiningtree Areas.—The Matachewan area is probably the westerly extension of the Kirkland Lake break, and for convenience mines in the bordering West Shiningtree area are grouped with it. The *Tyranite* sank a winze from the 525- to the 815-foot level, and some surface diamond-drilling was done at the *Matona*. The *Young-Davidson* milled 1,000 tons per day and sank a winze from the 2nd to the 4th level. The main shaft at the *Matachewan Consolidated* was deepened 100 feet to the 788-foot level. The mill operated at the daily rate of 450 tons. There was no underground work done in 1938 at the *Bilmac* mine. In April construction of a 75-ton amalgamation mill was started, which was completed at the end of September. All work then ceased. The 3-compartment vertical winze at the *Ronda* mine was sunk from the 500- to the 675-foot horizon and also raised from the 300-foot level to the surface to supply a new main shaft. Development work was done on the 425-, 550-, and 675-foot levels. Shrinkage stopes were established on the 200-, 300-, and 425-foot levels. The construction of a 125-ton cyanide mill was started in September and was practically completed at the end of the year. Pirate Gold Mines, Limited, acquired the old *Kingston* mine, which had a shaft of 100 feet and some lateral work completed at that level. Development work was started by the new company on the 100-foot level on a very small scale on December 28, 1938.

Gold Mines of Sudbury and Nipissing Districts.—Gold mines of the West Shiningtree area, district of Sudbury are grouped with those of the Matachewan area. In the district of Sudbury open-pit mining was carried on at the *Long Lake* (Lebel Oro) mine from April until late in November. The cyanide mill was operated all year. At the *New Golden Rose* mine development consisted of stoping between the 66- and the 466-foot levels. The cyanide mill was active throughout the year. To the northwest, in the Gogama-Shiningtree area, a new company, Tionaga Gold Mines, started work in February on the *Smith-Thorne* mine. The two-compartment 45-degree shaft was deepened from 599 to 727 feet on the incline, and a new level established at 695 feet. Stoping was started on the 570-foot level, and a new level opened up at 450 feet. A 50-ton amalgamation mill, which was started in June, was put into operation in November.

In Strathy township, district of Nipissing, *Beanland* completed sinking to 600 feet and did some crosscutting and drifting. Operations ceased in April. The Consolidated Mining and Smelting Company completed sinking on the *Hermiston-McCauley* option to 350 feet and did some crosscutting, drifting, and diamond-drilling. The mine was closed down in November.

Gold Mines of Algoma District.—Agawa Gold Mines, Limited, which took over the old *Centennial* mine from L. B. United Mines, Limited, started surface work in March and underground operations in August. The work below the surface was done on the 250-foot level and was continued for the rest of the year. Work at the *Parkhill* ceased early in January, 1938. Intermittent underground work on a very small scale was reported from *Deep Lake*. Mining and milling was stopped at the *Algold*. A second level from the 35-degree shaft was opened

ALGOMA DISTRICT

ANNUAL PRODUCTION STATISTICS OF GOLD MINES, 1902–1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Year	Algold (New Goodreau[1])		Algoma Summit (McCarthy-Webb)		Darwin (Grace[2])		Deep Lake		Minto and Jubilee[3]		Parkhill		Miscellaneous		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910					10,297	69,923							[4]2,512	8,874	12,809	78,797
1910					60	2,020							[5]1,600	5,020	1,660	7,040
1911														[6]627		627
1923						153										153
1925						41										41
1926	415	1,847													415	1,847
1929											33	2,057			33	2,057
1930					750	588			1,074	2,559					1,824	3,147
1931									9,448	80,269	9,082	75,543			18,530	155,812
1932	117	474							18,765	185,171	16,822	166,009			35,704	351,654
1933									23,671	182,376	11,565	246,580	60	[7]282	35,296	429,238
1934			421	4,926					22,189	169,301	19,431	310,647			42,041	484,874
1935			205	3,008	2,103	17,750			34,890	196,252	20,871	338,388	7,946	[8]49,027	66,015	604,425
1936	3,073	14,948	2,711	8,516	17,598	231,401	2,415	49,148	39,385	150,596	22,441	330,886	3,245	[9]15,638	90,868	801,133
1937	11,064	41,613	44,869	68,130	14,720	214,707	375	7,001	15,577	35,325	25,209	200,048	1,576	[10]19,309	113,390	586,133
Total	14,669	58,882	48,206	84,580	45,528	536,583	2,790	56,149	164,999	1,001,849	125,454	1,670,158	16,939	98,777	418,585	3,506,978

[1]Acquired by Algold Mines, Limited, in 1934.

[2]Acquired by Darwin Gold Mines, Limited, in 1934. Operated by the Algoma Commercial Company in 1902 and 1903, who produced 6,097 tons of ore, from which $48,708 was recovered; and by the Le Page Gold Mining Company from 1907 to 1910, who produced 4,260 tons, valued at $23,235.

[3]Production shown from 1930 to 1933 was from the Minto; in 1934, 11,946 tons came from the Jubilee; from 1935 to 1937 the whole production was from the Jubilee. Both mines are now owned by Minto Gold Mines, Limited.

[4]Havilah (Ophir), Galbraith township, $8,549 from 2,489 tons in 1893; Norwalk (Manxman), $200 from 20 tons in 1904; Golden Reed, $125 from 3 tons in 1908.

[5]Havilah (Ophir), $3,808 from 800 tons; Norwalk (Manxman), $1,212 from 800 tons.

[6]Havilah (Ophir), $627.

[7]Soo Mining and Prospecting Syndicate.

[8]Van Sickle (S. B. Smith).

[9]S. B. Smith clean-up, $11,224 from 1,282 tons; Shenango, $354; Stanley, $2,936 from 1,963 tons; G. L. White, $1,124.

[10]Edwards, 1,573 tons, $16,977; Shenango, $720; Hiawatha (Louittit), 3 tons, $624; Alden-Goudreau, $988.

and worked at the *Algoma Summit* property. Work was also done on the first level. The mill operated all year on ore drawn from the shrinkage stopes on both levels. The construction of a 200-ton cyanide mill was completed at the *Cline Lake* and went into operation on July 28. Development work was done on the 125-, 250-, 400-, and 500-foot levels. Shrinkage stoping was carried on on all the levels mentioned.

In the Oba area surface work alone was done at the *Shenango* property. Shaft-sinking was continued to a depth of 299 feet at the *Hiawatha*, and levels were started at 150 and 275 feet.

Gold Mines of Thunder Bay District.—Three gold mines went into production in 1938. *MacLeod-Cockshutt* commenced milling at the rate of 300 tons per day in April, and shortly after increased this amount to 500 tons. *Hard Rock* commenced production at the first of the year, treating about 240 tons per day. Both these mines made major ore discoveries early in the year. The *Magnet* mine was financed by the Newmont Mining Corporation of New York late in 1937, and on July 10, 1938, ore from three levels was being milled in the mill at the Tombill. Newmont also took over the *Elmos* property early in the year, and shaft-sinking was commenced in the summer followed by lateral exploration. *Bankfield* continued in production at the rate of 100 tons per day throughout the year, and *Tombill* maintained its production. At the latter property an additional 100-ton flotation unit was built to handle ore from the Magnet. A programme of restricted development was carried on at the *Jellicoe*, and plans were made to have the available ore treated at one of the mills in the area. Production at the rate of about 280 tons continued at the *Little Long Lac*. The shaft at this property was deepened, and three more levels were opened up during the last quarter of the year. *Hutchison Lake* suspended operation in April. Operations were carried on at *MacFarlane Long Lac*, which was taken over by MacFarlane Consolidated Mines, Limited. Theresa Gold Mines, Limited, worked the *Caouette claims* in the same locality.

In the Sturgeon River area, the *Sturgeon River* maintained a production of 40 tons per day. Work was done by the *Hy-Lo Syndicate* on their property south of Jackpine. The *Vega* property was also worked, and assessment work was completed on other small properties. The shaft at the *Leitch* was deepened to open up three new levels. The mine produced 80 tons per day. Towards the end of the year, *Sand River*, which was in constant production, deepened its shaft to open up new levels. A new headframe, hoist, and plant, were erected at the *Northern Empire*, which continued production throughout the year.

In the Beardmore area, *Wilport* and *Ontario Cryderman* reported assessment work during the summer. Some drilling was done at the *Buffalo Beardmore* property. *Richgreen* continued with surface exploration throughout the year and were the only company, besides the *Spooner*, who did any drilling.

In the Sturgeon Lake area, the only property in operation during 1938 was the *St. Anthony*, which continued production throughout the year.

The *Cook Lake*, in the Schreiber area, suspended operations in May, leaving the entire area inactive for the remainder of the year.

Gold Mines of Patricia Portion of Kenora District.—Sachigo River, the northernmost gold producer in Ontario, turned over its new 25-ton mill on May 17, 1938. The mill was grinding about 27 tons per day. A feature of this camp is that Cree Indians are employed as wood-cutters, surface labourers, rock pickers, and crushermen. According to the company they have proved highly satisfactory as good, steady, and careful workmen.

In the Favourable Lake area, *Berens River* suspended all operations on January 23, 1938, when it was decided to install a 225-ton cyanide mill at the property. The building of a road to the property was financed by the Ontario and Manitoba Governments.

In the Red Lake area, *Cochenour Willans* made arrangements with Gold Eagle Gold Mines to mill a minimum of 1,000 tons of ore per month. The ore, according to the agreement, would be trucked over the ice during the winter season and in the summer, scows would be used. It was intimated that profits would be employed to further develop the property. Early in the spring of 1938 Faulkenham Lake Gold Mines, Limited, commenced diamond-drilling on adjoining claims, known as the *Starratt-Olsen* property, which had been optioned to Val D'Or Mineral Holdings, Limited. On August 25 the mine and plant buildings were started and the Faulkenham steam plant was moved to claim K.R.L. 12,730, where a 3-compartment shaft was collared by hand. Sinking with power had reached a depth of 225 feet by the end of the year. *Gold Eagle* produced at the rate of 135 tons of sorted ore per day. During 1938 a 2-compartment vertical winze was sunk and two new levels were opened up at 600 and 700 feet. Hasaga Gold Mines, Limited, was formed to amalgamate the *McIntyre Red Lake* property of J. E. Hammell and the *Red Lake Gold Shore* mine, which suspended operations in August. Two 3-compartment shafts were sunk, which are known as the No. 1 shaft, near the west boundary of Howey, and the No. 2, located some 2,500 feet west of No. 1 shaft. An intensive diamond-drilling campaign financed personally by Mr. Hammell preceded the shaft-sinking. Following the acquisition of the Red Lake Gold Shore property in October, the mill was reconditioned and milling was resumed to treat the ore from the development of the *Hasaga* No. 1 shaft workings. The *Howey* continued to operate during the whole of 1938. An average of 1,475 tons of ore was hoisted daily, from which 250 tons was sorted. Development and exploration below the 1,300-foot level, and particularly on the 2,000-foot level, did not reveal any commercial ore. Operations at the *Lake Rowan* were suspended on May 31. Development work had been carried out on the 250- and 400-foot levels, but a complete ore picture had not been established up to the time work was suspended. *Madsen Red Lake* was another addition to the list of gold producers during 1938. Its 300-ton cyanide mill was completed in August. Stope preparations had been commenced in June, and by the end of the year the mill was treating about 360 tons of ore per day. Milling on an average of 173 tons per day, *McKenzie Red Lake* operated continuously during 1938. New ore of importance was opened up on the 650-foot level. An interesting coincidence was the finding and identifying of the mineral scheelite in the ore vein. A new 36-degree winze was commenced on November 17 to open up four new levels at 100-foot intervals vertically. The *Red Crest* mine operated underground until March 2, when operations were suspended. Lack of commercial ore forced the *Red Lake Gold Shore* to cease operations on September 1. All ore had been mined down to the 910-foot level. The company was absorbed by Hasaga Gold Mines in October.

In the Woman Lake area, high Diesel power costs, unsatisfactory ore grade, and difficulty in keeping the mill operating at capacity caused the *J-M Consolidated* to close down its plant on March 1. Efforts were directed at preparing No. 2 shaft, which is situated some 2,000 feet north of No. 1 shaft, for production. Levels were established at 125, 250, and 375 feet. Development and stope preparation followed until August 15, when milling was resumed at the rate of 100 tons per day. At the *Uchi* mine development was continued throughout the year, but by early spring it was assured that the mine would be equipped for

production. A new 4-compartment shaft was collared and sinking commenced on October 18. At the end of the year it had been sunk to a depth of 228 feet, and the mill and crushing-plant foundations had all been poured. By early fall all supplies and machinery had been delivered by water freight from Hudson, on the Canadian National railway, to Gold Pines at the head of Lac Seul. More than 1,000 tons of cement were flown into the property.

In the Birch Lake area, Jason Mines, Limited, was formed to take over the liabilities and property of the *Argosy*. Argosy Gold Mines, Limited, had suspended all operations on February 2 and gone into receivership. On September 23, Jason started a diamond-drilling exploration on what is known as No. 1 vein, some 1,200 feet east of the No. 2 or main vein.

In the Pickle-Crow area, the *Albany River* was taken over by Albany River Gold Mines, Limited, under the control of Pickle Crow Gold Mines, Limited. Operations at this property were supervised by the staff of the Pickle Crow mine, although no changes had been made in the Albany River personnel. Development was carried on until August 29, when operations were suspended owing to a shortage of power. It was expected that work would be continued as soon as power became available from the Ear Falls–Uchi line. The *Central Patricia* continued to operate all year, milling an average of 278 tons per day, which included 27 tons daily from the *Springer* or No. 2 operation. Trucks began transporting ore from the Springer vein to the mill on May 28. At the end of the year the mill was treating 315 tons daily. Shaft-sinking was resumed in December at both properties. No. 1 shaft was 1,624 feet deep, and No. 2 shaft 525 feet deep by the end of the year. The *Pickle Crow* operated all year, hoisting an average of 375 tons daily, from which 56 tons were sorted before milling. Shaft-sinking was completed to 1,996 feet by April 15 and new levels opened up at 1,350, 1,500, 1,650, and 1,950 feet, followed by lateral work on all these levels. During the spring, diamond-drilling was done on a vein some 800 feet north of the shaft. As a result of this drilling, a 1,200-foot crosscut was started in September from the 750-foot level at the Pickle Crow to explore the zone at depth. After assuming the direction of the *Albany River* in June, contracts were made with the Ontario Hydro-Electric and an extension from the Ear Falls–Uchi line, 110 miles in length, was commenced.

Gold Mines of Kenora District.—In the Lake of the Woods area, underground operations at the *Kenricia* were suspended in December, 1937, when it was decided to build a 100-ton cyanide mill at the property. The mine was idle during 1938, but the workings were kept dry. Power was obtained in November, and mill foundations were completed. On February 16, Split Lake Gold Mines resumed operations on the *Oliver-Severn* claims on Bigstone bay, 6 miles east of Kenora. The workings were unwatered, a new headframe was erected, and a mining plant was installed. Drifting, shaft-sinking, and lateral work were done. Operations were suspended on May 18, and the property was idle for the remainder of the year. The *Wendigo*, the only gold producer in the Lake of the Woods area during 1938, produced at the rate of 90 tons per day. A flotation unit was added in January. The concentrates were bagged and shipped to a customs smelter. During the year the shaft was deepened and extensive lateral work was done.

Straw Lake Beach in Straw Lake area operated underground intermittently all year. In July installation of a 60-ton mill was commenced, and milling was begun in November at the rate of 54 tons per day.

In the Upper Manitou area, the *Big Master* carried on a diamond-drilling campaign from February to June to explore three new vein systems. The old

KENORA DISTRICT

PRODUCTION STATISTICS OF GOLD MINES, 1885–1937[1]

(Value includes gold and silver, and exchange and equalization have been added since 1920)

Mine	Year	Quantity	Value
		tons	
Baden-Powell[2]	1902, 1905	104	$1,273
Big Master	1902, 1903, 1905	5,027	39,261
Black Jack	1893	50	300
Britannia	1899	20	110
Cameron Island (Damascus)[3]	1898, 1906, 1934, 1935, 1936	1,287	163,871
Camp Bay	1904–1906	7,717	7,531
Cedar Island (Cornucopia)[4]	1896, 1932, 1935, 1936	17,050	174,146
Champion (Bad)	1900	[5]100	.....
Clark	1935	87	1,250
Combined	1904	37	220
Cornucopia. *See* Cedar Island.			
Cross, J. G.	1937	.....	107
Crown Point	1900	150	900
Duport. *See* Cameron Island.			
Darkwater	1936, 1937	13	1,086
Elora[6]	1936, 1937	10,365	28,511
Empire	1908	300	1,800
Glass Reef	1900	.....	171
Gold Hill	1886, 1893	220	19,610
Gold Panner	1900	100	900
Grace	1902, 1907, 1908	415	865
Kenland. *See* Regina.			
Kenora Prospectors and Miners. *See* Cedar Island and Mikado.			
Laurentian[6]	1906–1909[7]	19,950	141,140
Mikado[8]	1896–1902, 1910, 1911, 1931	57,813	421,070
Minerva	1885	28	1,372
Olympia	1906, 1911, 1912	1,148	3,564
Ophir	1893, 1894, 1900, 1911	6,089	22,677
Quarry Island	1899	176	1,063
Regina[9]	1895–1899, 1902, 1904, 1905, 1936	28,718	156,275
Royal Sovereign	1902	.....	122
Rush Bay (Golden Horn)	1906, 1907	350	560
Sakoose (Golden Whale)	1899–1901	8,028	58,758
Sultana	1894–1902, 1904–1906	77,436	428,638
Sunbeam	1904	650	4,875
Treasure	1898	34	529
Twentieth Century	1902, 1903	8,688	43,586
Vermilion Lake (Botham)	1930, 1935	43	575
Wabigoon–Contact Bay[10]	1905,[11] 1916,[12] 1917,[12] 1918,[13] 1920,[14] 1923,[14] 1929	1,839	7,936
Wendigo	1900,[15] 1936, 1937	38,311	368,932
Total		292,343	$2,103,584

[1]In addition to the figures given and duplicating them in part, the following reduction plants carried on operations in Kenora, then called Rat Portage, and reported as follows: (1) Dominion Reduction Company (1895, 1897, 1900), 666 tons, $5,298; (2) Ottawa Gold Milling and Mining Company (1898–1900), 5,153 tons, $26,181; (3) Rat Portage Reduction Works (1900) milled 200 tons of Wendigo ore; no data of recovery made are available; (4) Keewatin Reduction Works (1900) milled 100 tons ore from Champion and 1,000 tons from Wendigo; no data of recovery made are available.

[2]Northern Lights Mines Company.

[3]Acquired by Duport Mining Company, Limited, in 1929.

[4]Acquired by Kenora Prospectors and Miners, Limited, in 1928. The mine was called Cornucopia prior to 1932.

[5]Reported milled in custom mill, no data.

[6]Elora Gold Mines, Limited, acquired the Laurentian mine in 1935.

[7]Operated by Imperial Gold Mines, Limited.

[8]Acquired by Kenora Prospectors and Miners, Limited, in 1928.

[9]Or Black Eagle; acquired by Kenland Gold Mines, Limited, in 1936, from Horseshoe Mines, Limited.

[10]Contact Bay Mines, Limited, was incorporated in 1918 and acquired the Rognon, Redeemer, and Bonanza claims; the name was changed to Wabigoon–Contact Bay Mines, Limited, in 1923; and in 1935 the property was acquired by Northern Mines, Incorporated.

[11]Redeemer. [12]Rognon. [13]Redeemer (with the exception of 8 tons, valued at $46, from Rognon). [14]Bonanza. [15]Some 1,200 tons milled in custom mill in 1900, but no statistics of values available.

workings were unwatered in July for examination purposes by Selby Lake Mines, who were granted an option on the Big Master property. The examination consisted of underground sampling, checking diamond-drill cores, and underground geology. The mine was then allowed to fill up again. Underground work was resumed at the *Selby Lake* in January, after a temporary shutdown. Diamond-drilling and lateral work were done on the 125- and 250-foot levels until March 24. Work was then suspended. The mine was unwatered in July for examination. The *Elora* mine was unwatered in August and the old workings were sampled; in September operations were suspended.

Some two miles west of Kenora, the *Kenopo Mining and Milling Company* built a 25-ton mill. The company has two claims adjoining Electrum lake, near High lake, about two miles east of the Manitoba boundary. High-grade ore was mined from the surface and trucked to the mill.

Gold Mines of Rainy River District.—There was very little activity in 1938 in gold prospecting and development of properties. At Mine Centre, the *Orelia* leased eight patented claims, and work was commenced on June 1. The old amalgamation mill was repaired, and about 250 tons of old tailings from the lake were milled with unsatisfactory results. About 150 tons of ore were taken from an open cut near the old workings of the mine. During August, September, and October, a very thorough job of trenching, test-pitting, and sampling was done at the *Lucky Coon* property. It was inactive at the end of the year. Diamond-drilling was done on the *South Vermillion* mine from July to October. At Atikokan the *Elizabeth* did only assessment work on the surface. Underground operations at the *Upper Seine*, which had commenced early in the year, were suspended on June 12.

RAINY RIVER DISTRICT

PRODUCTION STATISTICS OF GOLD MINES, 1895–1937

(Value includes gold and silver, and exchange and equalization have been added since 1920)

Mine	Year	Quantity	Value
		tons	
Barker	1898	70	$490
Central Canada[1]	1934	350	742
Elizabeth	1912	50	400
Foley[2]	1897, 1898, 1933–1935	5,553	51,403
	1934 (in concentrates)	15	1,255
Gold Winner	1900	15	70
Golden Crescent (A.D. 2)	1897	192	1,543
Golden Star	1898–1901, 1934	15,262	168,768
Hammond Reef	1897	977	3,857
Harold Lake	1895, 1896	1,131	11,236
Independence (Bennett tp.)	1898	125	1,906
Lucky Coon	1899, 1935, 1936	10	249
Manitou	1896	12	413
Olive	1897–1900, 1937	7,255	48,903
Saundary[3]	1934	13	435
Sawbill[4]	1897–1899	2,416	8,982
W. E. Stone	1919, 1920	2	319
Total		33,448	$300,971

[1]Formerly the Walsh.
[2]Acquired in 1936 by Santa Fe Gold Mines, Limited.
[3]Formerly the Headlight or Swede Boy.
[4]Now owned by Upper Seine Gold Mines, Limited.

The Price of Gold in Canada

In 1938 the price of gold in Canadian funds fluctuated from the low of $34.99 in January to the high point of $35.36 in June. The average for the year was $35.17, compared to $34.99 in 1937, $35.03 in 1936, and $35.19 in 1935.

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 the years 1931 and 1932, as follows: $81,728.42 received in 1933 should be credited to 1932, and $113,088.91 should be deducted from 1932 and credited to 1931. In 1930, the exchange did not overlap with 1931.

EXCHANGE EQUALIZATION RECEIVED ON GOLD MARKETED BY ONTARIO PRODUCERS, 1920–1938

Year	Porcupine	Kirkland Lake	Matachewan	N. W. Ontario	Other sources	Total
1920	$1,265,644	$110,354	.....	$257	.....	$1,376,275
1921	1,238,211	121,425	.....	.....	.....	1,359,636
1922	189,022	19,591	.....	.....	$8	208,621
1923	241,602	38,565	.....	29	.....	280,196
1924	172,722	24,028	.....	.....	.....	196,750
1925[1]	—2,607	—231	.....	.....	.....	—2,838
1926[1]	.....	—595	.....	.....	.....	—595
1927	.....	.....	.....	.....	.....	.....
1928	.....	2,811	.....	.....	.....	2,811
1929	87,173	70,283	.....	.....	.....	157,456
1930	20,912	15,791	.....	.....	.....	36,703
1931	830,799	1,006,607	.....	61,857	26,958	1,926,221
1932	2,815,381	3,106,487	.....	211,959	330	6,134,157
1933	8,249,321	7,305,041	$143,866	[2]495,335	292,874	16,486,437
1934	13,275,684	13,694,400	246,491	1,235,995	834,869	29,287,439
1935	14,043,630	13,718,813	620,177	2,784,979	1,002,198	32,169,797
1936	14,684,038	13,860,383	602,989	3,938,110	1,054,406	34,139,926
1937	16,041,591	14,300,102	749,249	4,856,995	1,080,771	37,028,708
1938	18,276,108	14,969,855	852,934	6,806,053	1,165,280	42,070,230
Total	$91,429,251	$82,363,710	$3,215,706	$20,391,569	$5,457,694	$202,857,930

[1]Discounts paid during years when Canadian funds were at a premium. Figures for the two years have been deducted to arrive at the net totals.
[2]Includes $26 from West Shiningtree.

Gold-Milling Plants

Eleven new plants became producers in 1938: Moneta, 200 tons; Tombill, 100 tons; Hard Rock, 300 tons; MacLeod-Cockshutt, 500 tons; Kerr-Addison, 600 tons; Golden Gate, 150 tons; Sachigo River, 25 tons; Hallnor, 400 tons; Porcupine Lake, 20 tons; Cline Lake, 200 tons; Madsen Red Lake, 300 tons. In addition to the new mills, Deep Lake, 25 tons; Minto, 100 tons, and J-M Consolidated, 100 tons, reopened after having been closed down in 1937. At the end of the year eight mills were under construction.

STATISTICS OF GOLD-MILLING PLANTS AT ONTARIO MINES, 1938

Area and mine	Rated daily capacity	Daily operating average	Plants under construction	Idle plants	Plants proposed
LARDER LAKE AREA:					
Britcana					15
Chesterville					500
Kerr-Addison	650	611			
Omega	500	484			
Raven River	75	65			
KIRKLAND LAKE BELT:					
Bidgood	125	144			
Golden Gate	150	49			
Golden Summit				15	
Kirkland Lake Gold	225	253			
Lake Shore	2,300	2,525			
Lucky Kirkland					35
Macassa	400	303			
Mesabi	100	47			
Morris Kirkland[1]	100	94			
Sylvanite	525	522			
Teck-Hughes	1,000	1,041			
Toburn	150	143			
Upper Canada					150
Wright-Hargreaves	1,200	1,190			
PORCUPINE BELT:					
Amca				75	
Buffalo Ankerite (two mills)	1,000	994			
Canusa				50	
Coniaurum	600	519			
Delnite	275	235			
De Santis			100		
Devon					50
Dome	1,500	1,648			
Gillies Lake–Porcupine				60	
Hallnor	400	297			
Hollinger	6,000	4,791			
McIntyre-Porcupine	2,500	2,359			
McLaren-Porcupine				15	
Moneta	200	152			
Munro Croesus				15	
Naybob	150	37			
Northern Turnbull				15	
Pamour	1,500	1,411			
Paymaster Consolidated	550	520			
Porcupine Lake	20	18			
Porcupine Peninsular				150	
Porcupine United				25	
Preston East Dome			300		
Ross (Hollinger)	150	122			
Vimy				50	
Vipond (Mace)	300	170			
MATACHEWAN AND WEST SHININGTREE AREAS:					
Bilmac			75		
Churchill				10	
Matachewan Consolidated	300	423			
Ronda			125		
Tyranite					200
Young-Davidson	1,000	992			
SUDBURY DISTRICT:					
Fox Lake				25	
Gomak				35	
Halcrow-Swayze				25	
Kenty				5	
Long Lake (Lebel Oro)	75	94			
New Golden Rose	100	110			
Smith-Thorne (Tionaga)	50	42			

STATISTICS OF GOLD-MILLING PLANTS AT ONTARIO MINES, 1938—*Continued*

Area and mine	Rated daily capacity	Daily operating average	Plants under construction	Idle plants	Plants proposed
ALGOMA DISTRICT:					
Algold	100	35	.....	.....	.....
Algoma Summit	500	192	.....	.....	.....
Centennial (Agawa)	.....	.....	.....	50	.....
Cline Lake	200	193	.....	.....	.....
Darwin	.....	.....	.....	42	.....
Deep Lake[2]	25	.....	.....	.....	.....
Edwards	.....	.....	.....	75	.....
Minto	100	53	.....	.....	.....
Parkhill[2]	72	40	.....	.....	.....
Shenango	.....	.....	.....	50	.....
Stanley	.....	.....	.....	35	.....
THUNDER BAY DISTRICT:					
Ardeen	.....	.....	.....	200	.....
Bankfield	130	132	.....	.....	.....
Empress	.....	.....	.....	50	.....
Hard Rock	300	212	.....	.....	.....
Harkness-Hays	.....	.....	.....	25	.....
Leitch	75	83	.....	.....	.....
Little Long Lac	280	279	.....	.....	.....
MacLeod-Cockshutt	500	466	.....	.....	.....
J. Bruce McMartin (Sarmac)	.....	.....	.....	20	.....
North Shores	.....	.....	.....	25	.....
Northern Empire	180	182	.....	.....	.....
St. Anthony	125	81	.....	.....	.....
Sand River	75	97	.....	.....	.....
Schreiber Pyramid	.....	.....	.....	15	.....
Sturgeon River	75	77	.....	.....	.....
Tashota	.....	.....	.....	52	.....
Tombill	100	87	.....	.....	.....
KENORA AND RAINY RIVER DISTRICTS:					
Elora	.....	.....	.....	57	.....
Golden Star	.....	.....	.....	5	.....
Kenland	.....	.....	.....	60	.....
Kenricia	.....	.....	100	.....	.....
Olive	.....	.....	.....	10	.....
Orelia[2]	25	.....	.....	.....	.....
Saundary	.....	.....	.....	5	.....
Straw Lake Beach	60	53	.....	.....	.....
Upper Seine	.....	.....	75	.....	.....
Wendigo	80	82	.....	.....	.....
PATRICIA PORTION:					
Argosy	125	52	.....	.....	.....
Bathurst (Car Lake)	.....	.....	.....	10	.....
Berens River	.....	.....	225	.....	.....
Central Patricia	200	297	.....	.....	.....
Gold Eagle	125	120	.....	.....	.....
Hasaga[3]	125	114	.....	.....	.....
Howey	1,250	1,227	.....	.....	.....
Hudson-Patricia	.....	.....	.....	50	.....
J-M Consolidated	100	98	.....	.....	.....
McKenzie Red Lake	150	173	.....	.....	.....
Madsen Red Lake	360	314	.....	.....	.....
Pickle Crow	400	317	.....	.....	.....
Sachigo River	25	25	.....	.....	.....
Sol D'Or	.....	.....	.....	10	.....
Uchi	.....	.....	500	.....	.....
Total	30,032	27,486	1,500	1,416	950

[1]Operated 9 months and rented plant to Upper Canada.
[2]Very small production from erratic operations.
[3]Red Lake Gold Shore mill.

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, 1934–1938

Year	Quantity	Precious metals		Total value (standard)	Buying rate in Canada for New York funds[1]
		Gold	Silver		
	crude ounces	fine ounces	fine ounces		
1934	2,668,456	2,031,719	292,445	$42,134,234	0.99
1935	2,798,831	2,195,386	310,104	42,578,603	100.54
1936	2,998,696	2,346,529	379,693	48,674,046	100.072
1937	3,260,622	2,565,457	381,276	53,199,646	99.98
1938	3,570,998	2,840.981	398,898	58,896,343	100.559

[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.

World Output

The figures for the output by the leading gold-producing countries from 1934 to 1938, inclusive, in the following table are those published by the American Bureau of Metal Statistics.

OUTPUT BY THE LEADING GOLD-PRODUCING COUNTRIES, 1934–1938[1]
(One dollar = 0.048375 ounces)

	1934	1935	1936	[2]1937	[2]1938
NORTH AMERICA:	fine ounces	fine ounces	fine ounces	fine ounces	fine ounces
United States[3]	2,916,373	3,618,843	4,295,648	4,753,104	5,008,178
Canada	2,972,074	3,284,890	3,748,028	4,096,213	4,715,480
Mexico	661,390	682,319	753,950	846,381	923,000
Newfoundland	12,000	12,700	16,000	22,500	26,000
Total North America	6,561,837	7,598,752	8,813,626	9,718,198	10,672,658
CENTRAL AMERICA AND WEST INDIES	130,000	135,000	140,000	140,000	*160,000
SOUTH AMERICA:					
Brazil	113,621	120,597	125,405	145,771	145,000
Chile	237,656	265,938	248,793	272,698	293,995
Colombia	344,140	328,991	389,491	442,222	519,000
Ecuador	66,427	71,512	78,685	59,500	55,000
Peru	98,861	110,950	152,391	213,990	250,000
Guiana—British	27,510	30,488	32,234	35,993	*36,000
—Dutch	9,600	9,600	12,100	10,600	12,000
—French	47,454	47,390	45,557	45,583	40,605
Venezuela	109,053	112,390	109,996	116,514	125,000
Other South America	65,501	75,000	50,000	55,000	*60,000
Total South America	1,119,823	1,172,856	1,244,652	1,397,871	1,536,600

[1]From the Year Book of the American Bureau of Metal Statistics, 1938.
[2]The 1937 and 1938 compilations contain some preliminary data, and conjectural figures (*) have been inserted where necessary.
[3]Production of the Philippine Islands is included with the United States.

OUTPUT BY THE LEADING GOLD-PRODUCING COUNTRIES, 1934–1938—*Continued*
(One dollar = 0.048375 ounces)

	1934	1935	1936	1937	1938
	fine ounces	fine ounces	fine ounces	fine ounces	fine ounces
EUROPE:					
Czechoslovakia	7,587	16,573	16,236	10,031	10,000
France	101,498	91,598	85,680	72,757	*75,000
Jugoslavia	71,342	76,485	84,104	87,564	78,301
Rumania	111,496	144,675	150,746	166,540	172,453
Russia and Siberia	4,000,000	5,000,000	6,500,000	*5,900,000	*5,800,000
Sweden	246,687	180,554	158,339	193,222	230,000
Other Europe	18,500	15,000	25,000	35,000	45,000
Total Europe	4,557,100	5,224,885	7,020,105	6,465,114	6,410,754
OCEANIA:					
New South Wales	36,123	50,102	60,739	68,607	88,708
Queensland	115,471	102,990	121,174	127,281	151,432
Victoria	70,275	87,600	113,940	145,799	144,243
Western Australia	651,338	649,049	846,208	1,000,642	1,167,792
Tasmania	5,622	8,343	17,600	20,277	22,200
New Guinea	184,505	184,009	221,000	217,149	241,700
New Zealand	160,248	165,277	164,575	168,487	151,062
Other Oceania	22,500	45,000	53,100	65,000	138,000
Total Oceania	1,246,082	1,292,370	1,598,336	1,813,242	2,105,137
ASIA:					
British India	322,143	327,653	333,386	331,748	322,000
China (including Manchuria)	152,400	155,000	200,000	210,000	188,000
Chosen (Korea)	399,560	472,927	562,316	734,580	930,000
Netherland India	71,039	68,248	71,688	55,618	*75,000
Formosa	33,629	37,230	40,000	*50,000	*60,000
Japan	486,976	589,020	713,685	723,375	*760,000
Other Asia	86,700	75,000	100,000	95,000	100,000
Total Asia	1,552,447	1,725,078	2,021,075	2,200,321	2,435,000
AFRICA:					
Belgian Congo	337,382	376,155	402,487	432,321	460,000
French West Africa	97,706	121,000	114,422	128,217	127,153
Kenya	(4)	23,000	38,463	54,774	70,000
Madagascar	15,979	15,464	15,200	13,471	15,000
Rhodesia	693,265	727,927	801,512	808,447	815,191
British West Africa[5]	384,268	428,550	499,474	621,395	725,000
Tanganyika	42,606	52,182	69,675	74,676	89,800
Transvaal, Cape Colony, and Natal	10,479,857	10,773,991	11,336,214	11,734,575	12,160,392
Other Africa	100,000	87,000	115,000	130,000	160,000
Total Africa	12,151,063	12,605,269	13,392,447	13,997,876	14,622,536
TOTAL FOR WORLD	27,318,362	30,054,210	34,230,241	35,732,622	37,942,685

[4]Included in Other Africa.
[5]Comprising Gold Coast, Sierra Leone, and Nigeria.

Maximum Canadian production	4,715,480 ounces in 1938
Maximum Russian production	6,500,000 ounces in 1936
Maximum U.S. production	5,008,178 ounces in 1938
Maximum Transvaal, Cape Colony, and Natal production	12,160,392 ounces in 1938
Maximum World production	37,942,685 ounces in 1938

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, 1937 AND 1938

Area or district	1937			1938		
	No. of wage-earners	Wages paid	Average wage per annum	No. of wage-earners	Wages paid	Average wage per annum
Porcupine belt	7,043	$12,214,799	$1,734	7,557	$13,133,550	$1,738
Kirkland Lake area	4,633	7,629,648	1,646	4,560	7,880,132	1,728
Larder Lake area	[1]	[1]	[1]	537	775,465	1,444
Matachewan area	350	629,741	1,799	436	710,078	1,629
Sudbury district[2]	207	286,705	1,385	196	349,266	1,782
Algoma district	344	470,833	1,369	291	422,370	1,451
Thunder Bay district	955	1,569,761	1,644	1,450	2,444,373	1,686
Patricia portion	1,056	1,864,761	1,766	1,322	2,052,382	1,552
Kenora and Rainy River districts	171	244,357	1,429	142	202,957	1,429
Operating but non-producing	2,765	3,622,920	1,310	1,279	1,421,946	1,112
Total	17,524	$28,533,525	$1,628	17,770	$29,392,519	$1,654

[1]Included in Kirkland Lake area.
[2]Includes West Shiningtree area.

Nickel-Copper and Platinum Metals

Two companies, the International Nickel Company of Canada, Limited, and Falconbridge Nickel Mines, Limited, made the statistical returns to the Department of Mines from which the following information was gathered.

The total gross value of the various primary products of the nickel-copper industry, including platinum metals, silver, gold, selenium, tellurium, and sulphur, was estimated in 1938 at $96,309,239, compared to $99,351,493, which was the value of the production of the gold-mining industry.

The output of new nickel totalled 210,432,701 pounds, valued at $53,875,726, against 224,627,184 pounds, worth $59,414,075, in the previous year. The recovery of copper from Sudbury ores was 308,706,996 pounds valued at $30,373,279.

It will be noted in the table below that there was less ore shipped and treated and that the copper in blister produced in Ontario was below the figure for 1937, but the quantity of matte exported as well as the nickel and copper content was greater in 1938.

NICKEL-COPPER MINING AND SMELTING, 1934–1938

Item	1934	1935	1936	1937	1938
	tons	tons	tons	tons	tons
1. Ore shipped	2,903,310	3,608,437	4,634,434	6,318,907	6,276,232
2. Ore treated	2,896,959	3,616,223	4,620,183	6,304,517	6,280,283
3. Copper in blister produced in Ontario	95,826	119,720	137,369	154,415	147,439
4. Nickel produced in Ontario	35,487	40,191	51,930	73,650	62,141
5. Matte exported[1]	46,755	46,371	50,644	58,673	63,423
6. Nickel content of matte exported[2]	28,771	28,949	32,787	38,663	43,075
7. Copper content of matte exported[2]	6,692	6,272	6,495	6,496	6,914

[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. Every year since 1934 and including that year, some thousands of tons were brought back to Canada for treatment. These have been deducted.

[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.

Production of Precious Metals

The recovery of precious metals from the Sudbury ores is a very important part of the nickel-copper industry. In 1938 the value of platinum metals, gold, and silver produced by the two companies amounted to $12,784,586. The silver output of the mines of the Sudbury district surpasses by far that of the Cobalt area. Selenium, tellurium, and sulphuric acid are other by-products of the industry.

PRECIOUS METALS RECOVERED, 1934–1938

	1934	1935	1936	1937	1938
	ounces	ounces	ounces	ounces	ounces
Platinum metals:					
Platinum	116,177	105,335.28	131,551	139,355.50	161,310
Palladium	83,932	81,902.61	99,758	113,483.53	122,932
Rhodium, ruthenium, osmium, and iridium		2,869	3,913	6,345.07	7,961
Total ounces	200,109	190,106.89	235,222	259,184.10	292,203
Value	$6,187,992	$5,407,392	$7,802,997	$9,931,556	$8,873,621
Gold ounces	60,370	69,023.96	73,372	75,437.88	80,222
Silver ounces	1,882,293	2,243,746	2,484,568	2,364,010	2,505,129

Operations at the Mines

Four mines were operated by the International Nickel Company during 1938. At the Frood mine stoping was carried on between the 1,800- and 3,300-foot levels throughout the year. Open pit operations were started in August. An addition was made to the No. 3 shaft rock-house to handle both ore and waste from the open pit. The Creighton mine operations were carried on at capacity until July, when they were reduced until November. Full capacity was then resumed. The No. 2 shaft at Levack was completed to a depth of 1,860 feet. Stations were cut and put in operating service late in November. The production of ore was reduced from the beginning of July until November. Production was kept at capacity during the full year at Garson. The addition to the concentrator at the Copper Cliff plant was completed. One blast furnace was taken out of production at the smelter during the period of slackened production at the mines. At the Coniston smelter one blast furnace was also taken out of production.

The No. 5 shaft at the Falconbridge was sunk an additional 662 feet to a total depth of 2,475 feet. On the 2,100-foot level, development was started to connect No. 5 shaft to No. 1 shaft. Production was maintained at about 40,000 tons a month from stoping between the 225- and 1,200-foot levels. Some ore was also drawn from shrinkage stopes which had been previously mined.

At the Denison mine the 3-compartment vertical shaft was sunk an additional 368 feet to a total depth of 880 feet. Stations were cut at 650 and 800 feet. Electrical power was obtained from the High Falls hydro-electric line. Development was carried on at the 350- and 500-foot levels, and small-scale operations were also noted on the 650-foot level.

Dividends

Total dividends paid to the end of 1937 and payments in 1938 are given in the table on page 31. 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.

STATISTICAL SYNOPSIS OF THE NICKEL-COPPER INDUSTRY IN ONTARIO, 1936, 1937, AND 1938

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
1936	3	6 mines 3 smelters 2 refineries	$108,824,797	$21,886,753	71 130 180	$220,130 467,466 449,138	4,344 3,212 1,568	$7,087,766 4,319,309 2,161,686	Matte (exported) Metallic nickel Nickel oxide and salts Converter copper Gold (standard) Exchange Silver Platinum metals Selenium and tellurium	$44,650,242 26,054,603 1,516,738 1,053,490 1,121,198 7,802,997 206,200
Total			$108,824,797	$21,886,753	381	$1,136,734	9,124	$13,568,761		$82,405,468
1937	2	7 mines[4] 3 smelters 2 refineries	$117,494,956	$35,736,054	76 148 203	$251,472 541,291 527,632	5,462 3,786 1,950	$9,919,558 5,793,241 2,972,137	Matte (exported) Metallic nickel Nickel oxide and salts Converter copper Gold (standard) Exchange Silver Platinum metals Selenium and tellurium	$60,713,374 40,388,817 1,559,439 1,080,132 1,061,000 9,931,556 213,390
Total			$117,494,956	$35,736,054	427	$1,320,395	11,198	$18,684,936		$114,947,708
1938	2	6 mines[5] 3 smelters 2 refineries	$125,117,382	$32,091,513	76 157 115	$266,999 560,772 364,845	5,247 3,622 1,928	$9,626,411 5,731,439 2,961,161	Matte (exported) Metallic nickel Nickel oxide and salts Converter copper Gold (standard) Exchange Silver Platinum metals Selenium	$70,350,870 29,405,285 1,658,336 1,163,473 1,089,156 8,873,621 94,691
Total			$125,117,382	$32,091,513	348	$1,192,616	10,797	$18,319,011		$112,635,432

[1]The capital invested is exclusive of value of mineral lands. In the report for 1929, Volume XXXIX, Part I, 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]Includes Cuniptau.

[4]Includes Drury Nickel Mines, Limited, and Ontario Nickel Corporation, Limited, which were active but non-producing.

[5]Includes Denison Nickel Mines, Limited, which was active but non-producing.

DIVIDENDS PAID BY NICKEL COMPANIES TO END OF 1938

Company	Period	To end of 1937	1938
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	1929–1938	17,184,406.53	$1,933,898.75
International Nickel Company of Canada, Limited[2] common	1929–1938	103,060,324.76	29,156,338.00
Falconbridge Nickel Mines, Limited	1933–1938	4,714,962.00	1,001,276.09
Total	.....	$205,045,660.29	$32,091,512.84
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 $28,291,126	.....
GRAND TOTAL	.....	$233,336,786.29	$32,091,512.84

[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]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.

Silver-Cobalt

The metal content[1] of all ores raised, treated, and shipped by the silver-cobalt mines in 1938 totalled 1,364,072 ounces of silver, 245,031 pounds of cobalt, and 35,804 pounds of nickel in 60,828.59 tons of ore, as against 1,632,087 ounces of silver, 238,600 pounds of cobalt, and 3,677 pounds of nickel in 62,088 tons during the calendar year 1937.

The figures above show that the output of silver is steadily declining and that cobalt, owing to the active demand, showed an increase in so far as metal content of ore is concerned.

The declining output from the famous silver-cobalt mining camps at Cobalt, South Lorrain, and Gowganda exemplifies the history of many other high-grade discoveries of precious metals. While there are the examples of iron, copper, lead, zinc, and nickel mines, which either have been in production for centuries or already give indications of very long life, it is a fact that the majority of the

[1]A distinction should be kept in mind between production of silver and the metal content of ore shipped. The former is based on the actual recovery of silver bullion plus the silver content of ores, etc., exported from the province, while metal content of ore shipments refers merely to the assay contents of the ore shipped from the mines, irrespective of whether or not it was actually smelted during the period under review. That is, for the figures of production of the metals silver and cobalt, the statistics are based as nearly as possible on the smelter returns from the ores treated during the period. It does not necessarily follow that because ores are shipped from the mines, they are also smelted.

precious metal deposits have had short lives. A few precious metal mines in Mexico, South America, South Africa, and India have already been worked for many years and are still in production. Many of the gold mines of Ontario will continue for years. In contrast, however, the silver-cobalt mines of Ontario, discovered in 1904, rose to their peak of production in 1911 with more than thirty million ounces, then gradually declined to the ten million mark in 1926, and since that time have so dwindled in output that barely more than one million ounces are now to be credited annually to this once famous camp.

In part, the serious decline in silver may be placed to the low prices for that metal now obtaining and, also, to the ever-mounting increases of by-product silver recovered in base-metal smelting. But the silver areas, despite their relatively short life as large producers, will possibly be the scene of mining for several years to come. These complex ores have had much influence on metallurgy and have added new metals and alloys to the manufacturing industry. The successful processing and smelting of silver-cobalt-arsenic ores and the methods developed for the production of cobalt metal and cobalt oxide and salts was a triumph for Canadian metallurgy and for many years made Ontario the world's leading producer of this relatively rare metal.

As a matter of fact, it is the active demand for cobalt which now keeps the silver mines in operation. In 1939, some 44 properties reported production of ore, the output ranging from a 1-ton lot to as high as 27,000 tons by the O'Brien mine. Many of the old mines were operated by lessees, thus creating a considerable degree of employment for many who otherwise would have been on relief. A new venture was undertaken by the establishment in November of the Cobalt Products milling plant, which supplied a market for the small operator. The O'Brien mill also treated more than 4,000 tons of custom ore in addition to the material from the company-owned mines.

The tables referring to this industry, called Shipments from Silver Mines, Smelters, and Refineries; Dividends and Bonuses Paid; and Silver Shipments by Camps, which have been carried for so many years in the annual reports of the Department, will no longer be repeated in their detailed form, as on pages 29, 30, 31, and 32, of Part I, Volume XLVII. They will be continued in abbreviated form as follows:—

SHIPMENTS FROM SILVER MINES, SMELTERS, AND REFINERIES

Material	1904–1937		1938		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
Bismuth.....tons	80	$159,047	5	$9,754	85	$168,801
Copper.....tons	931	286,347	15	2,910	946	289,257
Lead.....tons	355	31,855	11	748	366	32,603
Nickel.....tons	6,230	1,488,513	70	38,768	6,300	1,527,281
Cobalt.....tons	16,328	28,490,902	229	790,913	16,557	29,281,815
Arsenic.....tons	72,189	5,842,856	1,088	56,538	73,277	5,899,394
Silver.....ounces	430,832,802	258,573,207	4,316,558	1,865,798	435,149,360	260,439,005
Total.....	.....	$294,872,727	.....	$2,765,429	.....	$297,638,156

DIVIDENDS AND BONUSES PAID BY SILVER-MINING COMPANIES

	To Dec. 31, 1937	1938	Total
Coniagas Mines, Ltd.....	$11,940,000.00	$200,000.00	$12,140,000.00
Nipissing Mining Co., Ltd.....	32,652,297.25	185,000.00	32,837,297.25
All other companies.....	55,132,488.91	.....	55,132,488.91
Total.....	$99,724,786.16	$385,000.00	$100,109,786.16

SILVER SHIPMENTS BY CAMPS

	1904–1937	1938	Total
	ounces	ounces	ounces
Cobalt	381,635,561	819,511	382,455,072
Casey township	2,799,740	.....	2,799,740
South Lorrain	22,867,295	40,208	22,907,503
Gowganda	24,647,496	502,871	25,150,367
Montreal River and Maple Mountain	31,657	.....	31,657
Northwestern Ontario	19,101	1,482	20,583
Total	432,000,850	1,364,072	433,364,922

The following table shows the total silver production for the years 1937 and 1938:—

SILVER PRODUCTION, 1937 AND 1938

Source	1937		1938	
	Fine ounces	Value	Fine ounces	Value
Sales of bullion by the reduction companies, smelters, and mines	1,527,149	$677,910	1,272,634	$548,594
Contained in silver-cobalt concentrates and residues exported from Canada	62,865	23,597		
Estimated as recovered from concentrates treated in other provinces	233,438	104,836		
In crude gold bullion	514,403	226,421	538,795	228,048
Recovered by nickel-copper refineries	2,364,010	1,061,000	2,505,129	1,089,156
Total	4,701,865	$2,093,764	4,316,558	$1,865,798

It might be observed again that these figures are based as nearly as possible on the actual output of silver bullion and as a result may differ considerably from the figures of silver as contained in ores mined and shipped. There is also included the silver recovered by the auriferous quartz mines and in the smelting of nickel-copper ores.

Formerly the Cobalt camp, with the Deloro Smelting and Refining Company being the only plant in North America capable of handling cobalt-arsenide ores, was the largest producer of cobalt metal and oxides in the world. The development of cobalt deposits in Africa and Australia during the past decade has, however, made available large quantities of the metal, which are refined in Germany and Belgium principally. The metal content of silver-cobalt ores from Ontario mines by camps in 1937 and 1938 was as follows:—

METAL CONTENT OF SILVER-COBALT ORES SHIPPED BY CAMPS, 1937 AND 1938

Camp	1937			1938		
	Silver	Cobalt[1]		Silver	Cobalt[1]	
	fine ounces	lbs.		fine ounces	lbs.	
Cobalt	702,416	213,636	$97,046	819,511	200,543	$109,563
Gowganda	522,483	21,258	917	502,871	16,778	1,036
South Lorrain	47,045	7,037	4,978	40,208	27,710	14,180
Total	1,271,944	241,931	$102,941	1,364,072	245,031	$124,779

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

Iron Ore, Pig Iron, and Steel

The three blast furnace establishments in Ontario imported 801,646 long tons of iron ore in 1938, compared to 1,064,341 long tons in the previous year. No domestic ore has been used since 1924. From 1933 to 1937 the production of pig iron and steel had been marked by an increasing annual output. In 1938, however, the figures were considerably lower than in 1937. The total quantity of pig iron produced in 1938 was 463,153 long tons, which included basic, 313,402; foundry, 81,973; and malleable, 67,778 tons. The average price for these varieties was $25.58 per ton at Montreal. Imported iron ore sold at an average price of $5.10 (American funds) per long ton at lower lake ports, as against $5.02 in 1937

IRON AND STEEL STATISTICS, 1933–1938

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	
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
1935.....	647,597	172,609	339,551	391,792	9,011,256	584,239	19,864,126
1936.....	733,160	190,678	375,498	421,083	9,432,259	675,887	23,115,335
1937.....	1,064,341	283,059	556,172	592,800	15,904,824	891,452	36,701,079
1938.....	801,646	199,607	428,822	463,153	11,847,454	746,398	29,855,920

The average wholesale prices of pig iron in Canada during the 12 months of 1938 were as follows: No. 1 foundry, base silicon 2.25 maximum (price per gross ton, car lots, f.o.b. sellers' works), $24.00; standard malleable, base silicon 2.25 maximum (price per gross ton, f.o.b. plant), $22.00; basic silicon, 1.30 maximum (price per gross ton, f.o.b. plant), $21.50.

PIG IRON, STEEL, AND FERRO- AND OTHER ALLOY PRODUCERS, 1938

Company	Location
Abrasive Company of Canada, Ltd.[1 2]	Hamilton.
Algoma Steel Corporation, Ltd.[3 4]	Sault Ste. Marie.
Atlas Steels, Ltd.[4]	Welland.
Burlington Steel Co., Ltd.[4]	Hamilton.
Canadian Carborundum Co., Ltd.[1 2]	Niagara Falls.
Canadian Electric Castings, Ltd.[4]	Orillia.
Canadian Furnace, Ltd.[2 3]	Port Colborne.
Chromium Mining and Smelting Corporation, Ltd.[2]	Sault Ste. Marie.
Dominion Foundries and Steel, Ltd.[4]	Hamilton.
Electro-Metallurgical Co. of Canada, Ltd.[2]	Welland.
Exolon Company, Ltd.[1 2]	Thorold.
Fahralloy Canada, Ltd.[4]	Orillia.
Ford Motor Co.[4]	Ford.
Lionite Abrasives, Ltd.[1 2]	Niagara Falls.
Norton Company[1 2]	Chippawa.
Steel Company of Canada, Ltd.[3 4]	Hamilton.
Welland Electric Steel Foundry[4]	Welland.
Wm. Kennedy and Sons, Ltd.[4]	Owen Sound.

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

The production of steel declined from 891,452 long tons in 1937 to 746,398 in 1938. The average selling price was $40.00 per ton at Hamilton. Ferro-alloys in 1938 totalled 43,866 tons, compared to 63,675 tons in 1937.

Work which had started at the Helen iron mine in Michipicoten in 1937 was suspended in May, 1938, and resumed in December. This work consisted of development operations and rebuilding of surface equipment. A dis-

covery of major importance was made in Ontario in March, 1938. Hematite ore of Bessemer grade was found to underly considerable portions of Steep Rock lake, near Atikokan, west of Port Arthur. The development work in 1938 consisted mainly of diamond-drilling. The legislation passed by the Ontario Legislature in 1937 providing that a bounty of 2 cents per unit of iron will be paid to producers of iron ores for a period of ten years became effective on January 1, 1939.

The Algoma Steel Corporation at Sault Ste. Marie, the Steel Company of Canada at Hamilton, and Canadian Furnace, Limited, at Port Colborne operated their furnaces during 1938.

IRON BLAST FURNACES IN OPERATION, 1938

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, Ltd.....	1	1	350	Port Colborne.
Steel Company of Canada, Ltd.....	2	2	825	Hamilton.

Molybdenite

A small shipment of molybdenite was reported by the Zenith mine, which is located in Bagot township, Renfrew county. The shipment consisted of 13,000 pounds of concentrates.

There was much prospecting activity, especially in southeastern Ontario. Another small shipment of molybdenum ore was reported as having been made from Loon station, on the Canadian Pacific railway, in Western Ontario. There is, however, no official data obtainable from the producers.

NON-METALLICS

A slight decrease in value was registered by the non-metallic minerals in 1938 in relation to the total value of the 1937 production.

There was no production of asbestos or diatomite during the year. The output of graphite was considerably less than in 1937, but nepheline syenite and sulphur were produced in greater quantities.

During the year the search for new deposits and development work on old properties were continued, especially in southeastern Ontario. The demand for fluorspar and barite by Canadian and American industries was notable.

Actinolite, Asbestos, and Barite

There was no production of actinolite, asbestos, or barite recorded in 1938. The Rahn Lake Mines Corporation is completing construction of its mill for the treatment of asbestos and expects to operate it early in 1939. Canada Baryte Mines, Limited, was organized in October, 1938, having acquired a lease and option on the mine and mill of the Canada Night Hawk Mines, Limited, and will treat barite ores on an experimental basis.

Arsenic

The Deloro Smelting and Refining Company at Deloro is the only producer in Ontario of white arsenic (As_2O_3), which is recovered as a by-product in the smelting of silver-cobalt arsenide ores in Northern Ontario. The output for

1938 was 2,175,646 pounds, valued at $56,538, as compared with 1,389,426 pounds, valued at $41,032 in 1937.

Feldspar and Nepheline Syenite

Despite the rise in production of nepheline syenite, which is a rival for feldspar in the glass trade, the latter mineral is still being produced, although in lessened quantity. The trade agreement between Canada and the United States, effective in 1939, lessened the duty 21 per cent., thus enabling the producers who have favourable transportation facilities to reach the more northerly markets of the United States, provided the grade can meet the rigid specifications imposed. The production for 1938 was 8,106 tons valued at $65,964, as against 9,061 tons valued at $72,610 in 1937.

Nepheline syenite has a limited domestic market, but the recent trade agreement between Canada and the United States allowing imports to that country up to 50,000 tons per year assures an outlet for our resources in Methuen township. This mineral has won a place in the glass industry, where its low melting point and larger percentage of alumina and absence of free silica make it most desirable. There are many known deposits in Haliburton and Hastings counties, and new inventions and processes may make larger quantities necessary. The value of the output for 1938 was $142,737, as compared with $121,481 in the previous year.

Fluorspar

The demand for fluorspar as a flux is increasing and although the output, which comes wholly from the vicinity of Madoc in Hastings county, is small, it is increasing in amount each year. In 1938, production amounted to 217 tons valued at $3,906, as compared with 150 tons valued at $2,550 in 1937.

In accordance with the trade agreement between Canada and the United States, which came into effect on January 1, 1939, a tariff reduction of 25 per cent. is granted for fluorspar containing over 97 per cent. calcium fluoride. Three grades of fluorite are used by the trades: foundry flux, which contains about 85 per cent. calcium fluoride; acid, which contains 98 per cent.; and enamel, running 96 per cent. in calcium fluoride.

Graphite

The Black Donald Graphite Company, situated near Calabogie, is the only Ontario producer of graphite. Although the output for 1938 was $41,590, as compared with $125,343 for 1937, this does not take into consideration a considerable quantity of material on hand at the end of the current year. The company has its own concentrator, but the mine and mill operated only intermittently in 1938.

Gypsum

There are immense quantities of gypsum in southwestern Ontario now being developed by two companies, Gypsum, Lime and Alabastine, Canada, Limited, with a plant at Caledonia, and the Canada Gypsum Company, Limited, at Hagersville. The 1938 production showed an increase of 28 per cent. over the previous year, reflecting improved building and construction conditions in the province. Most of this material is consumed in the company plants for the production of gypsum products, such as wall plaster, alabastine, etc. The total amount of gypsum sold and used in 1938 was 57,503 pounds, valued at $242,470, in comparison with 53,780 pounds, valued at $233,895 in 1937.

GYPSUM SALES, 1934–1938

Grade	1934	1935	1936	1937	1938
	tons	tons	tons	tons	tons
Crushed	5,636	5,381	2,898	5,999	5,279
Fine-ground	376	187	295	285	314
Calcined, sold	226	121	287	224	232
Calcined, used in products	26,996	32,558	36,711	47,272	51,678
Total sold or used	33,234	38,247	40,191	53,780	57,503
Total value	$141,389	$164,807	$182,783	$233,895	$242,470
No. of workers	[1]69	[1]77	[1]85	[2]182	[2]194
Wages paid	$53,718	$99,137	$80,481	$197,630	$208,269

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

Mica

Mica is one mineral for which substitutes have never equalled the natural variety. The mica industry has had a varied existence, fluctuating between great scarcity and oversupply in market conditions. Eastern Ontario is the source of this province's output, and the number of small operators are dependent mostly on the United States market, where there is a demand for phlogopite (amber) and waste and scrap mica. The rate of duty on untrimmed phlogopite mica in small pieces was reduced from 15 to 10 per cent. ad valorem; waste scrap valued at not more than 5 cents per pound, from 25 to 15 per cent.; and ground or pulverized from 20 to 15 per cent. ad valorem. The 1938 production for all grades of mica was 504,739 pounds, valued at $6,445, which was a drop from the 1937 figures of 798,271 pounds, valued at $9,137.

SHIPMENTS OF MICA, 1936, 1937, AND 1938

Grade	1936		1937		1938	
	Quantity	Value	Quantity	Value	Quantity	Value
	pounds		pounds		pounds	
Ground and rough	7,960	$1,990	3,840	$2,304	12,000	$360
Thumb-trimmed	8,037	1,475	140,811	3,891	11,439	3,022
Splittings and knife-trimmed	9,446	3,243	.....	.....	3,700	775
Scrap	1,031,900	4,725	653,620	2,942	477,600	2,288
Total	1,057,343	$11,433	798,271	$9,137	504,739	$6,445

The average prices for the different grades of mica as calculated from the reports of Ontario producers in 1938, were as follows:—

Size	Price per lb.	Size	Price per lb.
1 by 1 inch	$0.05	2¼ by 5 inches	$0.65
1 by 2 inches	.10	3 by 3 inches	.60
1 by 3 inches	.20	3 by 4 inches	.91
2 by 3 inches	.40–.50	3 by 5 inches	1.25
2 by 4 inches	.50–.65	4 by 6 inches	1.50
2¼ by 3¾ inches	.55		

Scrap was sold from $9 to $10 per short ton.

Mineral Waters

The sales of mineral waters for 1938 showed a slight increase over 1937, three producers reporting 28,416 gallons, valued at $2,586, as sold. In former years large quantities of medicinal waters were produced from Ontario wells.

Natural Gas and Petroleum

The Natural Gas Commissioner of Ontario supplied the following notes for 1938:—

Natural Gas

The production of natural gas in 1938 was 10,952,806 M cubic feet. This is an increase over 1937 of 206,472 M cubic feet. The value, however, shows a decrease of $128,012. The decrease in value is actually not as much as it would appear. In past years it has been the practice to value the output of producers who wholesale this gas to distributing companies at retail rates, which placed a fictitious value on the portion of this gas that leaked from the pipe lines in transit. This error was a very minor one until the past year or two, when the proportion of wholesaled gas increased enormously.

On the whole, the natural gas business is in a healthy state, and producers are optimistic.

COMPARATIVE PRODUCTION AND VALUE OF NATURAL GAS, 1936, 1937, AND 1938

Year	Production	Value	Increase or decrease	
			Production	Value
	M cu. ft.		M cu. ft.	
1936	10,006,743	$6,054,294	1,847,918	$1,116,210
1937	10,746,334	6,588,798	739,591	534,504
1938	10,952,806	6,460,763	206,472	—128,035[1]

[1]The decrease in the value is due to the lower average price from increased sales of gas to industries.

NATURAL GAS PRODUCTION IN ONTARIO BY FIELDS, 1938

County	Field	Quantity
		M cu. ft.
Essex	Kingsville	3,265,726
	Tilbury	
Kent	Declute	1,797,789
	Dover	509,677
Lambton	Dawn	1,894,730
	Oil Springs	
Oxford	Brownsville[1]	556,922
Elgin		
Elgin	Bayham	113,651
Norfolk	Norfolk	437,867
Lincoln	Lincoln	1,912,882
Haldimand	Haldimand	
Wentworth	Wentworth	
Welland	Welland	253,085
Brant	Onondaga	135,348
Bruce	Amabel	1,129
Wells in surface drift	Harwich and Howard tps.	14,000
Private wells		60,000
Total produced		10,952,806
Value		$6,460,763
		M cu. ft.
Imported mixed gas		125,807
Total distributed		11,078,613

[1]Dereham township, 506,005 M cu. ft.; Bayham township, 50,917 M cu. ft.

Petroleum

The production of petroleum was increased in 1938, owing to the bringing in of a small field in Warwick township, Lambton county, and a revival in the Mosa township field. The output was 172,642 barrels, valued at $359,268, which constitutes a net gain of 7,437 barrels over the production for 1937.

Twenty-eight drilling rigs were in operation, and 58 men were employed in drilling. They were paid $30,389 in wages.

OIL WELLS AND THEIR PRODUCTION, 1938

Field	Wells			Wells drilled		Production[1]		Gain or loss in 1938[2]	
	Operating	Not operating	Abandoned	Producing	Dry			Gain	Loss
						bbls.	gals.	bbls.	bbls.
Petrolia and Enniskillen.	721	663	8	.....	1	58,270	7	310	.....
Oil Springs	827	236	1	.....	.....	32,298	25	.....	1,554
Moore tp	45	39	.....	.....	.....	1,398	1	.....	855
Sarnia tp	52	41	1	.....	.....	594	31	150	.....
Plympton tp	25	6	.....	.....	.....	191	2	.....	45
Bothwell and Thamesville	252	96	9	8	15	42,419	15	1,312	.....
Dover tp	3	.....	.....	.....	.....	8,800	32	.....	1,698
Raleigh and Tilbury East tps	1	.....	.....	.....	.....	206	22	.....	2,265
Onondaga tp	7	29	.....	.....	.....	886	11	158	.....
Mosa tp	104	31	1	13	3	13,526	24	4,841	.....
Euphemia and Dawn tps.	38	96	4	4	2	5,416	6	.....	473
Dunwich tp	3	87	.....	.....	.....	194	23	.....	109
Brooke tp	1	6	3	.....	.....	101	12	.....	671
Chatham tp	3	.....	.....	3	5	26	27	26	.....
Warwick tp	[3]25	.....	.....	25	11	8,309	30	8,309	.....
Other fields	[4]3	[5]1	[5]1	[4]3	[6]4	.....	.....	.....	.....
Total	2,110	1,331	28	56	41	172,641	23	15,106	7,670

[1]Information from the Imperial Oil Refineries, Limited.
[2]Net gain, 7,437 barrels.
[3]2 in Adelaide township and 1 in Metcalfe township are included in these figures.
[4]Assiginack township, district of Manitoulin.
[5]Bosanquet township.
[6]3 in Bosanquet township; 1 in Gordon township, district of Manitoulin.

OIL PRODUCTION BY FIELDS, 1931–1938

Field	1931	1932	1933	1934	1935	1936	1937	1938
	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.
Petrolia and Enniskillen	57,515	58,871	57,298	57,938	59,282	59,092	57,960	58,270
Oil Springs	30,792	31,438	32,343	29,863	31,646	31,795	33,853	32,299
Moore tp	3,739	3,272	2,192	2,963	3,263	3,200	2,253	1,398
Sarnia tp	1,466	1,227	2,181	825	870	584	445	595
Plympton tp	296	274	211	202	237	248	237	191
Bothwell	18,024	19,460	22,935	32,133	34,175	36,534	40,425	40,430
Tilbury East tp	.....	.....	.....	.....	.....	.....	2,471	206
Dover tp	891	453	763	558	13,117	15,536	10,498	8,801
Raleigh tp	.....	.....	239	264	195	1,125	.....	.....
Onondaga tp	34	543	946	601	431	262	728	886
Mosa tp	8,517	8,429	8,168	9,031	8,788	8,182	8,686	13,527
Thamesville	462	534	847	614	428	458	683	1,990
Euphemia tp	121	496	510	189	(1)	(1)	425	406
Dunwich tp	507	285	346	283	408	307	303	195
Brooke tp	.....	.....	.....	1,941	122	.....	773	101
Dawn tp	.....	5,061	8,079	3,980	11,538	8,171	5,464	5,010
Warwick tp	.....	.....	.....	.....	.....	.....	.....	8,310
Chatham tp	.....	.....	.....	.....	.....	.....	.....	27
Total	122,364	130,343	136,058	141,385	165,040	165,494	165,205	172,642
Value	$219,993	$247,468	$253,486	$299,874	$346,156	$348,767	$356,558	$359,268
Average price	$1.80	$1.89	$1.86	$2.12	$2.10	$2.11	$2.15	$2.08

[1]Included in Dawn township.

Peat

Three operators only were reported as having produced peat during 1938. The output of 620 tons, valued at $3,500, was slightly less than in 1937, when the production amounted to 930 tons, worth $4,923.

Quartz, Quartzite, and Silica Brick

There was an increase in quantity in the production of quartz and quartzite in 1938, but a decrease in the amount of silica brick sold or used. The figures for this year are 1,173,259 tons, valued at $597,037, compared with 1,142,372 tons worth $633,073 in 1937. The quantity of silica brick sold or used for the current year was 595 thousand, valued at $50,592, as against 818 thousand at $59,980 for the previous year.

The Killarney quarry near Killarney is the main source of this mineral in the province, and it is used in large quantities as a flux in iron and nickel-copper smelting.

QUARTZ, QUARTZITE, AND SILICA BRICK, 1934–1938

Year	Rock sold or used		Silica brick sold or used		Total value
	Quantity	Value	Quantity	Value	
	tons		M		
1934	89,838	$134,572	369	$14,730	$149,302
1935	83,034	120,005	493	22,976	142,981
1936	884,585	216,037	471	26,715	242,752
1937	1,142,372	633,073	818	59,980	693,053
1938	1,173,259	597,037	595	50,592	647,629

Salt

In 1938 six companies were actively producing salt or brine to the amount of 388,130 tons, valued at $1,637,140, as against 407,701 tons, worth $1,539,599, in 1937. The price of vacuum fine salt increased about 25 per cent. toward the end of the year, it being officially recorded in December that the price had risen from $1.31 to $1.85 per barrel of 280 pounds net. Inquiries seem to confirm the indication that the price increase will be maintained in 1939.

SALT SOLD OR USED, 1934–1938

Schedule	1934	1935	1936	1937	1938
	tons	tons	tons	tons	tons
Table and dairy	69,779	73,704	76,567	76,908	85,422
Fine	67,777	82,608	83,095	104,967	104,174
Coarse	14,730	17,997	23,188	17,540	20,713
Highway	347	261	1,312	89	71
Land	.....	.....	.....	.....	5,758
Other grades[1]	.....	.....	.....	3,048	1,055
Total	152,633	174,570	184,162	202,552	217,193
Brine (salt equivalent)	124,118	145,433	165,882	205,149	170,938
Total sold or used	276,751	320,003	350,044	407,701	388,130
Value	$1,734,196	$1,698,508	$1,557,078	$1,539,599	$1,637,140
Wage-earners[2] No.	252	274	281	274	286
Wages	$296,116	$309,354	$326,170	$292,644	$384,784

[1]Includes salt used on highways.
[2]Workers at the Sandwich salt and chemical works are included.

Sulphuric Acid

The sulphur content of the acid manufactured at Copper Cliff by Canadian Industries, Limited, from converted gases was estimated at 16,897 tons, valued at $168,970, in 1938, compared to 14,009 tons, worth $140,090, in 1937. No shipments of pyrite were reported.

Talc

Production and trade in talc declined in 1938. Most of this mineral is mined near Madoc, two properties, the Henderson and Connolly, accounting for the entire production. During the year, considerable development work was done on the property of the Madoc Talc and Mining Company about 14 miles from Gilmour.

The paint industry, by absorbing about one-fourth of the talc sold, continues to be the leading consumer, followed by the ceramic industry, whose demand is increasing, primarily for the manufacture of glazed wall tiles. The roofing, paper, and rubber industries are other consumers.

TALC STATISTICS, 1934–1938

Year	Sales		Wage-earners, mine and mill	Wages paid
	Quantity	Value		
	tons		No.	
1934	13,934	$135,978	47	$33,796
1935	13,710	138,161	31	23,874
1936	14,562	143,701	34	26,370
1937	12,457	123,301	41	13,194
1938	10,853	109,810	29	26,688

STRUCTURAL MATERIALS

Building Permits

In 58 Canadian cities building permits in 1938 were valued at $60,855,610, as against $55,844,990 in 1937. Of this total 27 Ontario cities accounted for $25, 424,507, as noted in the following table abstracted from the *Annual Review of Building Permits in Canada in 1938*, issued by the Dominion Bureau of Statistics, Department of Trade and Commerce, Ottawa:—

BUILDING PERMITS, 1934–1938

Year	Ontario cities		Wholesale prices index[1]	Toronto metropolitan area,[2] value	Wages index 1913=100[3]
	No.	Value			
1934	30	$14,351,380	82.6	$8,396,775	154.8
1935	27	23,847,536	81.2	11,685,586	159.8
1936	27	19,256,177	85.4	10,522,624	160.8
1937	27	28,156,707	94.3	13,270,524	165.3
1938	27	25,424,507	89.1	10,072,121	169.4

[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.

Construction Contracts

The value of Canadian construction contracts awarded for 1938 reported by *McLean Building Review*, was $187,277,900, as compared with $224,056,700 in 1937. Ontario contracts in 1938 amounted to $73,070,100, or 39 per cent. of the total.

VALUE OF CONSTRUCTION CONTRACTS, 1934–1938

Classification	1934	1935	1936	1937	1938
Residential	$17,578,600	$20,646,500	$23,760,000	$28,081,500	$28,314,900
Business	15,795,600	20,340,800	17,727,200	26,638,600	25,947,800
Industrial	4,305,200	3,645,000	7,207,400	17,932,600	7,060,700
Engineering	25,678,900	26,240,500	23,698,700	25,124,700	11,746,700
Total	$63,358,300	$70,872,800	$72,393,300	$97,777,400	$73,070,100

Cement

The cement industry suffered a setback in 1938 as a result of reduced activity in the consuming industries. In 1937 production had nearly doubled that of 1936. In 1938 the output of Portland cement was 1,818,032 barrels, valued at $2,555,214. Two companies were active: the Canada Cement Company, with plants at Lakefield, Belleville, and Port Colborne, the first-mentioned being idle; and the St. Mary's Cement Company, with a plant at St. Marys, which was in operation throughout the year.

PORTLAND CEMENT STATISTICS, 1934–1938

Year	Operating plants	Sales		
		Quantity	Value	Average price per barrel
	No.	barrels[1]		
1934	4	1,702,128	$2,403,590	$1.41
1935	2	1,243,836	1,752,148	1.41
1936	3	1,542,463	2,180,895	1.41
1937	3	2,650,652	3,657,067	1.38
1938	3	1,818,032	2,555,214	1.41

[1]350 pounds.

Lime

Lime is used quite extensively for chemical purposes in addition to being an ingredient of mortar and sand-lime brick. During 1938, 16 companies and individuals, operating 19 plants, reported sales that totalled 270,480 tons, valued at $1,989,260, as against 294,467 tons, worth $2,152,644, in 1937. Statistics for the last five years follow:—

LIME STATISTICS, 1934–1938

Year	Lime marketed or used						Fuel costs	Wage-earners	Wages
	Hydrated			Quicklime					
	Quantity	Total value	Value per ton	Quantity	Total value	Value per ton			
	tons			tons				No.	
1934	22,281	$249,038	$11.18	168,760	$1,287,250	$7.63	$173,951	187	$116,020
1935	23,514	227, 97	9.66	198,338	1,478,106	7.45	324,295	210	147,397
1936	26,650	271,209	10.17	219,943	1,674,851	7.61	394,058	231	182,250
1937	26,163	278,239	10.63	268,304	1,874,405	6.98	465,644	250	226,122
1938	27,849	297,032	10.66	242,631	1,692,228	6.97	400,755	212	200,837

Distribution of the quicklime and hydrated lime sold in 1938, 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	7,105	$52,444	14,764	$152,832
Sand-lime brick	5,048	33,660	.....	.....
Agriculture	.....	.....	1,533	15,392
Chemical and metallurgical industries:				
Smelters	1,053	5,672	85	1,055
Iron and steel	12,298	86,936	23	245
Gold-milling	28,077	179,762	223	2,594
Pulp and paper	6,652	42,437	111	1,100
Glass	6,985	46,223	.....	.....
Sugar	5,577	53,883	15	157
Tanneries	2,684	18,529	248	2,684
Fertilizers and insecticides	1,035	7,295	65	644
Dealers and others	5,963	45,643	9,693	108,389
Other chemicals[1]	160,154	1,119,744	1,089	11,940
Total	242,631	$1,692,228	27,849	$297,032

[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

Statistics for sand and gravel, which are given in detail in the following table, indicate a recession in both quantity and value for the year 1938 when compared with the figures for the preceding year.

OUTPUT OF SAND AND GRAVEL, 1937 AND 1938

Source	1937		1938	
	Quantity	Value	Quantity	Value
	tons		tons	
Private pit operators	2,674,255	$880,395	2,254,198	$814,906
Dredged from Great Lakes and rivers	1,078,011	512,553	923,378	513,516
Department of Northern Development / Department of Highways	2,168,750	1,037,500	2,086,078	470,671
Miscellaneous counties and townships	2,119,101	1,059,550	2,298,374	1,149,187
Estimate for other producers[1]	792,409	123,856	669,253	97,763
Total	8,832,526	$3,613,854	8,531,281	$3,046,043

[1]Railway ballast.

Sand-Lime Products

Brick, sand-lime building blocks, ready-mixed mortar, and plaster are the main products which fall under this heading. Their marketing has been steadily declining in the past few years owing to a depressed construction industry and also to the inroads of artificial building blocks and kindred materials. In 1937 the selling value of these products was $153,910; in 1938 the value had dropped to $98,521.

Stone

The quantity and value of stone products quarried in the province in 1938 were considerably below the figures for 1937. This was owing to a reduction in the amount of paving done by the Ontario Department of Highways, which completed a larger proportion of grading than in past years. Only 433 wage-earners were employed in 1938. They received wages amounting to $265,239.

The industry is of a seasonal nature, and employment begins in the early summer and stops with the first frosts of the fall.

OUTPUT OF STONE, 1936, 1937, AND 1938

Variety	1936		1937		1938	
	Quantity	Value	Quantity	Value	Quantity	Value
	tons		tons		tons	
Limestone	2,205,992	$1,773,764	3,582,176	$2,841,470	2,242,964	$1,911,841
Marble	4,765	29,204	6,685	27,247	10,537	40,694
Trap	70,599	167,263	679,760	769,860	254,917	351,941
Granite	421,628	415,339				
Sandstone	3,436	10,805	8,680	22,934	4,662	16,220
Slate	260	2,080	300	2,258	211	2,469
Total	2,706,680	$2,398,456	4,277,601	$3,663,769	2,513,291	$2,323,165

CLAY PRODUCTS

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 1934–38

Product	1913	1922	1934	1935	1936	1937	1938
Brick:							
Common and sewer	$3,283,894	$2,614,120	$227,276	$275,835	$374,365	$359,504	$383,228
Pressed, fancy, building tile, etc.	1,162,860	2,899,205	607,658	715,057	772,198	1,030,830	1,027,683
Pottery	52,875	88,889	[1]52,578	50,000	51,507	54,581	59,092
Drain tile	292,767	368,180	137,699	125,593	131,041	233,258	252,444
Sewer pipe	600,297	973,824	226,005	196,647	235,238	338,895	342,549
Haydite and other products	.....	.....	9,790	7,093	9,587	16,777	18,500
Total	$5,392,693	$6,944,218	$1,261,006	$1,370,225	$1,573,936	$2,033,845	$2,083,496

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

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, 1938

Kind		Quantity	Value
Brick:			
Soft-mud process	face, No.	10,813,293	$208,110
	common, No.	9,502,839	122,056
Stiff-mud (wire cut) process	face, No.	16,364,586	303,941
	common, No.	14,392,961	200,733
Dry-press	face, No.	9,928,151	192,618
	common, No.	3,736,390	56,858
Fancy or ornamental brick (including special shapes, embossed and enamelled brick)	No.	62,835	4,175
Sewer	No.	216,638	3,581
Tile:			
Structural (hollow blocks, including fireproofing and load-bearing tile)	tons	36,094	298,466
Roofing tile	No.	150,204	5,183
Floor tile (quarries)	sq. ft.	100,000	15,190
Drain	No.	10,747,653	252,444
Sewer pipe (including copings, flue linings, etc.)		.....	342,549
Pottery (flower pots), from domestic clay		.....	59,092
Haydite and other products		.....	17,861
Blue clay	tons	213	639
Total value		.....	$2,083,496

MISCELLANEOUS STATISTICS

Mining Company Incorporations

A summary of mining companies incorporated and licensed in Ontario from 1934 to 1938, inclusive, is given hereunder:—

MINING COMPANIES INCORPORATED AND LICENSED, 1934–1938

Year	Incorporated				Extra-provincial and mortmain companies licensed	
	No.	Nominal capital	"No par" companies		No.	Capital for use in Ontario
			No.	Shares		
1934	212	$488,335,000	82	86,183,000	9	$925,000
1935	116	205,320,000	24	18,054,500	1	40,000
1936	294	724,615,000	45	54,974,000	.....	.....
1937	312	505,670,000	30	31,883,100	.....	.....
1938	234	297,390,000	28	25,257,450	.....	.....

Of the 262 companies incorporated in 1938, 234 had specified capital only and 28 were companies having shares without nominal or par value.

MINING COMPANIES INCORPORATED IN ONTARIO IN 1938 HAVING SHARES WITHOUT NOMINAL OR PAR VALUE

Name of company	Head office	Date of incorporation	No. of shares
Acorn Minerals, Limited	Toronto	July 27	500,000
Allied Development Corporation, Limited	Hamilton	Dec. 17	250,000
Anglo-American Gypsum Company, Limited	Hamilton	Nov. 9	100,000
Canada Slate Products, Limited	Toronto	Jan. 25	1,000,000
Canuck Explorers, Limited	Toronto	July 20	1,500,000
Chan Yellowknife Gold, Limited	Toronto	Feb. 14	3,500,000
Charles Taylor Exploration Company, Limited	Toronto	Jan. 19	40,000
Cobalt Products, Limited	Toronto	June 22	40,000
Deep Lake Gold Mines, Limited	Gold Park	Mar. 1	3,000,000
Dixie Gold Mines, Limited	Toronto	Sept. 2	40,000
Eclipse Petroleum, Limited	Fort Erie	Mar. 14	900,000
Edwards Consolidated Mines, Limited	Toronto	Mar. 14	227,500
Hoyle Gold Mines, Limited	Toronto	Feb. 3	4,000,000
Jerome Exploration Company, Limited	Toronto	Mar. 28	40,000
Kenopo Mining and Milling Company, Limited	Kenora	Dec. 7	40,000
La Luz Mines, Limited	Toronto	June 11	2,000,000
Lac Seul Development and Exploration Company, Limited	Toronto	Sept. 20	9,950
Moose Basin Minerals, Limited	Toronto	Sept. 1	40,000
Normeric Exploration Company, Limited	Toronto	April 12	100,000
Northern Canada Mines, Limited	Toronto	Jan. 24	1,500,000
Numalake Mines, Limited	Toronto	May 27	500,000
Perwal Petroleums, Limited	Toronto	June 23	2,500,000
Potosi Mines, Limited	Toronto	Oct. 12	40,000
Ranson Mines, Limited	Toronto	July 4	100,000
Steerola Exploration Company, Limited	Toronto	Jan. 6	100,000
Terimac Mining Development, Limited	Toronto	Dec. 13	150,000
Vacomac Gold Options, Limited	Toronto	Jan. 13	40,000
West Petroleum, Limited	Toronto	May 23	3,000,000
Total (28 companies)	.....	.....	25,257,450

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1938

Name of company	Head office	Date of incorporation	Capital
Active Exploration Mining Syndicate, Limited	Toronto	May 28	$35,000
Adwood Cobalt-Silver Mining Syndicate, Limited	Toronto	June 8	35,000
Aetna Mines, Limited	Toronto	Sept. 28	3,000,000
Agami Gold Mines, Limited	Toronto	July 18	3,000,000
Ahr Porcupine Mining and Exploration, Limited	South Porcupine	May 7	3,000,000
Alba Gold Mines, Limited	Toronto	Sept. 19	3,000,000
Albany River Gold Mines, Limited	Pickle Crow	July 4	3,000,000
Alpha-Larder Mines, Limited	Toronto	May 14	3,500,000
Anoki Gold Mines, Limited	Toronto	Sept. 10	3,500,000
Ansara Kirkland Mining Syndicate, Limited	Kirkland Lake	Jan. 19	35,000
Archie Larder Gold Mining Syndicate, Limited	Larder Lake	July 4	35,000
Arctic Yellowknife Mines, Limited	Toronto	Mar. 11	3,000,000
Au-Lac Mines, Limited	Toronto	May 13	3,500,000
Aurex Larder Gold Mines, Limited	Toronto	April 13	3,000,000
Baroda Gold Mines, Limited	Toronto	Feb. 9	3,000,000
Battery Gold, Limited	Toronto	Feb. 1	3,000,000
Bellford Mining Syndicate, Limited	Toronto	Jan. 13	35,000
Bernadette McElroy Gold Mining Syndicate, Limited	Kirkland Lake	Mar. 21	35,000
Bernice Mines (1938), Limited	Toronto	Mar. 2	3,000,000
Best-Beardmore Mining Syndicate, Limited	Toronto	April 9	35,000
Bethel Gold Mines, Limited	Toronto	June 4	3,000,000
Beulah Yellowknife Mining Syndicate, Limited	Toronto	April 1	35,000
Big Gull Mining Syndicate, Limited	Toronto	July 5	35,000
Bil-Ger Mining Syndicate, Limited	Toronto	Feb. 21	35,000
Blue Jay Long Lac Gold Mines (1938), Limited	Toronto	June 17	3,000,000
Bonroc Mining Syndicate, Limited	Toronto	May 31	35,000
Border-Cadillac Mines, Limited	Toronto	Oct. 25	3,000,000
Bounty Yellowknife Mining Syndicate, Limited	Toronto	June 21	35,000
Braeside Mining Syndicate, Limited	Toronto	Jan. 31	35,000
Brenmore Mining Syndicate, Limited	New Liskeard	May 27	35,000
Briscoe Bryce Mines, Limited	Toronto	Nov. 28	2,000,000
Brock Gold Mines, Limited	Toronto	May 4	3,000,000
Brucore Cobalt Mining Syndicate, Limited	Toronto	Dec. 19	35,000
Buckhorn Mining Syndicate, Limited	Toronto	Mar. 17	35,000
Buffonta Mines, Limited	Toronto	Oct. 28	2,000,000
Bush Lake Gold Mines, Limited	Toronto	Feb. 26	3,000,000
Bute Larder Gold Mining Syndicate, Limited	Toronto	Jan. 10	35,000
Calong Gold Mines, Limited	Toronto	Nov. 21	3,500,000
Camgar Mining Syndicate, Limited	Ottawa	June 2	35,000
Camur Yellowknife Mining Syndicate, Limited	Toronto	Mar. 24	35,000
Canada Baryte Mines, Limited	Toronto	Oct. 15	500,000
Canora Gold Mines, Limited	Toronto	Aug. 15	3,000,000
Canorex Mining Syndicate, Limited	Sudbury	Feb. 26	35,000
Capmac Gold Mining Syndicate, Limited	Toronto	July 11	35,000
Carbris Porcupine Mining Syndicate, Limited	Toronto	July 4	35,000
Carriconna Mines, Limited	Toronto	Dec. 10	3,000,000
Chaplin Mining Syndicate, Limited	North Cobalt	Aug. 31	35,000
Charles Long Lac Gold Mines, Limited	Toronto	Sept. 7	3,000,000
Chuck Mining Syndicate, Limited	Toronto	May 6	35,000
Clam Lake Gold Mines, Limited	Toronto	Nov. 14	3,000,000
Clamshell Mining Syndicate, Limited	Sioux Lookout	Sept. 1	35,000
Clearteck Mining Syndicate, Limited	Kirkland Lake	Mar. 18	35,000
Coalton Gold Mining Syndicate, Limited	Toronto	Jan. 15	35,000
Comet Larder Lake Mining Syndicate, Limited	Toronto	June 3	35,000
Copana Mining Syndicate, Limited	Kirkland Lake	Mar. 25	35,000
Coral-Creek Mining Company, Limited	Toronto	Nov. 9	50,000
Cote d'Or Mining Syndicate, Limited	Toronto	Nov. 1	35,000
Credo Porcupine Gold Mines, Limited	Toronto	April 14	3,500,000
Culhane Porcupine Mining Syndicate, Limited	Toronto	July 18	35,000
Cymry Gold Mining Syndicate, Limited	Toronto	April 9	35,000
Darrell Gold Mines, Limited	Toronto	Oct. 12	3,000,000
Dening Long Lac Mining Syndicate, Limited	Toronto	July 7	35,000
Desales Mining Syndicate, Limited	Toronto	Jan. 24	35,000
Digger Mines Syndicate, Limited	Toronto	May 2	35,000

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1938—*Continued*

Name of company	Head office	Date of incorporation	Capital
Dillabough Mining Syndicate, Limited	Ramore	Aug. 12	$35,000
Do So Yellowknife Gold Mines, Limited	Toronto	July 22	3,000,000
Dobos Gold Mining Syndicate, Limited	Kirkland Lake	Sept. 2	35,000
Dole Mining Syndicate, Limited, The	Pembroke	June 4	35,000
Dominion Nickel Mining Syndicate, Limited	Toronto	Jan. 31	35,000
Donwood-Larder Mines, Limited	Toronto	Dec. 14	3,000,000
Dotsee Cobalt Mines, Limited	Toronto	June 20	100,000
Dowhill Mines, Limited	Toronto	Mar. 15	3,000,000
Drillers Yellowknife Mining Syndicate, Limited	Toronto	Aug. 11	35,000
Dukes Molybdenite Mining Syndicate, Limited	Toronto	Jan. 24	35,000
Earngold Mines, Limited	Toronto	July 20	4,000,000
Elk Lake Asbestos Mining Syndicate, Limited	Elk Lake	July 8	35,000
Ernona Gordon Lake (N.W.T.) Mining Syndicate, Limited	Toronto	Aug. 2	35,000
Errowana Gold Mines, Limited	Toronto	Oct. 26	3,000,000
Ess Creek Mining Syndicate, Limited	Sudbury	June 1	35,000
Evans Porcupine Mines, Limited	South Porcupine	Mar. 9	2,000,000
Faith Porcupine Mining Syndicate, Limited	St. Catharines	June 10	35,000
Flat Lake Gold Mines, Limited	Toronto	May 2	3,000,000
Four-Square Mining Syndicate, Limited	North Bay	Jan. 3	35,000
Fraser Alluvial Mining and Dredging Company, Limited	Toronto	May 21	3,000,000
Frechette Island Mining Syndicate, Limited	Toronto	July 4	35,000
Fulcrum Mining Syndicate, Limited	Hudson	May 30	35,000
Golden Arrow Mines, Limited	Toronto	Dec. 8	3,000,000
Golden Blade Mining Syndicate, Limited	Ottawa	Mar. 8	35,000
Goldmast Mining Syndicate, Limited	Toronto	Dec. 16	35,000
Goldwood Gold Mines, Limited	Toronto	Feb. 9	3,000,000
Goodsite Mining Syndicate, Limited	Toronto	Feb. 2	35,000
Gorham Gold Mines, Limited	Toronto	May 5	2,500,000
Greyarko Longlac Mines, Limited	Toronto	June 11	3,000,000
Hanswick Gold Mining Syndicate, Limited	Sudbury	Sept. 8	35,000
Hartwal Gold Mining Syndicate, Limited	Toronto	Aug. 25	35,000
Hasaga Gold Mines, Limited	Red Lake	Oct. 18	5,000,000
Helen Exploration and Mining Syndicate, Limited	Kirkland Lake	Nov. 28	35,000
Hol-Booth Gold Mines, Limited	Timmins	June 10	40,000
Huntingdon Talc Mining Syndicate, Limited	Toronto	July 25	35,000
Huper Larder Gold Mining Syndicate, Limited, The	Larder Lake	June 11	35,000
Huron and Bruce Oil Company, Limited	Clinton	Mar. 10	50,000
Indian Reserve Oil Mining Syndicate, Limited	Toronto	Feb. 8	15,000
Janus Mines, Limited	Toronto	May 25	3,000,000
Jason Mines, Limited	Toronto	Nov. 9	3,000,000
Jelox Gold Mining Syndicate, Limited	Toronto	Mar. 17	35,000
Jodelo Gold Mines, Limited	Toronto	May 17	3,000,000
Joljak Mining Syndicate, Limited	Toronto	Feb. 21	35,000
Jordan Mining Syndicate, Limited	Toronto	Jan. 3	35,000
Jowato Mines, Limited	Toronto	May 21	40,000
Kalibak Gold Mines, Limited	Kapuskasing	July 29	3,000,000
Kenelda Gold Mines, Limited	Toronto	Mar. 9	3,000,000
Kenmore Gold Mines, Limited	Toronto	Nov. 24	3,000,000
Kentlake Mining Syndicate, Limited	Toronto	Mar. 14	35,000
Kirduke Gold Mining Syndicate, Limited	Toronto	Aug. 26	35,000
Kiryan Gold Mines, Limited	Toronto	Sept. 28	3,500,000
Kohinoor Gold Mines, Limited	Toronto	May 11	3,000,000
Krist Larder Gold Mining Syndicate, Limited	Kirkland Lake	Feb. 17	35,000
Kutchin Yellowknife Mining Syndicate, Limited	Toronto	Sept. 6	35,000
La Fontaine Gold Mining Syndicate, Limited	Sault Ste. Marie	Jan. 27	35,000
Lajoie Gold Mining Syndicate, Limited	Toronto	Mar. 8	35,000
Lambroff Gold Mining Syndicate, Limited	Kirkland Lake	May 30	30,000
Lanark Kirkland Mining Syndicate, Limited	Perth	Nov. 16	35,000
Larossian Gold Mining Syndicate, Limited	Toronto	July 29	35,000
Leethorn Gold Mines, Limited	Toronto	July 27	3,000,000
Lower Canada Gold Mines, Limited	Toronto	Dec. 9	3,000,000
Lundberg Mining Syndicate, Limited	Toronto	Dec. 5	35,000

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1938—*Continued*

Name of company	Head office	Date of incorporation	Capital
Macdill Mining Syndicate, Limited	Toronto	July 28	$35,000
MacFarlane Consolidated Mines, Limited	Toronto	Nov. 15	3,500,000
McGinn Mining Syndicate, Limited, The	Sudbury	June 20	35,000
MacGregor Porcupine Gold Mines, Limited	Toronto	Oct. 5	4,000,000
McKay Mines Exploration, Limited	Toronto	July 8	3,000,000
MacPherson Porcupine Mining Syndicate, Limited	Toronto	Sept. 13	35,000
Mac-Read Mining Syndicate, Limited	Savant Lake	Dec. 12	35,000
Madoc Talc and Mining Company, Limited, The	Trenton	Jan. 12	250,000
Mantha Mining Syndicate, Limited	North Bay	Nov. 3	35,000
Mapin Gold Mines, Limited	Toronto	Oct. 27	1,000,000
Maudegascon Gold Mines, Limited	Toronto	April 21	3,000,000
Mauretania Exploration and Investments, Limited	Toronto	Mar. 23	100,000
Merlorno Porcupine Mining Syndicate, Limited	Timmins	Jan. 22	35,000
Meteorlake Mining Syndicate, Limited	Toronto	April 19	35,000
Mid-Delo Mining Syndicate, Limited	Toronto	Jan. 27	35,000
Milcarron Mining Syndicate, Limited	Toronto	Mar. 5	35,000
Milkie Mining Syndicate, Limited	Englehart	Oct. 4	35,000
Millwights Mines, Limited	Toronto	Dec. 8	3,000,000
Minesta Mines, Limited	Toronto	Feb. 15	3,000,000
Misema Mining Syndicate, Limited	Kirkland Lake	Mar. 14	35,000
Mitnor Gold Mines, Limited	Toronto	Aug. 12	3,000,000
Mitnor Mining Syndicate, Limited	Toronto	April 25	35,000
Moira Fluorspar Mining Syndicate, Limited	Belleville	Sept. 16	35,000
Monetary Metals Mining Company, Limited	Toronto	Oct. 19	2,000,000
Moose River Gypsum Company, Limited	Cochrane	Dec. 9	100,000
Moosewood Gold Mines, Limited	Toronto	June 29	3,500,000
Morgan Exploration and Mining Syndicate, Limited	Kirkland Lake	Mar. 14	35,000
Murray-Algoma Mines, Limited	Hawk Junction	June 3	3,000,000
Nakhodas Mining Company, Limited, The	Toronto	April 9	100,000
N. A. Timmins Explorations (Ontario), Limited	Toronto	Sept. 28	40,000
Negus Mines, Limited	Toronto	Jan. 8	3,000,000
Nelson Gold Mining Syndicate, Limited	Kirkland Lake	Feb. 1	35,000
New Darwin Gold Mines, Limited	Toronto	Sept. 29	3,500,000
New Manco Gold Mines, Limited	Toronto	Nov. 24	3,000,000
Nezah Mining Syndicate, Limited	Toronto	May 28	35,000
Nipton Mining Syndicate, Limited	Sudbury	Oct. 13	35,000
Norse-Beardmore Mining Syndicate, Limited	Toronto	Feb. 1	35,000
Norwin Long Lac Mines, Limited	Toronto	July 21	3,000,000
Okolo Porcupine Mining Syndicate, Limited	Toronto	Mar. 28	35,000
Opeepmore Mining Syndicate, Limited	Toronto	Nov. 4	35,000
Orser Mining Syndicate, Limited	Verona	Feb. 7	35,000
Oslo Mining Syndicate, Limited	Hudson	Jan. 8	35,000
Osway Gold Mines, Limited	Sudbury	Oct. 20	3,000,000
Paddy Lake Mining Syndicate, Limited	Lochalsh	June 22	35,000
Page Exploration and Mining Syndicate, Limited	Toronto	June 11	35,000
Palode Mining Syndicate, Limited	Toronto	Nov. 24	35,000
Pasha Gold Mines, Limited	Toronto	July 18	3,000,000
Patten River Mining Syndicate, Limited	Cochrane	Mar. 23	35,000
Peters Gold Mining Syndicate, Limited	Toronto	Jan. 3	35,000
Pirate Gold Mines, Limited	Toronto	April 19	3,000,000
Pluto Yellowknife Mining Syndicate, Limited	Toronto	April 13	35,000
Pomahomo Gold Mining Syndicate, Limited	Kirkland Lake	April 5	35,000
Ragged Chutes Mining Syndicate, Limited, The	Ragged Chutes	Aug. 8	35,000
Rebair Gold Mines, Limited	Toronto	Mar. 23	3,000,000
Red Cedar Lake Gold Mines, Limited	Fort William	Mar. 28	3,000,000
Redore Mining Company, Limited	Sudbury	Sept. 15	3,000,000
Regnery Gold Mines, Limited	Sault Ste. Marie	Sept. 15	100,000
Ridgedome Gold Mining Company, Limited	Toronto	July 26	3,500,000
Rochon-Maney Mining Syndicate, Limited	Windsor	Sept. 23	35,000
Rocket Larder Gold Mining Syndicate, Limited	Cobalt	Feb. 22	35,000
Rolac Mines, Limited	Toronto	June 27	3,000,000
Round-Up Petroleum Corporation, Limited	Toronto	May 27	3,000,000
Sagamore Larder Gold Mining Syndicate, Limited	Toronto	May 20	35,000
Sarcee Mines, Limited	Toronto	Dec. 21	3,000,000

ONTARIO COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN 1938—*Continued*

Name of company	Head office	Date of incorporation	Capital
Schnob Mining Syndicate, Limited	Toronto	Mar. 30	$35,000
Sheba Mining Syndicate, Limited	Toronto	May 16	35,000
Shirlac Gold Mines, Limited	Toronto	May 2	3,000,000
Sirago Nico Mining Syndicate, Limited	Toronto	July 4	35,000
Slate River Mining Syndicate, Limited	Fort William	Mar. 9	35,000
Smada Lead Mines, Limited	Toronto	Oct. 20	3,000,000
Sonia Gold Mining Syndicate, Limited	Ottawa	Jan. 11	35,000
Spartan Gold Mines, Limited	Lindsay	April 27	1,500,000
Spectacle Larder Lake Mines, Limited	Kirkland Lake	Nov. 10	3,000,000
Split Mica Mining Syndicate, Limited	Toronto	Oct. 20	35,000
Staper Mining Syndicate, Limited	Ottawa	Feb. 5	35,000
Steeproc Gold Mining Syndicate, Limited	Toronto	Aug. 10	35,000
Strathmore Gold Mines, Limited	Toronto	Aug. 12	3,000,000
Tanhill-Larder Gold Mining Syndicate, Limited	Toronto	Sept. 12	35,000
Theresa Gold Mines, Limited	Kapuskasing	April 1	2,000,000
Tom-Mac Mining Syndicate, Limited	Sudbury	Mar. 12	35,000
Tomahawk Iron Mines, Limited	Bradford	Feb. 26	3,500,000
Tomorken Mining Syndicate, Limited	Kirkland Lake	May 27	35,000
Torovic Gold Mines, Limited	Toronto	Feb. 26	3,000,000
Tovarich-Larder Gold Mines, Limited	Toronto	Mar. 7	3,000,000
Trio Porcupine Mines, Limited	Timmins	July 12	3,000,000
Troup Porcupine Mines, Limited	Toronto	Aug. 19	5,000,000
Troy Consolidated Gold Mines, Limited	Ottawa	Mar. 29	3,500,000
Tsingtao Mining Syndicate, Limited	Toronto	April 21	35,000
Tumwata Gordon Lake (N.W.T.) Gold Mining Syndicate, Limited	Toronto	April 19	35,000
Tundra Yellowknife Mining Syndicate, Limited	Toronto	May 19	35,000
Twindyke Mines, Limited	Toronto	Sept. 17	3,000,000
Ultra Gold Mining Syndicate, Limited	Kirkland Lake	July 18	35,000
Upper Yellowknife Mining Syndicate, Limited	Toronto	May 7	35,000
Usa-Teck Gold Mines, Limited	Toronto	Mar. 16	3,500,000
Valhalla Beardmore Gold Mining Syndicate, Limited	Fort William	April 19	35,000
Vermilion Oils, Limited	Toronto	June 8	5,000,000
Walpole Yellowknife Mining Syndicate, Limited	Toronto	April 13	35,000
Warneford Beardmore Mining Syndicate, Limited	Toronto	Feb. 11	35,000
Ward Lake Gold Mines, Limited	Toronto	May 2	3,500,000
Wasu Porcupine Mines, Limited	Toronto	Sept. 30	3,000,000
Wayhigh Gold Mining Syndicate, Limited	Sudbury	May 3	35,000
Westario Sulphur Mines, Limited	Hudson	April 2	3,000,000
Whiskey Lake Mining Syndicate, Limited	Sudbury	Aug. 22	35,000
Wonowon Mining Syndicate, Limited	Toronto	April 6	35,000
Yale Mining Syndicate, Limited	Toronto	July 11	35,000
Yellorex Mines, Limited	Toronto	Mar. 10	3,000,000
Total (234 companies)			$297,390,000

Mining Revenue and Expenditures

The revenue of the Department of Mines for the fiscal year ending March 31, 1939, was $2,556,300.98, as compared with $2,277,179.74 in the previous year. Expenditures were $379,562.95.

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 year 1938:—

DETAILS OF PROFIT TAX

GOLD:		
Bankfield Consolidated Mines, Limited	$801.81	
Buffalo Ankerite Gold Mines, Limited	30,062.35	
Central Patricia Gold Mines, Limited	16,435.53	
Dome Mines, Limited	125,519.01	
Hollinger Consolidated Gold Mines, Limited	163,442.73	
Kirkland Lake Gold Mining Company, Limited	7,802.72	
Lake Shore Mines, Limited	337,739.48	
Leitch Gold Mines, Limited	2,446.11	
Little Long Lac Gold Mines, Limited	17,117.86	
Macassa Mines, Limited	9,589.34	
McIntyre-Porcupine Mines, Limited	90,328.98	
McKenzie Red Lake Gold Mines, Limited	10,121.77	
Northern Empire Mines Company, Limited	1,883.42	
Pamour Porcupine Mines, Limited	8,122.68	
Pickle Crow Gold Mines, Limited	39,581.46	
Red Lake Gold Shore Mines, Limited	889.51	
Sturgeon River Gold Mines, Limited	2,289.36	
Sylvanite Gold Mines, Limited	13,953.33	
Teck-Hughes Gold Mines, Limited	44,969.44	
Toburn Gold Mines, Limited	5,505.61	
Wright-Hargreaves Mines, Limited	122,989.73	
Young-Davidson Mines, Limited	2,191.62	
		$1,053,783.85
NICKEL-COPPER:		
Falconbridge Nickel Mines, Limited	$15,933.61	
International Nickel Company of Canada, Limited	1,058,289.11	
		1,074,222.72
Total		$2,128,006.57

The following table gives details of the revenue of the Department of Mines for the fiscal year ending March 31, 1939:—

REVENUE, DEPARTMENT OF MINES, APRIL 1, 1938, TO MARCH 31, 1939

ORDINARY:		
Sand and gravel—		
Royalties	$48,738.74	
Licenses	1,400.00	
		$50,138.74
Casual fees		1,679.09
Sale of record books, Unwrought Metal Sales Act		44.00
Gas leases		5,870.00
Inspection cable testing fees		7,426.43
Assessment—		
Acreage tax	$46,934.04	
Profit tax	2,128,006.58	
Gas tax	48,079.25	
		2,223,019.87
Chemical and assay fees		1,140.41
Mining recorders—rentals—		
Mining leases	$11,123.43	
Licenses of occupation	6,935.30	
		18,058.73
Miner's licenses		60,661.86
Recording fees		98,480.12
Miscellaneous fees		5,821.60
Map sales		1,839.00
Draughtsman, North Bay—		
Sale of maps		560.60
Natural Gas Commissioner—permits		2,280.74
Temiskaming Testing Laboratories		17,592.96
Sulphur Fumes Arbitrator		90.50
Miscellaneous		273.65
		$2,494,978.30
CAPITAL:		
Mining recorders—mining land sales		61,322.68
Total revenue		$2,556,300.98

SUMMARY OF BUSINESS TRANSACTED IN THE SEVERAL MINING DIVISIONS DURING 1938

Schedule item	Fort Frances	Sudbury	Porcupine	Larder Lake	Sault Ste. Marie	Port Arthur	Kowkash	Timiskaming	Montreal River	Kenora	Red Lake	Total
1. Letters received	1,028	3,761	4,066	4,546	3,076	3,706	650	1,286	1,009	3,075	2,411	28,614
2. Letters written	1,119	3,232	3,904	4,387	2,704	4,047	657	1,093	1,040	2,977	2,146	27,306
3. Miner's Licenses issued[1]	57	588	399	498	233	398	46	142	57	167	288	2,873
4. Miner's Licenses renewed[1]	108	588	627	1,119	309	767	74	348	204	244	470	4,858
5. Mining claims recorded[2]	342	1,840	1,216	1,562	698	1,319	70	379	204	252	826	8,708
6. Mining claims cancelled	124	890	613	1,236	224	3,847	72	559	133	73	1,207	8,978
7. Agreements, transfers, etc., recorded	221	877	941	1,066	620	1,022	47	299	179	254	382	5,908
8. Receipts for Miner's Licenses, Permits, Recording Fees, etc.	$4,467.00	$25,010.52	$20,436.50	$24,479.00	$11,015.00	$23,903.50	$1,304.50	$5,875.00	$4,637.50	$6,078.79	$12,501.10	$139,708.41
9. Receipts as Purchase Money or Rental	$327.47	$12,220.37	$5,353.71	$10,150.05	$1,816.02	$17,139.88	$870.05	$621.71	$1,109.93	$1,660.63	$9,121.46	$60,391.28
10. Total remitted to Department	$4,794.47	$37,230.89	$25,790.21	$34,629.05	$12,831.02	$41,043.38	$2,174.55	$6,496.71	$5,747.43	$7,739.42	$21,622.56	$200,099.69
11. Claims of which surveyors' plans were filed	54	44	77	154	166	117	13	45	70	75	64	879
12. Disputes entered	.....	8	1	7	14	4	.....	.....	.....	.....	.....	34
13. Disputed cases decided by Recorders	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	2
14. Appeals to Mining Court	.....	.....	.....	6	.....	.....	.....	.....	.....	.....	.....	6
15. Extensions of time granted	125	1,010	1,466	1,186	683	2,028	37	45	502	462	626	8,170
16. Certificates of Record granted	4	96	50	125	16	164	13	12	20	17	74	591
17. Certificates of Performance of Work granted	4	115	52	120	25	182	13	9	20	23	73	636
18. Claims for which papers were forwarded to the Department for issue of title	1	91	50	102	19	181	13	8	18	17	71	571
19. Substitute Miner's Licenses issued	3	13	6	21	4	14	4	5	5	1	8	84
20. Abstracts issued	290	2,262	2,847	2,416	1,108	3,412	104	262	512	643	1,166	15,022
21. Blue-prints sold	131	1,148	1,258	2,358	348	622	34	310	249	106	224	6,788

[1]Miner's licenses issued and renewed at the Department in Toronto were 1,938, making a total of 9,669 for the province, as compared with 12,068 in 1934, 10,179 in 1935, 13,131 in 1936, and 13,855 in 1937.

[2]In addition, the claims recorded at the Department of Mines in Toronto were 339, making a total of 9,047 for the province, as compared with 16,888 in 1934, 9,440 in 1935, 17,295 in 1936 and 15,292 in 1937.

STATEMENT OF MONIES RECEIVED FROM MINING RECORDERS FOR THE FISCAL YEAR ENDING MARCH 31, 1939

Mining division	Purchase price	License of occupation	Mining leases	Maps	Miscellaneous fees	Miner's licenses	Recording fees	Total
Fort Frances	$779.78	.....	$217.88	$68.25	$1,007.75	$844.00	$1,680.00	$4,597.66
Kowkash	309.00	.....	397.80	11.75	54.50	556.00	800.00	2,129.05
Montreal River	.....	.....	1,238.54	80.75	186.50	1,183.00	3,130.00	5,818.79
Porcupine	5,106.93	.....	.....	320.00	630.25	5,124.00	14,798.25	25,979.43
Larder Lake	11,911.53	$342.72	.....	545.50	722.00	7,091.00	15,598.75	36,211.50
Red Lake	8,445.34	378.12	32.95	77.75	368.50	3,655.00	8,952.50	21,910.16
Sudbury	11,729.76	51.90	434.26	311.50	973.65	5,489.00	19,123.32	38,113.39
Timiskaming	778.11	4.85	291.99	77.75	115.00	2,277.00	3,672.00	7,216.70
Port Arthur	16,394.10	836.29	2,107.61	221.75	1,190.75	5,455.00	15,338.85	41,544.35
Sault Ste. Marie	2,676.86	13.00	.....	86.75	337.00	2,621.00	6,518.75	12,253.36
Kenora	1,360.86	25.58	34.70	37.25	235.70	1,879.00	3,082.75	6,655.84
Head office	1,830.41	5,282.84	6,367.70	.....	.....	24,487.86	5,784.95	43,753.76
Total	$61,322.68	$6,935.30	$11,123.43	$1,839.00	$5,821.60	$60,661.86	$98,480.12	$246,183.99

MINING CLAIMS RECORDED IN THE SEVERAL MINING DIVISIONS, 1907 AND 1919–1938

Mining division	1907	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Coleman[1]	291	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Frances	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	70	75	175	98	137	313	237	198	292	342
Gowganda[2]	.....	145	215	101	55	33	444	220	96	24	40	34	244	377	114	122	207	205	.....	.....	.....
Kenora	.....	31	25	53	168	150	77	229	935	140	520	348	194	109	203	329	933	874	1,773	1,161	252
Kowkash	.....	9	31	3	148	206	438	150	28	250	368	319	12	56	40	84	231	84	153	143	70
Larder Lake	3,813	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	1,258	1,982	3,567	1,562
Montreal River	866	134	81	143	174	400	471	471	290	126	156	48	661	1,127	156	444	627	276	380	292	204
Parry Sound[3]	102	39	33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Porcupine	.....	136	192	273	760	1,424	556	620	1,297	3,127	611	650	135	307	387	613	785	729	2,443	1,720	1,216
Port Arthur	317	171	108	120	296	222	300	494	1,278	982	1,269	691	338	609	475	900	6,842	1,815	3,420	1,983	1,319
Red Lake	.....	.....	.....	.....	.....	.....	.....	.....	5,827	2,018	1,100	973	305	298	185	343	1,036	754	2,045	1,600	826
Sault Ste. Marie	291	90	90	216	541	498	284	451	395	735	702	487	318	276	92	450	532	429	1,076	1,023	698
Sudbury	456	673	267	319	701	436	559	546	1,367	3,351	6,424	2,164	807	1,597	1,986	2,362	1,549	2,013	1,540	1,814	1,840
Timiskaming	7,860	244	329	159	328	971	735	634	438	875	499	346	202	78	63	256	688	290	745	512	379
At Toronto	.....	231	87	145	171	116	139	226	203	795	1,576	1,186	171	142	356	307	534	476	1,540	1,185	339
Total	13,996	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	9,440	17,295	15,292	9,047

[1]Joined with Timiskaming since 1911.
[2]Joined with Montreal River in 1936.
[3]The 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, claims recorded, profit tax, and total revenue during the past five years:—

PROSPECTING ACTIVITY, PROFIT TAX, AND TOTAL REVENUE, 1934–1938

Year	Calendar year					Fiscal year[1]
	New miner's licenses issued	Miner's licenses renewed	Total licenses and renewals	Mining claims recorded	Profit tax	Total mining revenue
1934	7,409	4,757	12,166	16,888	$1,073,824.46	$1,487,886.94
1935	3,335	5,113	8,448	9,763	1,400,656.14	[2]1,917,981.93
1936	7,170	5,961	13,131	17,295	1,563,680.99	2,187,620.60
1937	5,511	8,344	13,855	15,292	1,801,499.81	2.277,179.74
1938	3,445	6,224	9,669	9,047	2,128,006.58	2,556,300.98

[1]Up to and including 1934, the fiscal year was from November 1 of the previous year to October 31 of the year shown. The fiscal year now ends on March 31.

[2]Includes $130,338.18 for the five months' period November 1, 1934, to March 31, 1935, and $1,787,643.75 for the new fiscal year ending March 31, 1936.

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 record 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 MARCH 31, 1939

District	Sales			Leases			Total sales and leases		
	No.	Acres	Amount	No.	Acres	Amount	No.	Acres	Amount
Algoma	19	1,287.61	$3,264.02	....	.....	.....	19	1,287.61	$3,264.02
Cochrane	65	2,542.07	7,293.84	1	274.00	$100.00	66	2,816.07	7,393.84
Kenora	5	343.03	975.45	....	.....	.....	5	343.03	975.45
Nipissing	....	.....	.....	11	403.79	284.22	11	403.79	284.22
Patricia	89	3,781.10	10,571.68	....	.....	.....	89	3,781.10	10,571.68
Rainy River	3	130.99	327.47	....	.....	.....	3	130.99	327.47
Sudbury	94	4,007.21	11,760.85	52	2,804.38	1,152.96	146	6,811.60	12,913.81
Thunder Bay	150	6,083.06	16,364.32	52	2,533.51	2,620.22	202	8,616.57	18,984.54
Timiskaming	116	4,303.85	11,147.81	116	4,799.10	1,770.36	232	9,102.95	12,918.17
Elsewhere	4	225.00	60.00	....	.....	.....	4	225.00	60.00
Total	545	22,703.92	$61,765.44	232	10,814.79	$5,927.76	777	33,518.71	$67,693.20

Temiskaming Testing Laboratories

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

COMPARATIVE FINANCIAL STATEMENT OF THE TEMISKAMING TESTING LABORATORIES, 1934–1938

Year	Cash receipts	Earnings	Expenditures	Operating profit	Operating loss
1934	$9,816.20	$11,359.81	$12,762.68	.....	$1,402.87
1935	15,149.00	15,405.80	15,212.83	$192.97	.....
1936	19,915.55	20,066.71	17,131.36	2,935.35	.....
1937	15,094.78	14,652.39	14,870.10	.....	217.71
1938	17,112.11	17,256.42	17,085.37	181.05	.....

Provincial Assay Office

The Provincial Assay Office was established in Belleville by the Bureau (now Department) of Mines in 1898, as an aid in the development of the mineral resources of Ontario. W. F. Green, Provincial Assayer and Chemist, reports as follows for 1938:—

The large number of samples submitted to the Chemical Branch of the Department reflects the activity in prospecting in the province. Of these, 3,794 were done free, as provided by R.S.O., Chap. 45, Sec. 69. A total of 4,724 samples was received for investigation, and reports issued. These determinations may be classified as follows:—

COMPLETE ASSAY RETURNS, 1938*

Assay	Free assays under *The Mining Act*	General custom and Department work	Total
Gold	2,885	683	3,568
Silver	204	61	265
Platinum	10	4	14
Copper	123	21	144
Lead	16	1	17
Zinc	30	8	38
Nickel	99	14	113
Cobalt	36	3	39
Iron	31	17	48
Molybdenum	4	7	11
Tungsten	14	28	42
Tin	27	4	31
Beryllium	5	.....	5
Miscellaneous	62	47	109
Total	3,546	898	4,444

In addition 245 samples were received by mail for identification and reports issued. A large number were brought directly to the laboratory; of these no record was kept. Complete analyses of 20 rocks were made for the geologists of the Department and 6 for customs work.

The work of this Branch was carried on with the assistance of T. E. Rothwell, assayer and chemist, and Robert Stewart and William Ley, laboratory assistants.

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 on radio-activity are free, for which 4 samples were reported on for this period.

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. The office was established in February, 1920. It is now in charge of A. D. Williams.

LIST OF MINES, QUARRIES, AND WORKS, 1938

METALLICS

Company	Mine	Manager	Mine Address	Head Office Address
		GOLD[1]		
†Ackerman Gold Mines, Ltd.	Ackerman		Marmora	Marmora.
Addington Mines, Ltd. (under control of Consolidated Mining and Smelting Co. of Canada, Ltd.).	Addington or Rich Rock	C. E. White	Flinton	302 Bay St., Toronto.
Agawa Gold Mines, Ltd.	Agawa or Centennial	H. T. Leslie	Gold Park	80 Richmond St. W., Toronto.
Albany River Gold Mines, Ltd.	Albany River	Geo. S. Gilbert	Pickle Crow	25 King St. W., Toronto.
*†Algold Mines, Ltd.	Algold		Goudreau	45 Richmond St. W., Toronto.
*Algoma Summit Gold Mines, Ltd.	Algoma Summit	F. A. Brandt	Goudreau	19 Melinda St., Toronto.
Anoki Gold Mines, Ltd.	Anoki	C. S. Boland	Larder Lake	100 Adelaide St. W., Toronto.
*†Argosy Gold Mines, Ltd.	Argosy		Casummit Lake	c/o E. G. Clarkson, trustee, 15 Wellington St. W., Toronto.
Augite Porcupine Mines, Ltd.	Augite	Stanley S. Saxton	Timmins	357 Bay St., Toronto.
†Baghdad-Larder Mines, Ltd.	Baghdad-Larder (Walsh Katrine).		Larder Lake	710 Excelsior Life Bldg., Toronto.
*Bankfield Consolidated Mines, Ltd.	Bankfield	J. W. MacKenzie	Bankfield	100 Adelaide St. W., Toronto.
Barber-Larder Gold Mines, Ltd.	Barber-Larder	J. G. Tatham	Larder Lake	372 Bay St., Toronto.
†Beanland Mining Co., Ltd.	Beanland		Timagami	Kirkland Lake.
†Beaverhouse Lake Gold Mines, Ltd. (under control of Toburn Gold Mines).	Argonaut		Kirkland Lake	Haileybury.
Berens River Mines, Ltd.	Berens River	M. D. Banghart	Favourable Lake	Empire.
*Bidgood Kirkland Gold Mines, Ltd.	Bidgood	F. L. Smith	Kirkland Lake	Kirkland Lake.
Big Master Consol. Gold Mines, Ltd. (under control of Selby Lake Mines, Ltd.)	Big Master	C. R. Chataway	Goldrock, via Wabigoon	112 Yonge St., Toronto.
†Bilmac Gold Mines, Ltd.	Bilmac		Shiningtree	357 Bay St., Toronto.
Bobjo Mines, Ltd.	Bobjo	T. C. Fawcett	Clearwater Lake, via Sioux Lookout.	302 Bay St., Toronto.
Broulan Porcupine Mines, Ltd.	Broulan	J. M. C. Dunlop	Pamour	372 Bay St., Toronto.
*Buffalo Ankerite Gold Mines, Ltd.	Buffalo Ankerite	R. P. Kinkel	South Porcupine	South Porcupine.
†Cataraqui Gold Mines, Ltd.	Gilmour		Gilmour	21 King St. E., Toronto.
*Central Patricia Gold Mines, Ltd.	Central Patricia Springer	R. E. Barrett	Central Patricia	Central Patricia.

[1]This list does not include properties on which no underground development work has been done. Companies whose mines were producing in 1938 are marked with an asterisk (*) those at whose mines operations had been suspended at the end of 1938 are marked with a dagger (†).

Company	Mine	Manager	Mine Address	Head Office Address
		GOLD—*Continued*		
Cheminis Gold Mines, Ltd.	Cheminis	Howard J. Jewell.	Larder Lake	171 Yonge St., Toronto.
Chesterville Larder Lake Gold Mining Co., Ltd.	Chesterville	L. T. Postle	Cheminis	330 Bay St., Toronto.
Clark Gold Mines, Ltd.	Clark		Dyment	347 Dominion Square Bldg., Montreal, Que.
*Cline Lake Gold Mines, Ltd.	Cline Lake	M. J. O'Shaughnessy.	Lochalsh	Lochalsh.
Cole Gold Mines, Ltd.	Cole		Cole	Cole.
*Coniaurum Mines, Ltd.	Coniaurum	John Redington	Schumacher	25 King St. W., Toronto.
Consolidated Mining and Smelting Co. of Canada, Ltd.[1]	Cordova	C. A. Seaton	Cordova Mines	215 St. James St. W., Montreal, Que.
†Consolidated Mining and Smelting Co. of Canada, Ltd. (under option).	Hermiston-McCauley		Timagami	215 St. James St. W., Montreal, Que.
Continental Kirkland Gold Mines, Ltd.	Continental Kirkland	M. W. Hotchkin	Kirkland Lake	Kirkland Lake.
†Cook Lake Gold Mines, Ltd.	Cook Lake		Schreiber	350 Bay St., Toronto.
†Craig Gold Mines, Ltd.	Craig		Madoc.	
Credo Porcupine Gold Mines, Ltd.	Arcadia	A. M. Bilsky	South Porcupine	25 King St. W., Toronto.
*Deep Lake Gold Mines, Ltd.	Deep Lake	A. M. George	Gold Park	109 North Union St., Akron, Ohio.
*Delnite Mines, Ltd.	Delnite	John Beattie	Timmins	603 Royal Bank Bldg., Toronto.
De Santis Porcupine Mines, Ltd.	De Santis	C. M. Beck	Timmins	42½ Second Ave., Timmins.
†Devon Gold Mines, Ltd.	Devon	H. Reinecke	Matheson	Matheson.
*Dome Mines, Ltd.	Dome	J. H. Stovel	South Porcupine	36 Toronto St., Toronto.
Edwards Consolidated Mines, Ltd.	Edwards	M. H. Frohberg	Lochalsh	Lochalsh.
†Elizabeth Gold Mining Co., Ltd.	Elizabeth	W. N. McClintock	Atikokan	156 Yonge St., Toronto.
Elmos Gold Mines, Ltd.	Elmos	Arthur Kendall	Geraldton	6 King St. E., Toronto.
†Faulkenham Lake Gold Mines, Ltd.	Faulkenham Lake		Red Lake	10 Adelaide St. E., Toronto.
Faulkenham Lake Gold Mines, Ltd. (under option).	Starratt-Olsen	A. H. Honsberger.	Red Lake	10 Adelaide St. E., Toronto.
Faymar Porcupine Gold Mines, Ltd.	Faymar	S. F. Monck	Timmins	Timmins.
Federal Kirkland Mining Co., Ltd.	Federal Kirkland	J. H. Botsford	Kirkland Lake	85 Richmond St. W., Toronto.
Fernland Gold Mines, Ltd.	Fernland	Howard J. Jewell.	Larder Lake	171 Yonge St., Toronto.
Gillies Lake–Porcupine Gold Mines, Ltd.	Gillies Lake–Porcupine	G. C. Chase	Timmins	Timmins.
*Gold Eagle Gold Mines, Ltd.	Gold Eagle	H. P. Dickey	McKenzie Island	85 Richmond St. W., Toronto.
*Golden Gate Mining Co., Ltd.	Golden Gate	S. A. Pain	Swastika	66 King St. W., Toronto.
Gorham Gold Mines, Ltd.	Gorham	J. D. Wright	204 North Franklin St., Fort William.	330 Bay St., Toronto.

[1]See also Addington Mines, Ltd.; New Golden Rose Mines, Ltd.

*Hallnor Mines, Ltd.	Hallnor	A. L. Sharp	Pamour	Pamour.
*Hard Rock Gold Mines, Ltd.	Hard Rock	J. C. Dumbrille	Geraldton	603 Royal Bank Bldg., Toronto.
*Hasaga Gold Mines, Ltd.	Hasaga	H. L. Edwards	Red Lake	25 King St. W., Toronto.
Hiawatha Gold Mines, Ltd.	Hiawatha	P. W. Meahan	Oba	Oba.
*Hollinger Consolidated Gold Mines, Ltd.[1]	*Hollinger	John Knox	Timmins	602 Royal Bank Bldg., Toronto.
	*Ross	J. J. Caty	Ramore	
*Howey Gold Mines, Ltd.	Howey	R. E. Sullivan	Red Lake	Red Lake.
Hoyle Gold Mines, Ltd.	Hoyle (Lang)	J. M. C. Dunlop	Pamour	372 Bay St., Toronto.
Jellicoe Consolidated Gold Mines, Ltd.	Jellicoe	M. A. Twidale	Geraldton	25 King St. W., Toronto.
*J-M Consolidated Gold Mines, Ltd.	J-M Consolidated	W. W. Westaway	Jackson Manion	85 Richmond St. W., Toronto.
Kenricia Gold Mines, Ltd.	Kenricia	D. A. Duff	Kenora	25 King St. W., Toronto.
*Kerr-Addison Gold Mines, Ltd.	Kerr-Addison	W. S. Row	Larder Lake	38 King St. W., Toronto.
*Kirkland Lake Gold Mining Co., Ltd.	Kirkland Lake Gold	P. J. Harris	Chaput Hughes	1314 Metropolitan Bldg., Toronto.
†Kir-Vit Mines, Ltd.	Kir-Vit		Larder Lake.	
Lake Rowan Gold Mines, Ltd.	Lake Rowan	W. J. Hacker	Golden Arm	1178 Phillips Place, Montreal, Que.
*Lake Shore Mines, Ltd.	Lake Shore	E. W. Todd	Kirkland Lake	Kirkland Lake.
Lakeside-Kirkland Gold Mines, Ltd.	Lakeside-Kirkland		Kirkland Lake	23 College St., Kitchener.
*Lebel Oro Mines, Ltd.	Lebel Oro (Long Lake)	R. P. Teare	Box 156, Sudbury	320 Bay St., Toronto.
*Leitch Gold Mines, Ltd.	Leitch	A. D. Dickson	Beardmore	Beardmore.
*Little Long Lac Gold Mines, Ltd.	Little Long Lac	A. A. Barton	Little Long Lac	25 King St. W., Toronto.
*†Lucky Kirkland Gold Mines, Ltd.	Lucky Kirkland		Swastika	159 Bay St., Toronto.
*Macassa Mines, Ltd.	Macassa	G. A. Howes	Kirkland Lake	85 Richmond St. W., Toronto.
*Mace Gold Mines, Ltd.	Vipond	W. R. Adams	Schumacher	15 King St. W., Toronto.
†MacFarlane Consolidated Mines, Ltd.	MacFarlane Long Lac		Longlac	36 Toronto St., Toronto.
*McIntyre-Porcupine Mines, Ltd.	McIntyre-Porcupine	R. J. Ennis	Schumacher	Schumacher.
*McKenzie Red Lake Gold Mines, Ltd.	McKenzie Red Lake	J. L. Ramsell	McKenzie Island	19 Richmond St. W., Toronto.
*MacLeod-Cockshutt Gold Mines, Ltd.	MacLeod-Cockshutt	A. A. Barton	Little Long Lac	357 Bay St., Toronto.
*Madsen Red Lake Gold Mines, Ltd.	Madsen Red Lake	E. G. Crayston	Madsen	67 Yonge St., Toronto.
*Magnet Consolidated Mines (1936), Ltd.	Magnet	Arthur Kendall	Geraldton	Empire.
†Manor Gold Mines, Ltd.	Manor		Boston Creek	1701 Metropolitan Bldg., Toronto.
Martin-Bird Gold Mines, Ltd.	Martin-Bird	D. M. MacPhail	Larder Lake	200 Bay St., Toronto.
*Matachewan Consolidated Mines, Ltd.	Matachewan Consolidated.	G. W. Mitchell	Matachewan	25 King St. W., Toronto.
†Matachewan Hub Pioneer Mines, Ltd.	Matachewan Pioneer	H. A. Steven	Matachewan	330 Bay St., Toronto.
†Matona Gold Mines, Ltd.	Matona		Shiningtree	171 Yonge St., Toronto.
†Melba Gold Mines, Ltd.	Melba		Bourkes	Bourkes.
*†Mesabi Gold Mines, Ltd.	Mesabi			F. M. Moffatt, trustee, 199 Bay St., Toronto.
†Miles-Martin Kirkland Mines, Ltd.	Goodfish		Kirkland Lake	112 Yonge St., Toronto.
*Minto Gold Mines, Ltd.	*Cooper	R. D. Caylor	Wawa	Wawa.
	*Jubilee			
*Moneta Porcupine Mines, Ltd.	Moneta	J. D. Barrington	Timmins	67 Yonge St., Toronto.
*Morris Kirkland Gold Mines, Ltd.	Morris Kirkland	O. R. Wray	King Kirkland	156 Yonge St., Toronto.
Naybob Gold Mines, Ltd.	Naybob	I. M. Marshall	Timmins	85 Richmond St. W., Toronto.

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

Company	Mine	Manager	Mine Address	Head Office Address
		GOLD—*Continued*		
*New Golden Rose Mines, Ltd. (under direction of Consolidated Mining and Smelting Co. of Canada, Ltd.).	New Golden Rose or Afton.	W. E. Aitchison...	Glen Afton.....	302 Bay St., Toronto.
†North Whitney Mines, Ltd.....	North Whitney.....	.....	Pamour.....	330 Bay St., Toronto.
*Northern Empire Mines Co., Ltd.....	Northern Empire.....	Arthur Kendall...	Empire.....	Empire.
*Omega Gold Mines, Ltd.....	Omega.....	A. D. Campbell...	Larder Lake.....	15 King St. W., Toronto.
*Pamour Porcupine Mines, Ltd.....	Pamour.....	R. M. Macaulay..	Pamour.....	Pamour.
*Paymaster Consolidated Mines, Ltd.....	Paymaster Consolidated	Chas. E. Cook....	South Porcupine.....	South Porcupine.
*Pickle Crow Gold Mines, Ltd.....	Pickle Crow.....	A. G. Hattie.....	Pickle Crow.....	25 King St. W., Toronto.
Pirate Gold Mines, Ltd.....	Shinintree and Kingston	Dan Dubriy.....	Shiningtree.....	347 Bay St., Toronto.
†Planet Gold Mines, Ltd.....	Planet.....	.....	Boston Creek.....	350 Bay St., Toronto.
*Porcupine Lake Gold Mining Co., Ltd. ..	Porcupine Lake.....	J. G. Sipprell.....	Porcupine.....	112 Yonge St., Toronto.
*Preston East Dome Mines, Ltd.....	Preston East Dome....	V. A. James.....	South Porcupine.....	100 Adelaide St. W., Toronto.
*Raven River Mines, Ltd.....	Raven River.....	J. E. Jerome.....	Larder Lake.....	67 Yonge St., Toronto.
†Rebair Gold Mines, Ltd.....	Rebair.....	.....	Atikokan.....	9 Adelaide St. E., Toronto.
†Red Crest Gold Mines, Ltd.....	Red Crest.....	.....	Golden Arm.....	1178 Phillips Place, Montreal, Que.
*†Red Lake Gold Shore Mines, Ltd. (acquired by Hasaga Gold Mines, Ltd.).	Red Lake Gold Shore.			
Regnery, Walter, and Partners.....	Regnery.....	Walter Regnery..	Hawk Junction.	
Ronda Gold Mines, Ltd.....	Ronda.....	J. M. Thompson..	Shiningtree.....	85 Richmond St. W., Toronto.
*Sachigo River Exploration Co., Ltd.....	Sachigo River.....	B. G. Edward....	Sachigo River.....	25 King St. W., Toronto.
*St. Anthony Gold Mines, Ltd.....	St. Anthony.....	B. D. Elderkin...	Savant Lake.....	159 Bay St., Toronto.
*Sand River Gold Mining Co., Ltd.....	Sand River.....	G. B. Tribble.....	Beardmore.....	302 Bay St., Toronto.
†Selby Lake Mines, Ltd.[1]	Selby Lake.....	.....	Goldrock, via Wabigoon	10 Adelaide St. E., Toronto.
Shenango Gold Mines, Ltd.....	Shenango.....	Thos. L. de Rome	Oba.....	67 Yonge St., Toronto.
Slate River Mining Syndicate, Ltd.....	Slate River.....	.....	536 South Marks St., Fort William.	252 West Francis St., Fort William.
†South Vermillion Gold Mines, Ltd.....	South Vermillion.....	.....	Mine Centre.....	21 King St. E., Toronto.
†Split Lake Gold Mines, Ltd.....	Oliver Severn..... / Split Lake.....	.....	Kenora.....	67 Yonge St., Toronto.
Spooner Gold Mines, Ltd.....	Spooner.....	.....	Empire.....	67 Yonge St., Toronto.
*Straw Lake Beach Gold Mines, Ltd.....	Straw Lake Beach.....	J. D. Tolman.....	Emo.....	36 Toronto St., Toronto.
*Sturgeon River Gold Mines, Ltd.....	Sturgeon River.....	T. D. Anderson...	Nezah.....	320 Bay St., Toronto.
*Sylvanite Gold Mines, Ltd.....	Sylvanite.....	K. C. Gray.....	Kirkland Lake.....	Kirkland Lake.
*Teck-Hughes Gold Mines, Ltd.....	Teck-Hughes.....	J. G. McMillan...	Kirkland Lake.....	Kirkland Lake.
*Theresa Gold Mines, Ltd.....	Caouette claims.....	A. Caouette.....	Longlac.....	Box 99, Kapuskasing.

[1]See also Big Master Consolidated Gold Mines, Ltd.

*Tionaga Gold Mines, Ltd.	Smith-Thorne	R. A. Findlay	Tionaga	Tionaga.
*Toburn Gold Mines, Ltd.[1]	Toburn	M. W. Hotchkin	Kirkland Lake	1809 Royal Bank Bldg., Toronto.
*Tombill Gold Mines, Ltd.	Tombill	J. A. Pike	Geraldton	Empire.
†Trout Creek Gold Mining Co., Ltd.	Trout Creek	E. H. Orser	Kirkland Lake	Bank of Commerce Bldg., St. Catharines.
Tyranite Mines, Ltd.	Tyranite	W. J. Trestrail	Gowganda	Kirkland Lake.
Uchi Gold Mines, Ltd.	Uchi	R. H. Sturgess	Uchi Lake	25 King St. W., Toronto.
*Upper Canada Mines, Ltd.	Upper Canada	J. A. W. Brown	Kirkland Lake	80 Richmond St. W., Toronto.
Upper Seine Gold Mines, Ltd.	Upper Seine	W. N. McClintock	Atikokan	156 Yonge St., Toronto.
†Virita Porcupine Gold Mines, Ltd. (under option).	Penny Veteran			1705 Royal Bank Bldg., Toronto.
*†L. A. Voges (under lease)	Orelia		Mine Centre	427 Spadina Ave., Toronto.
†Wascanna Mines, Ltd.	Tash-Orn		Tashota	67 Yonge St., Toronto.
*Wendigo Gold Mines, Ltd.	Wendigo	H. G. Young	Box 990, Kenora	80 King St. W., Toronto.
*Wright-Hargreaves Mines, Ltd.	Wright-Hargreaves	M. W. Summerhayes.	Kirkland Lake	Fort Erie North.
Yama Gold Mines, Ltd.	Yama	R. A. Coutts	Boston Creek	171 Yonge St., Toronto.
*Young-Davidson Mines, Ltd. (under agreement with Hollinger Consolidated Gold Mines, Ltd.).	Young-Davidson	H. North	Matachewan	Matachewan.

[1]See also Beaverhouse Lake Gold Mines, Ltd.; Continental Kirkland Mines, Ltd.; and Federal Kirkland Mining Co., Ltd.

IRON

Algoma Ore Properties, Ltd.	Helen	A. A. Richardson.	Helen Mine	Sault Ste. Marie, Ont.

MOLYBDENITE

McCoy Molybdenite, Ltd.	McCoy		Denbigh	1705 Royal Bank Bldg., Toronto.
Zenith Molybdenite Corporation, Ltd.	Zenith		Ashdad	85 Richmond St. W., Toronto.

NICKEL AND COPPER

Denison Nickel Mines, Ltd.	Denison	C. R. Boehm	Worthington	217 Bay St., Toronto.
Falconbridge Nickel Mines, Ltd.	Falconbridge	Ernest Craig	Falconbridge	25 King St. W., Toronto.
International Nickel Co. of Canada, Ltd.	Creighton	B. F. Crandall	Creighton	25 King St. W., Toronto.
	Frood	F. J. Eager	Frood	
	Garson	J. B. Fyfe	Garson	
	Levack	C. H. Stewart	Levack	

Company	Mine	Manager	Mine Address	Head Office Address
		SILVER AND COBALT		
Bateman, E., and partners (lease of part of property).	Coniagas	E. Bateman	Cobalt.	
Cain, P. E., and McDonough, Jos.	Wettlaufer or Agnico	P. E. Cain	Cobalt.	
Chaplin, F. L. M. (under lease)	Cobnor	S. S. W. Cole	Cobalt.	
Cobalt Products, Ltd. (under lease)	Beaver	J. E. McDonough	Cobalt	67 Yonge St., Toronto.
Cobalt Properties, Ltd.	Cobalt Properties	Arthur Brockle-bank.	Cobalt	Cobalt.
Comet Leasing Co. (under lease)	Kerr Lake	James H. Price	Cobalt	Kirkland Lake.
Dean, J. C.	Silver Bar	J. C. Dean	Cobalt.	
Dotsee Cobalt Mines, Ltd.	Yorkshire Cobalt	O. L. Dixon	Cobalt	67 Yonge St., Toronto.
Fauteaux, R. (under lease)	Silver Cliff	R. Fauteaux	Cobalt.	
Fountain Falls Mining Syndicate, Ltd.	Fountain Falls	Peter Anderson	Cobalt	Haileybury.
Inch, W. C. (under lease)	Curry University	W. C. Inch	Haileybury.	
Legris, J. V. (under lease)	Lorrain Consolidated	J. V. Legris	Cobalt.	
MacArthur, J. A. (under option)	Rochester	J. A. MacArthur	Haileybury.	
McCready, W. E., and partner (under lease)	Red Jacket	W. E. McCready	Cobalt.	
MacDonald, Hugh (under lease)	Temiskaming	Hugh MacDonald	Cobalt.	
Martin, George (under lease)	Crown Reserve Provincial	George Martin	Cobalt.	
Mercier, Raoul (under lease)	Trethewey	Raoul Mercier	Cobalt.	
Miller-Elliott Mines	Canadian Lorrain	H. G. Miller	Cobalt	Cobalt.
M. J. O'Brien, Ltd.	O'Brien (Cross Lake) Miller Lake O'Brien	H. G. Kennedy H. G. Kennedy	Cobalt O'Brien	140 Wellington St., Ottawa.
Morgenthaler, A. G. (under lease)	Adanac	Rory Stewart	Cobalt.	
Murphy, Ambrose, and Landry, A.P.	Coniagas	Ambrose Murphy	Cobalt.	
Nerlip Mines, Ltd.	Nerlip	A. B. Pilliner	Cobalt	46 Wolverton Ave., Toronto.
Nipissing Mining Co., Ltd.	Nipissing	Hugh Park	Cobalt	Excelsior Life Bldg., Toronto.
Plouffe, J. H. (under lease)	Watts	J. H. Plouffe	Cobalt.	
Price, C. W. (under lease from January to June).	Foster	C. W. Price	Cobalt.	
Ringsdorf, R. H. (under lease from July to December).	Foster	R. H. Ringsdorf	Cobalt.	
Rowe, Alfred, and Stuckey, Charles (under lease).	Frontier	Charles Stuckey	Cobalt.	
Silver Valley Mines, Ltd.	Silver Valley	E. N. Tabah	Elk Lake	66 King St. W., Toronto.
Sirola, Donald E. (under lease)	Silver Queen	Donald E. Sirola	Box 271, Kirkland Lake	

Stewardson, F., and Moran, V.	Lily of the Valley	F. Stewardson	536 St. Marks St., Fort William.	
Sutherland, J. H. (under lease)	Lawson	J. H. Sutherland	Cobalt.	
Taylor, W. D. (under lease)	Lorrain Trout Lake	W. D. Taylor	Cobalt.	
Thornham, J. T., and Presse, Albert	Nipissing	J. T. Thornham	Cobalt.	
Wainwright, Thos., and Partner	Red Jacket (Wainawatt)	Thos. Wainwright	Cobalt.	
ZINC				
Lennox Mines Co., Ltd.	Lennox	Geo. Beausoleil	Enterprise	Napanee.

METALLURGICAL WORKS

Operator	Works	Manager	Address
Algoma Steel Corporation, Ltd.	Iron blast furnace	Jas. H. Bell	Sault Ste. Marie.
Canadian Furnace, Ltd.	Iron blast furnace	D. J. Higgon	Port Colborne.
Canadian Industries, Ltd.	Acid and chemical plant	E. H. Jordon	Copper Cliff.
Deloro Smelting and Refining Co., Ltd.	Silver-cobalt refinery	S. B. Wright	Deloro.
Falconbridge Nickel Mines, Ltd.	Nickel-copper smelter	M. J. Tamplin	Falconbridge.
International Nickel Co. of Canada, Ltd.	Nickel-copper smelter	P. F. MacDonald	Copper Cliff.
	Nickel-copper smelter	P. F. 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	H. S. Hilton	Hamilton.

NON-METALLICS

Company	Location	Manager	Address
ARSENIC			
Deloro Smelting and Refining Co., Ltd.	Deloro	S. B. Wright	600 Victoria Bldg., Ottawa.

Company	Location	Manager	Address
ASBESTOS			
Rahn Lake Mines Corp., Ltd.	Matachewan	G. C. Rahn	8½ Main St. W., North Bay.
BARITE			
Canada Baryte Mines, Ltd.	Langmuir tp., Timiskaming dist.		305 Kent Bldg., Toronto.
BERYL			
Canadian Beryllium Mines and Alloys, Ltd.	Quadeville, Renfrew co.	D. Hein	901 Royal Bank Building, Toronto.
FELDSPAR			
Bathurst Feldspar Mines, Ltd.	Bathurst tp., Lanark co.	T. H. Craig	21 King St. E., Toronto.
Craig, T. H.	W. ½ lot 12, con. IX, Bathurst tp., Lanark co.	T. H. Craig	16 Victoria St., Perth.
Frontenac Floor and Wall Tile Co., Ltd.	Grinding plant, Kingston		Box 178, Kingston.
Prince and Prince	Sabine tp., Nipissing dist.	A. M. Prince	Princes Lake.
Supple, J. A.	Lot 15, con. IV, Murchison tp., Renfrew co.	W. B. Cameron	Pembroke.
FLUORSPAR			
Stoklosar, Chas. A.	W. ½ lot 3, con. I, Madoc tp., Hastings co.	C. A. Stoklosar	Madoc.
GRAPHITE			
Black Donald Graphite Co., Ltd.	Brougham tp., Renfrew co.	W. B. 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	Acid plants, Copper Cliff		Copper Cliff.
Canadian Pyrites, Ltd	Flower Station (idle in 1937)		1400 Guardian Bldg., Cleveland, Ohio.

MICA

Bennett, H. V		H. V. Bennett	6 Church St., Perth.
Haughian, Frank	Lot 13, con. V, Bathurst tp., Lanark co.	Frank Haughian	Perth.
Kent Bros. (buyers)		W. C. Kent	114 Gore St., Kingston.
Kingston Mica Mining Co., Ltd	S. ½ lot 5, con. II, Bedford tp., Frontenac co.	Charles Keller	Godfrey.
Lee, W. W	Buck lake; Bob's lake	W. W. Lee	Bedford Mills.
Loughborough Mining Co., Ltd	Various properties in Ontario		322 James St., Ottawa.
Thirty Island Lake Mica Co., Ltd	Frontenac and Lanark counties	S. H. Orser	Verona.

MINERAL WATERS

Belleville Aqua Vitae Co., Ltd	S. ¼ lot 2, con. V, Thurlow tp., Hastings co.		216 Dufferin Ave., Belleville.
Boyd, T. Russell	Carlsbad Springs	T. Russell Boyd	Carlsbad Springs.
Charles Gurd and Co., Ltd	Caledonia Springs		1016 Bleury St., Montreal, Que.

NEPHELINE SYENITE

Canadian Nepheline, Ltd	Lot 14, con. IX, Methuen tp., Peterborough co.	R. G. Kilbon	Canada Permanent Bldg., Toronto.
Gooderham Nepheline	Lot 30, con. IV, Glamorgan tp., Haliburton co.	J. A. Fraser	24 Dickson St., Galt.
New England Nepheline Co., Inc	Bancroft	Erd	29 Ralston St., Keene, N.H.

Company	Location	Manager	Address
PEAT			
Leasa, Wm.	Lot 11, con. X, Ellice tp., Perth co.	Wm. Leasa	Milverton.
Runke and Sons, Geo.	Lot 55, German tract, Waterloo tp., Waterloo co.	Geo. Runke	115 Cameron St. N., Kitchener.
Stewart, Walter J.	Morewood		Morewood.
QUARTZ, QUARTZITE, AND SILICA BRICK			
Algoma Steel Corporation, Ltd.	Silica brick (quartz from Deroche tp.)		Sault Ste. Marie.
Deloro Smelting and Refining Co., Ltd.	Deloro	S. B. Wright	600 Victoria Bldg., Ottawa.
Dominion Mines and Quarries, Ltd.	Killarney	G. Willeys	Canada Life Bldg., Toronto.
Falconbridge Nickel Mines, Ltd.	Falconbridge	E. Craig	Falconbridge.
International Nickel Co. of Canada, Ltd.	Garson tp., Sudbury dist.	D. MacAskill	Copper Cliff.
Wright and Co.	Deroche tp., Algoma dist.	G. S. Cowie	960 Queen St., Sault Ste. Marie.
SALT			
Brunner Mond, Canada, Ltd.	Anderdon tp., Essex co.	C. K. MacFetridge	Canadian Bank of Commerce Bldg., Toronto.
Canadian Industries, Ltd.	Sandwich		Box 1260, Montreal, Que.
Dominion Salt Co., Ltd.	Sarnia		Sarnia.
Goderich Salt Co., Ltd.	Goderich	G. N. Dowker	Goderich.
Warwick Pure Salt Co.	Warwick tp., Lambton co.	M. Schikiransky	R. R. 5, Watford.
Western Canada Flour Mills Co., Ltd.	Goderich		287 MacPherson Ave., Toronto.
TALC			
Canada Talc, Ltd.	Con. XIV, Huntingdon tp., Hastings co.	Roy Taylor	Madoc.
Madoc Talc and Mining Co., Ltd.	Cons. XII and XIII, Cashel tp., Hastings co.	Jas. E. Doyle	Gunter.

STRUCTURAL MATERIALS

CEMENT

Canada Cement Co., Ltd.	Belleville	J. H. Legate	Canada Cement Bldg., Montreal, Que.
	Port Colborne	L. M. McDonald	
St. Marys Cement Co., Ltd.	Perth co.	John G. Lind	357 Bay St., Toronto.

LIME

Bell, Harry	N. ½ lot 23, con. XII, Sullivan tp., Grey co.		R.R. 4, Chesley.
Biederman, Albert G.	Wilberforce tp., Renfrew co.		R.R. 1, Golden Lake.
Brown's Lime Works	Owen Sound	Wm. Brown	4th St. and 9th Ave., Owen Sound.
Brunner Mond, Canada, Ltd.	Anderdon tp., Essex co.	C. K. MacFetridge	25 King St. W., Toronto.
Cameron, W. M.	Ramsay tp., Lanark co.		Carleton Place.
Canada and Dominion Sugar Co., Ltd.	Chatham		Chatham.
	Wallaceburg		
Canada Lime Company	Somerville tp., Victoria co.	C. M. Petrie	Coboconk.
	McNab tp., Renfrew co.		
Canadian Gypsum Co., Ltd.	Guelph	B. S. Barns	1221 Bay St., Toronto.
Chalmers Lime Works	Owen Sound	W. C. Moore	689 7th St. W., Owen Sound.
Dominion Rock Products, Ltd.	Eganville		941 Dominion Square Bldg., Montreal.
Electro Metallurgical Co. of Canada, Ltd.	Welland		Canada Life Bldg., Toronto.
Gypsum, Lime and Alabastine, Canada, Ltd.	Beachville		Paris.
	Hespeler		
	Milton		
Innerkip Lime and Stone Co., Ltd.	Beachville	C. E. Downing	Beachville.
Jamieson Lime Co.	Renfrew	J. A. Jamieson	Renfrew.
North American Cyanamid Ltd.	Beachville		Royal Bank Bldg., Toronto.
Rockwood Lime Co.	Eramosa tp., Wellington co.		Rockwood.
Shane Lime and Charcoal Co., Ltd.	Fourth Chute		Eganville.

STONE (GRANITE AND TRAP)

Building Products, Ltd.	Verona and Mountain Grove	A. de Wolfe	Box 6063, Montreal, Que.
Campbell Construction Co., Ltd.	Escott tp., Leeds co.	N. S. Campbell	137 Wellington St., Toronto.
Canadian Dredge and Dock Co., Ltd.	Thunder Bay area		Midland.
City of Fort William Corporation	Fort William	City Engineer	City Hall, Fort William.
Grenville Crushed Rock Co., Ltd.	Hawk Lake	W. H. Roberts	917 Keefer Bldg., Montreal, Que.

Operator	Location	Manager	Address
STONE (Granite and Trap)—*Continued*			
Hewitson Construction Co., Ltd.	McIntyre tp., Thunder Bay dist.		Walsh Block, Port Arthur.
Hydro-Electric Power Commission	Mann tp., Cochrane dist., and Patricia portion of Kenora dist.	D. Forgan	620 University Ave., Toronto.
Ontario Rock Co., Ltd.	Con. IV and VI, Belmont and Methuen tps., Peterborough co.	H. L. Scott	320 Bay St., Toronto.
Wm. Horne Granite Quarries	Butler	Wm. Horne	Butler, via Ignace.
STONE (Limestone and Marble)			
Bolender Bros. (White Star Mines)	Dysart tp., Haliburton co.	P. H. Bolender	Haliburton.
Bonter Marble and Calcium Co., Ltd.	Marmora tp., Hastings co.		Marmora.
Brunner Mond, Canada, Ltd.	Anderdon tp., Essex co.	C. K. MacFetridge	25 King St. W., Toronto.
Campbell Construction Co., Ltd.	Tudor tp., Hastings co.	N. S. Campbell	137 Wellington St., Toronto.
Canada Cement Co., Ltd.	Thurlow tp., Hastings co.	J. H. Legate	Canada Cement Bldg., Montreal.
Canada Crushed Stone Corporation, Ltd.	Dundas	R. W. Cunningham	Sun Life Bldg., Hamilton.
	Hagersville	G. Gilbertson	
Coldwater Crushed Stone, Ltd.	Medonte tp., Simcoe co.	R. Theodore	Coldwater.
Connolly Marble Mosaic and Tile Co., Ltd.	Madoc tp., Hastings co.		316 Dupont St., Toronto.
Cook, J. S.	Amabel tp., Bruce co.		Wiarton.
Falconbridge Nickel Mines, Ltd.	Falconbridge		25 King St. W., Toronto.
Gow, James	Fergus		Fergus.
Gypsum, Lime and Alabastine, Canada, Ltd.	Beachville	T. F. Robinson	Paris.
	Hespeler	J. J. Power	
	Milton	R. S. Adams	
Hagersville Quarries, Ltd.	Hagersville	J. S. Beck	Hagersville.
Haldimand Quarries and Construction, Ltd.	Hagersville	C. F. Anderson	Hagersville.
Harvey, Harold	Howe island	Ivan Grant	56 Kensington Ave., Kingston.
Hicks, William, and Son	8th St. W., Owen Sound		933 15th St. E., Owen Sound.
Innerkip Quarries, Ltd.	E. Zorra tp., Oxford co.		Fleet and Bathurst Sts., Toronto.
Johnson Bros Co., Ltd.	Highway 28, near Burleigh Falls		43½ Market St., Brantford.
Kehoe, T. J.	Brechin		Brechin.
Kingston Penitentiary	Portsmouth	P. Foley	Box 22, Kingston.
Kirby Bros. Supply Co., Ltd.	Junction Gore		215 Sussex St., Ottawa
Kirkfield Crushed Stone, Ltd.	Kirkfield	J. Barker	Fleet and Bathurst Sts., Toronto.
Law Construction, Ltd.	Allenford	C. Foulds	225 Sterling Rd., Toronto.
Limestone Products, Ltd.	Con. V, Orillia tp., Simcoe co.	G. S. Kremo	1104 Hermant Bldg., Toronto.

Longford Quarries, Ltd.	Longford Mills	R. M. Craig	Sun Life Bldg., Hamilton.
McGinnis and O'Connor	Collins Bay, Frontenac co.	T. A. McGinnis	412 King St., Kingston.
Noranda Mines, Ltd.	Haileybury		804 Royal Bank Bldg., Toronto.
North American Cyanamid, Ltd.	Beachville	A. J. Kennedy	Royal Bank Bldg., Toronto.
Ontario Reformatory	Guelph	Superintendent, Ont. Reformatory, Guelph	Deputy Provincial Secretary, Parliament Bldgs., Toronto.
Ontario Rock Co., Ltd.	Con. IV and VI, Belmont and Methuen tps., Peterborough co.	H. L. Scott	320 Bay St., Toronto.
Pirson, John	Hydro dump, Stamford tp., Welland co.	John Pirson	Stevensville.
Queenston Quarries, Ltd.	St. David's	A. Michie	76 Sun Life Bldg., Toronto.
R. E. Law Crushed Stone, Ltd.	Port Colborne	R. E. Law	Port Colborne.
Routley Construction Co., Ltd.	Rawdon tp., Hastings co.	C. R. McInnes	21 Dundas Sq., Toronto.
	Portland tp., Frontenac co.		
R. R. Foster and Sons, Ltd.	Merivale Rd., Nepean tp., Carleton co.	R. J. Foster	86 Spadina Ave., Ottawa.
S. H. Orser Ornamental Stone Products	Verona	S. H. Orser	Verona.
Silvertone Black Marble Quarries, Ltd.	Finch tp., Stormont co.	Carl Burd	305 O'Connor St., Ottawa.
Stockloser, Karl	Eldorado		Madoc.
Town of Collingwood	Collingwood	A. MacRae	Collingwood.
Walker Bros.	Stamford tp., Welland co.	J. G. Walker	Thorold.
Wehman, John	Kingston tp., Frontenac co.	John Wehman	23 Plum St., Kingston.
Welland Canals, Department of Transport	Welland Canal		St. Catharines.

STONE (SANDSTONE)

Campbell Sandstone Quarries, Ltd.	Nepean tp., Carleton co.	A. Campbell	143 Main St., Westboro.
Corner, Austin	Caledon tp., Peel co.		Acton.
Mountain Sandstone Quarry	Esquesing tp., Halton co.	H. Logan	Box 307, Georgetown.
Norton, A. W.	Esquesing tp., Halton co.		Limestone.
Sykes, Thomas	Glen Williams		Yonge St., Georgetown.

STONE (SLATE)

Canada Slate Products, Ltd.	Madoc	Wm. Wright	11 King St. W., Toronto.

SAND-LIME BRICK

Harbour Brick Co., Ltd.	565 Fleet St. W., Toronto		Fleet St., at Bathurst St., Toronto.
Toronto Brick Co., Ltd.	Toronto		897 Bay St., Toronto.
York Sandstone Brick Co., Ltd.	Toronto		447 Victoria Park Ave., Toronto.

Company	Location	Manager	Address
SAND AND GRAVEL (Licensed Dredging Operators)			
Hadley's Chatham, Ltd.	Thames river		47 Wellington St., Chatham.
McLean and Sons, A. B.	Lake Superior		Brock St., Sault Ste. Marie.
National Sand and Material Co., Ltd.	Lake Erie		402 Harbour Bldg., Toronto.
Pyke Salvage Co.	St. Lawrence river		506 Princess St., Kingston.
Scott, Thos. J.	Lake Superior		66 March St., Sault Ste. Marie.
Tees Transit Co.	Niagara bar		77 Sterling St., Hamilton.
United Towing and Salvage Co., Ltd.[1]	Lake Superior		635 Common St., Montreal, Que.
SAND AND GRAVEL[2] (Pit Operations)			
A. E. Jupp Construction Co., Ltd.	Mara tp., Ontario co.		170 Berkeley St., Toronto.
Brennan Paving Co., Ltd.	Perth and Huron cos.		400 Gage Ave. N., Hamilton.
Canadian Aggregates, Ltd.	Burford tp., Brant co.		Walkerville.
Consolidated Sand and Gravel, Ltd.	Paris		402 Harbour Bldg., Toronto.
Waterford Sand and Gravel Co., Ltd.	Waterford.		
C. Smythe, Limited	Etobicoke tp., York co.		Carlton and Church Sts., Toronto.
Curran and Briggs, Ltd.	Echo Bay, Dunsford, Bobcaygeon, Haliburton, Brockville.		203 Manning Chambers, Toronto.
Dominion Concrete Co., Ltd.	Oxford and Augusta tps., Grenville co.		Prescott St., Kemptville.
Donald, Andrew	Dereham tp., Oxford co.		R.R. 1, Ingersoll.
Grandmaitre, D.	Rockcliffe village		19 Olmstead St., Ottawa.
Hollinger Consol. Gold Mines, Ltd.	Tisdale tp., Cochrane dist.		Timmins.
Howard Sand and Gravel Co., Ltd.	E. Flamborough tp., Wentworth co.		Aldershot.
Hydro-Electric Power Commission of Ontario	Little tp., Cochrane dist.		620 University Ave., Toronto.
Kingston Sand and Gravel, Ltd.	Glenburnie		235 Wellington St., Kingston.
Rayner Construction, Ltd.	Powassan, Bracebridge, Geraldton		29 Commercial St., Leaside.
R. R. Foster and Sons, Ltd.	Nepean and Gloucester tps., Carleton co.		86 Spadina Ave., Ottawa.
Sandy and Salkeld			Goderich.
Spratt, J. H.	Gloucester tp., Carleton co.		Billing's Bridge.
Towland Construction Co., Ltd.	Saugeen tp., Bruce co. London tp., Middlesex co.		294 Dundas St., London.
Warren Bituminous Paving Co., Ltd.	Fenelon Falls		437 Fleet St. W., Toronto.
Wm. R. Barnes Co., Ltd.	Spring Vale, Waterdown, Brantford		243 Cumberland Ave., Hamilton.
Woollatt Fuel and Supply Co., Ltd.	Essex co.		2171 Ottawa St., Windsor.

[1]Formerly Sincenne-McNaughton Tugs, Ltd.

[2]Only owners producing 5,000 tons or over are listed.

CLAY PRODUCTS

Company	Location	Manager	Address
Belle River Brick and Tile Co.	Lot 3, con. I, Rochester tp., Essex co.	M. V. Pougnet (lessee)	Belle River.
Brampton Pressed Brick Co., Ltd.	Lot 9, Chinguacousy tp., Peel co.		Brampton.
Broadwell and Son, B.	Lot 12, con. IV, Gosfield S. tp., Essex co.		Kingsville.
Canadian Pressed Brick Co., Ltd.	Hamilton		195 Ottawa St., Hamilton.
Casemore and Son, R.	Keppel tp., Grey co.	H. O. Casemore	Shallow Lake.
Chapman Bros.	Lot 2, con. II, East York tp., York co.	H. W. Chapman	145 Dawes Road, Toronto.
Construction Materials, Ltd.	Horner Ave., Etobicoke		New Toronto.
Cooksville Co., Ltd.	Cooksville	W. E. Secker	46 Bloor St. W., Toronto.
Coultis and Son, Geo.	Lot 23, con. III, Bosanquet tp., Lambton co.		Thedford.
Cowell, George Wesley	Oxford co.		Tillsonburg.
Curtin, Frank, Estate of	Lot 15, con. V, Ops tp., Victoria co.	J. Curtin	R.R. 4, Lindsay.
Curtis Bros.	Lot 32, con. XII, Otonabee tp., Peterborough co.	E. Curtis	Box 809, Peterborough.
Deller, Wm. H.	Lot 5, con. V, W. Nissouri tp., Middlesex co.		Thorndale.
Deller and Son, Albert	Brownsville	Albert Deller	Brownsville.
Dochart Brick, Tile and Terra Cotta Works	Arnprior	Geo. E. Baker	Arnprior.
Donaldson, T. G.	Lot 19, con. XIV, Culross tp., Bruce co.		R.R. 1, Greenock.
Douglas, John R.	Lot 14, con. XII, Sombra tp., Lambton co.	J. R. Douglas	Wilkesport.
Dover Brick and Tile Works	Con. IX, Baldwin Rd., Dover tp., Kent co.	J. MacHardy	20 7th St., Chatham.
Elliott, Chas.	Lot 23, con. I, Turnberry tp., Huron co.		Bluevale.
Elliott, James, Jr.	Korah tp., Algoma dist.		519 Wellington St. W., Sault Ste. Marie
Elliott, Wm.	Lot 11, con. I, Culross tp., Bruce co.		Glenannan.
Fletcher Brick and Tile	Lot 1, con. VIII, Tilbury E. tp., Kent co.	T. H. Armstrong	Fletcher.
Fort William Brick Co.	Fort William	H. M. Piper	509 Victoria Ave., Fort William.
Foster Pottery Co.	Hamilton	S. Foster	Main St. W., Hamilton.
Fred W. Howlett and Sons, Ltd.	King St., Petrolia		Box 3, Petrolia.
Frid Brothers, Ltd.	Hamilton	A. Frid	Main W. & Machlin Sts., Hamilton.
Gammage, C. R.	Lambton co.		R.R. 2, Dresden.
Georgian Bay Building Products	Shallow Lake	R. T. Malcom	235 Ninth St. E., Owen Sound.
Gomoll Brick and Tile Works	Lot 15, con. X, S. Himsworth tp., Parry Sound dist.		Powassan.
Grimsby Brick and Tile Co.	Lot 23, Clinton tp., Lincoln co.		Main St., Grimsby.
Haist, W. R.	Stephen tp., Huron co.		Crediton.
Hamilton Pressed Brick Co., Ltd.	Wentworth co.	Robert W. New	211 Kensington Ave. S., Hamilton.
Harper Brick Works	Greenwood Ave., Toronto		348 Greenwood Ave., Toronto.

Company	Location	Manager	Address
CLAY PRODUCTS—*Continued*			
Hill, Aaron	Essex co.		Essex.
Hill, Albert W.	Lot 15, con. XIII, Tilbury E. tp., Kent co.		R.R. 1, Coastworth.
Hitch, D. A.	Ridgetown		Erie St. N., Ridgetown.
Hitch, Thos.	First Ave., St. Thomas		First Ave., St. Thomas.
Hodder and Sons, Mrs. J. H.	Lot 9, con. A, Dunwich tp., Elgin co.		Dutton.
Huntsville Brick Works	Lot 8, con. I, Chaffey tp., Muskoka dist.	C. H. Stevens	Box 308, Huntsville.
Interprovincial Brick Co., Ltd.	Lots 1-46, Nassagaweya tp., Halton co. Chinguacousy tp., Peel co.	W. E. Secker	46 Bloor St. W., Toronto.
Jackson Brick and Tile Yard	Brantford	W. Jackson	290 Rawdon St., Brantford.
James Cornhill Sons, Ltd.	Harwich tp., Kent co.	John F. Cornhill	Box 36, Chatham.
Jamieson Lime Co.	Renfrew	J. A. Jamieson	Renfrew.
Janes, D. A.	No. 2 Highway, Middlesex co.		Mount Brydges.
Jasperson Brick and Tile Co.	Coatsworth		Kingsville.
Jervis, W. J.	Lot 13, con. B, N. Dorchester tp., Middlesex co.		R.R. 3, Dorchester.
Johnson, James, Estate of	Stafford tp., Renfrew co.	L. G. Fraser	Pembroke.
Kerr, C., Estate of	Colborne tp., Huron co.		R.R. 4, Goderich.
Koebel Bros.	Lot 7, con. II, Wellesley tp., Waterloo co.	C. Koebel	Box 3, St. Clements.
Lindsay and Sons, Earl	Lot 24, con. II, Chatham gore, Kent co.	G. C. Lindsay	R.R. 2, Wallaceburg.
London Pottery Manufacturing Co.	Westminster tp., Middlesex co.	A. W. Ferguson	95 Rectory St., London.
McComb, Chester	Lot 17, con. XVI, London tp., Middlesex co.		R.R. 2, London.
McCormick, Thomas L.	Lot 7, con. IV, Warwick tp., Lambton co.		R.R. 5, Watford.
McEachran, Norman	Highgate		Highgate.
McFarlane, W. J.	Plympton tp., Lambton co.		Forest.
McFarren, F. B.	Toronto tp., Peel co.		34 Toronto St., Toronto.
Milton Brick, Ltd.	Milton		170 Bloor St. W., Toronto.
Moulton, J.	Lot 32, con. IV, Greenock tp., Bruce co.		R.R. 2, Holyrood.
Napanee Brick and Tile Works	Lot 13, con. VI, N. Fredericksburgh tp., Lennox and Addington co.	R. L. Chapman	R.R. 3, Napanee.
National Fire Proofing Co. of Canada, Ltd.	E. Flamborough tp., Wentworth co.		96 Bloor St. W., Toronto.
National Sewer Pipe Co., Ltd.	Swansea Hamilton Lots 1, 2, 4, con. I, and lots 1, 2, 3, con. II, E. Flamborough tp., Wentworth co.	R. H. New	Aldershot.
New Liskeard Brick Works	New Liskeard	D. Dunn	Box 74, New Liskeard.
Norwich Brick and Tile Works	N. Norwich tp., Oxford co.	A. Deller	R.R. 2, Norwich.

Ontario Brick and Tile Plant	Near Mimico	Thos. Gourlay	Dept. Prov. Secretary, Reformatories and Prisons Branch, Parliament Bldgs., Toronto.
O'Reilly, T. E.	Prescott highway, Nepean tp., Carleton co.	T. E. O'Reilly	320 Bay St., Ottawa.
Ott Brick and Tile Mfg. Co., Ltd.	Kitchener		16 St. Andrew St., Kitchener.
Ottawa Brick and Terra Cotta Co., Ltd.	Billing's Bridge		Billing's Bridge.
Owen Sound Brick Co., Ltd.	Sixth St. E., Owen Sound		928 Second Ave., Owen Sound.
Paxton, Fred R.	70 Herrick Ave., St. Catharines		70 Herrick Ave., St. Catharines.
Phinn, Geo. A.	Westminster tp., Middlesex co.		St. James Park P.O., London.
Phippen and Son	Dawes Road, E. York tp., York co.	H. W. Phippen	Box 11, Coleman P.O.
Richardson and Son, J.	Kerwood	J. F. Richardson	Kerwood.
Rollins, D. W.	Lot 10, con. I, Thurlow tp., Hastings co.		179 Dundas St., Belleville.
Snelgrove, A.	Beaverton		Beaverton.
Sproat and Sproat	Lot 6, con. IV, Tuckersmith tp., Huron co.	W. M. Sproat	R.R. 4, Seaforth.
Standard Brick Co., Ltd.	500 Greenwood Ave., Toronto		500 Greenwood Ave., Toronto.
Superior Brick and Tile Co., Ltd.	Lots 11, 12, Paipoonge tp., Thunder Bay dist.		426 Victoria Ave., Fort William.
Thomson, Ralph	Lot 34, con. VIII, Grey tp., Huron co.		Henfryn.
Thos. Godfrey and Co.	Beckwith tp., Lanark co.		Carleton Place.
Toronto Brick Co., Ltd.	Milton Don Valley, Todmorden 395 Greenwood Ave., Toronto		897 Bay St., Toronto.
Wagstaff Brick and Tile Yard	Lot 5, con. XIV, Ops. tp., Victoria co.	L. N. Wagstaff	32 Simcoe St., Lindsay.
Wallace and Son, R.	Lot 16, con. D., Widdifield tp., Nipissing dist.		Toronto General Trusts Corp., 253 Bay St., Toronto.
Wein, Aaron	Lots 1, 2, 3, con. V, Stephen tp., Huron co.		Crediton.
Wright and Sons, Geo.	Lot 7, Tilbury W. tp., Essex co.	F. M. Wright	Comber.

MINES OF ONTARIO IN 1938

By

Chief Inspector of Mines, D. G. Sinclair, Toronto; Inspectors, A. E. Cave, Kenora; W. O. Tower, J. B. Taylor, D. P. Douglass, Kirkland Lake; A. S. Bayne, Port Arthur; D. F. Cooper, Sudbury; E. B. Weir, Timmins; A. R. Webster, Toronto.

ASBESTOS

Rahn Lake Mines Corporation, Limited

The Rahn Lake Mines Corporation, Limited, was incorporated in June, 1934, with an authorized capitalization of 3,000,000 shares of no par value, of which 1,691,128 have been issued. The officers and directors are: G. C. Rahn, president; J. M. Magenau, vice-president; W. Brown, secretary-treasurer; D. D. Bennett, managing director; E. W. King, R. H. Howell, R. Densmore, F. L. Gayder, H. Philipson, and H. C. J. Oehlecker, directors. The head office is at 19 Melinda Street, Toronto. The mine address is Matachewan.

The property consists of 24 claims, 848 acres, in Montrose and Bannockburn townships, Matachewan area, district of Timiskaming, and was acquired from the Clover Leaf Mining Company, Limited, and the Empire Asbestos Mines Company.

During 1938 a log house to be used as a manager's residence, a garage to accommodate three cars, and a mechanic's workshop and tool-house were built. A 200-ton mill was in course of construction at the end of the year.

No. 1 shaft was sunk 25 feet to a total depth of 130 feet, and 80 feet of cross-cutting was done on the 100-foot level.

An average of 7 men was employed from July 7 to December 31, under the management of R. E. Holliday.

GOLD

Ackerman Gold Mines, Limited

Ackerman Gold Mines, Limited, was incorporated in September, 1937, with an authorized capitalization of $1 par value, of which 1,682,777 have been issued. The officers and directors are: C. H. Ackerman, president; H. F. Hansell, Jr., vice-president; Geo. A. Becker, secretary-treasurer; Reginald Blomfield, director. The head office and mine office are at Marmora. The property consists of 368 acres in Marmora township, county of Hastings.

Operations were continued from January 1, 1938, to May 31. The 45-degree, 2-compartment shaft was sunk 100 feet to a total depth of 270 feet. About 600 feet of drifting was done on the 170-foot level.

During the period of operation 33 men were employed, of whom 13 were in the mine. J. M. Thompson was manager.

Addington Mines, Limited

Addington Mines, Limited, was incorporated in February, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: Noah Dyment, president; W. M. Archibald, vice-president; J. E. Robinson, secretary-treasurer; Stanley Day,

E. G. Montgomery, and Jas. E. Riley, directors. C. E. White is superintendent at the mine. The head office is at 302 Bay Street, Toronto. The mine office is at Flinton.

The company owns the property known as the Addington or Rich Rock in Kaladar township, Lennox and Addington county. Operations are carried on under the control of the Consolidated Mining and Smelting Company of Canada, Limited. An account of the work done during 1938 appears on page 98 of this report.

Agawa Gold Mines, Limited

Agawa Gold Mines, Limited, was incorporated in November, 1937, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,575,091 have been issued. The officers and directors are: R. H. Halbert, president; Dr. E. Blanchard, vice-president; A. C. McLean, secretary-treasurer; Edouard Pinson and J. C. Allan, directors. The head office is at 80 Richmond Street West, Toronto. The mine address is Gold Park.

The company owns 20 claims, 800 acres, in Powell township, Matachewan area, district of Timiskaming, and 12 claims, 480 acres, in township 29, range 22, Michipicoten area, district of Algoma. The latter group includes the Centennial mine, formerly owned by L. B. United Mines, Limited, which was succeeded by Agawa Gold Mines, Limited, in November, 1937.

At the Centennial mine operations were carried on from March 15, 1938, to the end of the year. Between March 15 and August 1 some 1,750 feet of surface trenching was accomplished, and two diamond-drill holes, totalling 500 feet, were drilled from surface. Underground work began on August 1, and 100 feet of crosscutting and 608 feet of drifting were done on the 250-foot level. The mill did not operate during 1938.

H. T. Leslie is consulting engineer, and H. Walls is foreman in charge at the property. An average of 9 men was employed during the period of operation.

Albany River Gold Mines, Limited

Albany River Gold Mines, Limited, was incorporated in July, 1938, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,999,714 have been issued. The company acquired the assets of Albany River Mines, Limited, the shareholders receiving two shares of the new company for five shares of the old. The company then bought the property of Winoga Patricia Gold Mines, Limited, which adjoins the Albany River property on the south.

The officers and directors are: J. E. Hammell, president; Robert Fennell, vice-president and secretary-treasurer; A. G. Hattie, B. H. Budgeon, J. W. Morrison, W. H. Despard, and George Lawrence, directors. The head office address is 25 King Street West, Toronto. The mine address is Pickle Crow.

The property consists of 17 claims, 650 acres, in the townships of Connell and McCullagh, in the Pickle-Crow area, Patricia portion of Kenora district. Access to the mine is by airplane from Sioux Lookout or Hudson to Pickle Lake. The distance from Pickle Lake to the mine is 9 miles by road.

Underground operations in 1938 continued from January to August 29. The suspension of underground work at this date was mainly due to a shortage of power. A diamond-drilling campaign was carried on for the rest of the year.

The following table shows the amount of underground work accomplished on the property:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	652	.....	652
125-FOOT LEVEL:			
Drifts	465	.....	465
Crosscuts	450	.....	450
250-FOOT LEVEL:			
Drifts	150	.....	150
Crosscuts	30	.....	30
375-FOOT LEVEL:			
Drifts	1,350	48	1,398
Crosscuts	470	.....	470
500-FOOT LEVEL:			
Drifts	.....	950	950
Crosscuts	.....	207	207
625-FOOT LEVEL:			
Drifts	.....	1,055	1,055
Crosscuts	.....	392	392

During 1938 the following diamond-drilling was done:—

	Feet
Surface	21,013
Underground	2,689
Total	23,702

Operations at the mine are under the direction of A. G. Hattie, of the Pickle Crow mine. Geo. S. Gilbert is resident manager. An average of 10 men was employed underground during the first eight months of the year, and an average of 15 men on surface throughout the year.

Algold Mines, Limited

Algold Mines, Limited, was incorporated in February, 1934, with an authorized capitalization of 2,500,000 shares of no par value, of which 2,435,841 have been issued. The officers and directors are: W. R. Knox, president; J. G. Merrick, secretary; David Lieberman, treasurer; J. M. Macintosh, T. F. Daigle, and H. L. Donaldson, directors. The head office is at 45 Richmond Street West, Toronto. The mine address is Goudreau.

The property is located in township 28, range 26, Goudreau area, district of Algoma, and contains 728 acres.

Mining and milling operations were carried on from January 1 to August, 1938. The development work accomplished on the various levels during the year and the total when operations ceased are shown in the following table:—

Level	Drifting		Crosscutting		Raising	
	1938	Total	1938	Total	1938	Total
	feet	feet	feet	feet	feet	feet
100-foot	175	1,448	.....	95	.....	91
120-foot	.....	35	.....	.....	.....	.....
140-foot	.....	126	.....	15	.....	132
200-foot	169	2,146	.....	625	.....	305
400-foot	.....	470	.....	150	.....	.....
Total	344	4,225	.....	885	.....	528

Nine box-holes were driven on the 200-foot level.

Ore production was obtained from mining out No. 2 shaft pillar, from a shrinkage stope and slashing on the 200-foot level, and from the open pit. Some 8,541 tons was hoisted and milled, the mill treating an average of 40.6 tons per day.

R. F. Mitchell and J. E. Hanlon were successively in charge of operations. An average of 37 men was employed from January 1 to August 31. A small force of 4 or 5 men was employed on surface for the remainder of the year.

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, of which 3,990,842 have been issued. The officers and directors are: F. A. Brandt, president and manager; S. A. Lister, treasurer; E. O. Slingsby, secretary; J. J. Morch, S. D. Terry, and R. A. Hutchison, directors. The head office is at 19 Melinda Street, Toronto. The mine address is Goudreau.

The property consists of 7 claims, 322 acres, in township 49, Goudreau-Lochalsh area, district of Algoma, about 5 miles east of Goudreau.

Operations were continued throughout 1938. The following table shows the underground development work done at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT (inclined depth)	417	.....	417
172-FOOT LEVEL:			
Drifts	801	3,010	3,811
Crosscuts	833	.....	833
Raises	109	.....	109
Box-holes	.....	329	329
354-FOOT LEVEL:			
Drifts	.....	1,860	1,860
Crosscuts	.....	202	202
Raises	.....	69	69
Box-holes	.....	330	330

During 1938 eight diamond-drill holes, having a total length of 759 feet, were drilled from underground.

Ore hoisted amounted to 67,121 tons, from which 66,670 tons was sorted and milled. The 500-ton mill treated an average of 182.65 tons daily.

During the year the assay office was altered and enlarged, and a new frame cabin and a building for the storage of oil and gasoline were erected.

L. H. Biggar was in charge of the property during January and February and was succeeded by R. F. Mitchell, who remained in charge until the end of the year, after which F. A. Brandt became manager. An average of 104 men was employed.

Anoki Gold Mines, Limited

Anoki Gold Mines, Limited, was incorporated in September, 1938, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 1,375,505 shares have been issued. The officers and directors are: C. D. H. MacAlpine,

president; H. Hunter, secretary-treasurer; W. H. Woods, F. J. Bailes, W. R. Biton, and A. M. Heron, directors. The head office is at 100 Adelaide Street West, Toronto. The mine address is Larder Lake.

The company owns 15 claims, 613 acres, in Gauthier township, Kirkland Lake area, district of Timiskaming. The property includes the claims formerly held by Oriole Mines, Limited.

The previous owners had done considerable surface trenching and drilled 5 diamond-drill holes, totalling 2,336 feet, from surface.

Anoki Gold Mines, Limited, commenced operations on October 9, 1938, and continued until the end of the year.

Buildings constructed included a hoist-house, dry-house, blacksmith shop, explosives magazine, 2 pump-houses, an office, and a residence.

The following plant equipment was installed: a Canadian Ingersoll-Rand, 850-cubic-foot compressor, driven by a 125 h.p. English Electric motor; a 60 h.p. Mead-Morrison hoist; a Smart-Turner electric pump, driven by a 10 h.p. Westinghouse motor.

A 3-compartment, vertical shaft was sunk to a depth of 283 feet, and a station was cut at 200 feet.

C. S. Boland was superintendent, employing an average of 44 men.

Argosy Gold Mines, Limited

Argosy Gold Mines, Limited, was incorporated in May, 1935, to succeed Casey Summit Gold Mines, Limited, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors are: F. L. Trethewey, president; J. B. Tyrrell, vice-president; Fraser D. Reid and E. C. Fox, directors.

The property, consisting of 21 claims, 987 acres, at Casummit lake, about 100 miles north of Sioux Lookout on the Canadian National railway, in the Patricia portion of Kenora district, was shut down in February, 1938. The company was declared bankrupt, and E. G. Clarkson, 15 Wellington Street West, Toronto, was appointed trustee.

No development work was done during the short period of operation. Some 1,700 tons of ore were hoisted, of which 1,650 tons were milled.

In August the shareholders approved an arrangement whereby the property would be sold to a new company. On November 9, Jason Mines, Limited, was incorporated with an authorized capitalization of 3,000,000 shares of no par value. The shareholders of Argosy Gold Mines, Limited, received 1 share of Jason stock for 5 of Argosy.

The new company did 5,009 feet of diamond-drilling from surface in the No. 1 and No. 2 vein areas. At the end of the year the sinking of a 2-compartment inclined shaft on No. 1 vein was begun, and plans were made to dewater the workings from the shaft on No. 2 vein.

C. H. Rutherford is manager. The mine address is Casummit Lake.

Augite Porcupine Mines, Limited

Augite Porcupine Mines, Limited, was incorporated in July, 1936, with a capitalization of 2,000,000 shares of $1 par value. In 1938, the capitalization was increased to 3,000,000 shares of $1 par value. The number of shares issued at December 31, 1938, was 2,001,006. The officers and directors are: J. A. Mitchell, president; E. M. Tice, secretary-treasurer; D. H. Porter, C. L. Woody, and H. G. Donley, directors. The head office is at 357 Bay Street, Toronto. The mine address is Timmins.

The property consists of 6 claims, 190 acres, in Deloro township, Porcupine area, district of Cochrane.

Mining operations commenced in April, 1938, and continued for the rest of the year. Buildings were erected and a mining plant was installed, including a Canadian Ingersoll-Rand double-drum hoist, driven by a 100 h.p. motor, and a 1,080-cubic-foot Canadian Ingersoll-Rand compressor.

A 3-compartment shaft was sunk to a depth of 1,026 feet, and levels were established at 250, 500, 625, 750, 875, and 1,000 feet. Some 235 feet of crosscutting was done on the 875-foot level and 345 feet on the 1,000-foot level.

Four diamond-drill holes, having a total length of 2,677 feet, were drilled from surface, and two holes, totalling 989 feet, were drilled from underground.

An average of 38 men was employed for nine months under the direction of Stanley S. Saxton, manager.

Baghdad-Larder Mines, Limited

Baghdad Gold Mines, Limited, was incorporated in April, 1937, with an authorized capitalization of 3,000,000 shares of $1 par value. In February, 1938, the company's name was changed to Baghdad-Larder Mines, Limited. The officers are: T. M. Mungovan, president; K. Moir; W. G. Chipp, secretary-treasurer. The head office is at 710 Excelsior Life Building, Toronto. The mine address is Larder Lake.

The company acquired 17 claims in Katrine and Ossian townships, Larder Lake area, district of Timiskaming. The property includes the old Walsh Katrine mine.

The former operators sank a shaft 515 feet deep, with levels at 130, 250, 375, and 500 feet. A considerable amount of drifting and crosscutting was done on the three lower levels.

The present company commenced operations in November, 1938. The headframe and other surface buildings were repaired, the shaft was retimbered for 30 feet from surface, and a new bearer set was installed. Operations were temporarily suspended at the end of the year.

S. A. Pain was in charge of the work, employing 8 men.

Bankfield Consolidated Mines, Limited

Bankfield Consolidated Mines, Limited, which was incorporated on September 1, 1936, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,564,904 have been issued. The officers and directors are: C. D. H. MacAlpine, president; T. H. Stinson, vice-president; F. J. Bailes, secretary-treasurer; H. Hunter, assistant secretary; W. T. McEachern, D. M. Morin, J. H. C. Waite, and Jos. Errington, directors. The head office is at 100 Adelaide Street West, Toronto. The mine address is Bankfield.

The property consists of 16 patented and 3 unpatented claims, 872 acres, in Errington township, in the Magnet Lake section of the Little Long Lac area, district of Thunder Bay. It is reached by a 3-mile road from Kenwell on the Longlac–Port Arthur branch of the Canadian National Railways, or by a 5-mile automobile road from Geraldton.

Operations were continued throughout 1938. The following table shows the development work accomplished at the end of 1937, during 1938, and the total at the end of 1938:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	551	.....	551
WINZE	241	259	500
150-FOOT LEVEL:			
Drifts	1,573	.....	1,573
Crosscuts	447	.....	447
Raises	378	.....	378
Sublevelling	498	.....	498
275-FOOT LEVEL:			
Drifts	1,062	.....	1,062
Crosscuts	403	.....	403
Raises	127	.....	127
Sublevelling	298	.....	298
400-FOOT LEVEL:			
Drifts	163	.....	163
Crosscuts	30	.....	30
Raises	226	.....	226
525-FOOT LEVEL:			
Drifts	3,222	1,149	4,371
Crosscuts	2,869	1,273	4,142
Raises	236	.....	236
Box-holes	.....	15	15
775-FOOT LEVEL:			
Drifts	.....	358	358
Crosscuts	.....	235	235
900-FOOT LEVEL:			
Drifts	.....	624	624
Crosscuts	.....	199	199
Raises	.....	22	22
1,025-FOOT LEVEL:			
Drifts	.....	731	731
Crosscuts	.....	265	265
Box-holes	.....	31	31

During the year one diamond-drill hole, 300 feet in length, was drilled from surface, and 59 holes, having a total length of 6,832 feet, were drilled from underground.

The stopes on the 150- and 525-foot levels are almost completed to the sill floors. Mining has been discontinued on both levels, and ore is being pulled for mill feed.

During the calendar year, 47,632 tons of ore were hoisted and 47,500 tons were milled.

The following is taken from the report of the consulting engineer, W. H. Woods, for the year ending November 30, 1938:—

During the period the mill treated 46,350 tons of dry ore, from which was recovered 18,463.969 ounces of fine gold and 2,036.40 ounces of fine silver. The marketing of the bullion produced realized the sum of $650,106.02.

ANALYSIS OF OPERATING COSTS

	Total	Cost per ton milled
Development and exploration	$129,847.63	$2.801
Mining and hoisting	112,894.19	2.437
Milling	77,940.97	1.682
Bullion marketing expense	8,104.34	.175
Mine office and miscellaneous expense, including insurance, Workmen's Compensation, silicosis, etc.	52,225.58	1.127
Head office expense	16,582.00	.357
Total	$397,594.71	$8.579

Mining

During the year ore was drawn from the 1st, 2nd, and 4th levels. A summary of the work done in the mine is given below:—

Ore broken in stopes	tons	67,396
Drifting	feet	2,495
Crosscutting	feet	1,943.5
Raising	feet	15
Sinking	feet	354
Station-cutting	cu. ft.	40,950
Slashing	cu. ft.	22,549
Diamond-drilling	feet	5,697

Ore Reserves

During the year a reserve of broken ore was built up and sufficient new ore developed to more than maintain our ore position.

	Tons	Ounces per ton	Value per ton at $35
Broken ore	30,283	0.4437	$15.53
Developed ore	49,000	.342	$11.97

The Mill

Ore milled	tons	46,350
Average value per ton		$14.866
Gross value	$689,067.85	
Loss in tailings	38,961.83	
Net value recovered		$650,106.02
Average tons milled per day		127
Value per ton in tailings		$0.841
Per cent. extractions		94.3

Development

The crosscut to the North zone was completed, and some 1,542 feet of drifting east and west of the crosscut has been done. Several shearings and veins have been located but no commercial ore shoots have been located in this work.

The winze has been completed to the 8th level (1,025 feet), and development is being carried out on the 6th, 7th, and 8th levels. Ore has been developed on each level and a substantial tonnage of medium-grade ore is indicated. This area is now being prepared for stoping.

What appears to be the downward extension of the No. 1 ore body has been located by diamond-drilling below the 4th level, and this area will be developed during the coming year. This development is important, as it was originally thought that the No. 1 ore body bottomed either at or above the 4th level, whereas now it would appear that the drift cut a barren section of the deposit.

General

Additions to plants, buildings, and equipment during the year were as follows: A new pump-house and water system was put in operation and a 100,000 gallon tank installed; a waste bin was built into the headframe to allow for more efficient disposal of the waste rock; the heating plant was converted from wood to coal burning, and stokers were installed—this installation has resulted in a material saving in heating costs; a new blacksmith and mechanical shop was erected; three dwellings were erected for the married members of the staff.

J. W. MacKenzie is mine superintendent, and Harry Johnston is mill superintendent. An average of 123 men was employed, of whom 67 were in the mine and 11 in the mill.

Barber-Larder Gold Mines, Limited

Barber-Larder Gold Mines, Limited, was incorporated in February, 1937, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,440,505 had been issued at December 31, 1938. The officers and directors are: R. S. Potter, president; Dr. A. F. Demary and Donald Lough, vice-presidents; D. R. Michener, secretary-treasurer; J. Walter Young and S. J. Bird, directors. The head office is at 372 Bay Street, Toronto. The mine address is Larder Lake.

The property consists of 11 claims, 520 acres, in McGarry township, Larder Lake area, district of Timiskaming.

Operations were continued throughout 1938. A vertical, 3-compartment shaft was sunk to a depth of 404 feet, and levels were established at 125, 250, and 400 feet. A total of 1,274 feet of drifting and 1,803 feet of crosscutting was accomplished. Diamond-drilling amounted to 82 feet from surface and 1,160 feet from underground. Some 1,478 tons of ore were hoisted.

Buildings erected during the year included a headframe, a hoist- and power-house, a boiler-house, a dry-house, a steel shop, and an assay office.

The following plant equipment was installed: a Babcock-Wilcox and Goldie-McCulloch 1,080-cubic-foot compressor; Canadian Ingersoll-Rand double-drum hoist; 60 h.p. boiler; and standard assay plant.

A force of 33 men was employed under the direction of J. G. Tatham, manager.

Beanland Mining Company, Limited

The Beanland Mining Company, Limited, was incorporated in July, 1937, with an authorized capitalization of 2,500,000 shares of $1 par value, of which 1,617,941 have been issued. The officers and directors are: A. J. Perron, president; M. G. Hunt, secretary-treasurer; Sydney Beanland, T. M. Mungovan, and Dr. W. H. Wilson, directors. The head office is at Kirkland Lake, and the mine address is Timagami.

The property consists of 4 claims, approximately 200 acres, in Strathy township, Timagami area, district of Nipissing, formerly operated by the Goodfish Mining Company, Limited.

During 1938 the 3-compartment shaft was deepened from 355 to 505 feet, and a new level was established at 475 feet. Some 86 feet of drifting and 90 feet of crosscutting were accomplished, and 500 feet of diamond-drilling was done from underground. Operations ceased on April 10.

D. M. Briden was manager, employing 21 men.

Beaverhouse Lake Gold Mines, Limited

Beaverhouse Lake Gold Mines, Limited, was incorporated in June, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,770,005 have been issued.

The officers and directors are: P. M. Fleming, president; James E. Grant, vice-president; C. F. Tuer, secretary-treasurer; Napoleon Alarie, director. The head office is at Haileybury. The mine office is at Kirkland Lake.

The company acquired the property formerly operated by Argonaut Consolidated Gold Mines, Limited, consisting of 29 claims, 1,100 acres, in Gauthier and McVittie townships, Larder Lake area, district of Timiskaming. In 1937 Bunker Hill Extension Mines, Limited, took an option on a large block of treasury shares and supplied funds for development work. Bunker Hill's option was in turn optioned to the Premier Gold Mining Company, Limited. Operations during 1937 and 1938 were carried on under the direction of Toburn Gold Mines, Limited.

During 1938 the workings were dewatered to the 350-foot level and the following lateral development work was done:—

Level	Drifts	Crosscuts
	feet	feet
200-foot	717	258
350-foot	787	203

Ten diamond-drill holes, having a total length of 2,880 feet, were drilled from underground.

Buildings erected during the year included a headframe, a hoist-room, a shaft-house, a boiler-house, a pump-house, a powder magazine, a storehouse and sample shed, and a storehouse for meat.

Operations ceased on December 31, following which the Premier Gold Mining Company, Limited, dropped its option.

M. W. Hotchkin was manager, and S. L. Russel was superintendent, employing 19 men.

Berens River Mines, Limited

Berens River Mines, Limited, was incorporated in July, 1936, with an authorized capitalization of 1,000,000 shares of $1 par value. In 1938 the capitalization was increased to 2,000,000 shares of $1 par value, of which 1,550,134 have been issued. The company is a subsidiary of the Newmont Mining Corporation.

The officers and directors are: H. De Witt Smith, president; John Dryborough, vice-president; A. W. Burt, secretary; Carroll Searls, assistant secretary; H. E. Dodge, treasurer; Gus Mrkvicka, assistant treasurer; E. D. Birchard and Fred M. Connell, directors. The head office is at Empire, and the mine address is Favourable Lake.

The property consists of 39 claims, approximately 1,566 acres, situated some 3½ miles east of South Trout lake, which is 8 miles east of Favourable lake, in the Patricia portion of Kenora district. The mine is reached by airplane from Kenora, via Red Lake, or direct from Lac du Bonnet, in Manitoba. Freight is transported by airplane, and in winter by tractor, from Berens River, Man., a distance of 145 miles. A 3½-mile tractor road serves the mine from the dock on South Trout lake.

The only underground development work done in 1938 was accomplished during the first two weeks of January. The following table shows the development work at January 15, 1938:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	515	.....	515
250-FOOT LEVEL:			
Drifts	777	.....	777
Crosscuts	362	.....	362
Raises	84	.....	84
375-FOOT LEVEL:			
Drifts	1,370	34	1,404
Crosscuts	599	.....	599
Raises	130	.....	130
500-FOOT LEVEL:			
Drifts	715	99	814
Crosscuts	358	76	423

The following diamond-drilling was done during the early months of the year:—

	Feet
Surface	4,350
Underground	2,217
Total	6,567

The following is taken from the report of the manager for the year ending December 31, 1938 —

Construction

In May, 1938, the decision was made to prepare and equip the property for a production of 225 tons per day along the lines outlined in the first annual report, except for the provision of two 1,000 h.p. turbines instead of two 800 h.p. turbines below the Upper falls, and the addition of flotation equipment for recovery of a lead-silver concentrate from the cyanide tailings.

Construction supplies, equipment and operating supplies in the amount of approximately 2,200 tons were purchased and delivered to Berens River Landing on Lake Winnipeg in the early fall months of 1938. In order to speed up the construction programme, approximately 275 tons of construction equipment and supplies were flown to the power plant and mine sites prior to November 1. The remainder of the freight was warehoused at Berens River Landing to await transportation by tractor freight during the winter months.

Hydro-Electric Power Plant

A main dam at the outlet of North Wind lake was practically completed. The dam is of clay-fill construction, riprapped on the upstream side with rock, and has a total volume of approximately 20,000 cubic yards. A storage dam was built below the outlet of Cellist lake and should provide for the storage of approximately 125 square mile feet of water.

Other miscellaneous work in connection with the power plant included the excavation of the major parts of the power canal and spillway ditch and the clearing of the transmission line to the mine, a distance of 8.2 miles.

Mine

The main mill building, a warehouse, and machine shop have been erected and totally enclosed with one ply of sheeting. Completion of these buildings will be made after the arrival of cement and other items via tractor freight. All lumber for the various buildings, headframe, and miscellaneous construction is being sawn in the company's saw-mill at the mine.

Plant and Equipment

The Duck River power plant consists of two 1,000 h.p. Leffel-type vertical turbines operating under a 57-foot head, direct-connected to two 750 k.v.a. 2,300-volt vertical generators. This power will be stepped up to 13,200 volts for transmission 8.2 miles to the mine substation, where it will be stepped down to 575 volts for plant use. Provisions have been made at the Duck River plant for a third unit of 1,000 h.p. should additional power be required at a later date.

Underground operations will be supplied with air from 2,020-cubic-foot and 565-cubic-foot compressors, the latter converted from the steam compressor used in the preliminary development. Hoisting facilities will be provided by a 42- by 30-inch double-drum hoist adequate to handle ore from a depth of 1,500 feet.

The crushing plant adjacent to the headframe will be equipped with a 24- by 15-inch Blake-type jaw crusher and a 3-foot short-head cone crusher. The crushed ore will be delivered by 275-foot conveyer belt to a 500-ton fine ore bin housed in a 103- by 155-foot mill building.

The mill was designed as a cyanide plant, followed by flotation of cyanide tailings, after a series of exhaustive tests by the Division of Ore Dressing and Metallurgy of the Department of Mines at Ottawa and by the General Engineering Company of Salt Lake City and by the Merrill Company of San Francisco. The fine ore will be ground to 60 per cent. minus 200 mesh in a 7- by 8-foot ball mill. The overflow from a Dorr-type classifier, 5 feet by 21 feet 8 inches, will go to two 30- by 12-foot balanced tray thickeners in circuit with two 28- by 22-foot Dorr-type agitators and two 16- by 16-foot Wallace-type agitators. The pulp will be filtered through an 8- by 14-foot drum filter. The primary thickener overflow solution will be clarified and precipitated in a Merrill-Crowe unit of 1,000-ton capacity. For the present, the gold-silver precipitate will be shipped to an eastern refinery for recovery of gold and silver contents.

The cyanide tailings will be retreated in four 56-inch flotation machines to recover a high-grade silver-lead product. No effort to recover a zinc concentrate is contemplated.

General

In spite of the increase in size of power plant and addition of flotation treatment to the mill flow-sheet, it is anticipated that the construction programme will be completed within the original estimates and that the property is adequately financed to production, barring unforeseen contingencies.

Aided by funds appropriated by the Manitoba, Ontario, and Dominion governments, the company undertook the construction of a winter road from Berens River Landing, Lake Winnipeg, to the mine and power plant. The road was nearly completed at the end of October, only some work that could be more economically done during the winter remaining.

M. D. Banghart is manager and 46 men are employed.

Bidgood Kirkland Gold Mines, Limited

Bidgood Kirkland Gold Mines, Limited, has an authorized capitalization of 4,000,000 shares of $1 par value, of which 3,506,715 have been issued. The officers and directors are: W. J. Lawson, president; O. L. Knutson, vice-president; J. M. Macintosh, secretary-treasurer; A. E. Belcher, F. N. Rosar, S. K. Learie, and H. F. Parkinson, directors. The head office and mine office are at Kirkland Lake. The executive office is at 357 Bay Street, Toronto.

The property consists of 23 claims, approximately 753 acres, in Lebel township, Kirkland Lake area, district of Timiskaming.

During 1938 two 250-gallon, Canadian Ingersoll-Rand pumps and the mechanism for a 40,000-gallon mill agitator were installed.

The following is an extract from the report of the manager for the year ending December 31, 1938:—

During this period 52,636 tons of ore were milled, from which were recovered 17,412 fine ounces of gold and 10,581 fine ounces of silver. The value of bullion production amounted to $617,580.75, to which was added miscellaneous income of $2,037.35, making a total gross revenue of $619,618.10, or $11.77 per ton milled.

Exploration and Development

Work accomplished during the year was as follows:—

Sinking No. 2 winze	feet	371
Station-cutting and sumps	cu. ft.	12,637
Drifting	feet	5,453
Crosscutting	feet	1,251
Slashing (drifts and crosscuts)	cu. ft.	38,904
Raising	feet	217
Diamond-drilling	feet	23,614

As will be seen from the above summary, an extensive campaign of underground development was carried on during the year. This consisted chiefly of sinking the No. 2 winze from the 1,190-foot horizon to a depth of 1,561 feet, and the establishing of levels at the 1,275-, 1,400-, and 1,525-foot horizons. Only a small amount of lateral development was done on the levels above the 775-foot, but on levels from the 900-foot down to the 1,525-foot, a total of 5,006 feet of drifting and 1,133 feet of crosscutting was done.

Diamond-drilling was done on all levels from the 250-foot down to the 1,525-foot, but the greater portion of the drilling was done on the levels below the 900-foot.

The general programme of development work on the new levels consisted of drifting east and west along the main break and boring flat diamond-drill holes north and south from the drifts at 75-foot intervals. In this way a block of ground approximately 1,000 feet long and 500 feet wide has been pretty thoroughly tested.

Crosscuts are now being driven north on the 1,025- and 1,525-foot levels. These are being driven on line to points directly under the No. 2 (main) shaft, so that the area north and west of the shaft, which showed considerable promise on levels above the 500-foot, can be explored by diamond-drilling. A programme of deep diamond-drilling will also be done along the main break zone from crosscuts on the 1,525-foot level.

Summary of Ore Hoisted

The following table shows the origin of the ore hoisted during the year. Grade was obtained from car samples taken on deck, and tons hoisted represent the number of cars hoisted.

	Tons	Value per ton	Extraction per cent.
Hoisted from stopes	48,102	$13.85	91.2
Hoisted from development	4,620	6.84	8.8
Total	52,722	$13.23	100

Analysis of Operating Costs

	Total	Per ton milled
REVENUE:		
Gross bullion production	$617,580.75	$11.73
Miscellaneous income	2,037.35	.04
Total	$619,618.10	$11.77
EXPENDITURE:		
Development	$148,011.07	$2.82
Mining	214,852.56	4.08
Milling	76,913.55	1.46
General mine charges	36,445.37	.69
Total	$476,222.55	$9.05
Mine operating profit	$143,395.55	$2.72

Summary of Ore Reserves

	Tons	Value per ton	Total value
Broken ore	15,233	$10.76	$163,975.89
Positive ore	11,080	11.91	132,014.00
Probable ore	6,220	9.61	59,743.35
Total	32,533	$10.93	$355,733.24

Milling Statement

Ore milled	tons	52,636
Average tons milled per day		144.1
Per cent. possible running time		98
Average heads (bullion plus tails)		$13.35
Gross value (gold)	$702,674.28	
Tailings loss	89,547.93	
Gold recovered in bullion		$613,126.35
Average tailings per ton		$1.70
Recovery per ton		$11.65
Extraction	per cent.	87.2

F. L. Smith is manager. An average of 159 men was employed throughout the year.

Big Master Consolidated Gold Mines, Limited

Big Master Consolidated Gold Mines, Limited, was incorporated in April, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,618,000 have been issued. The officers and directors are: W. R. Salter, president; F. A. Gaby, vice-president; J. A. Griffith, secretary-treasurer; J. C. Rogers, Dr. M. H. Lebel, Hon. W. D. Black, R. J. Jowsey, directors. The head office is at 112 Yonge Street, Toronto, and the mine address is Goldrock, via Wabigoon.

The company holds 43 claims, of which 5 are patented, including the old Big Master mine. The property is located near the north end of Upper Manitou lake, district of Kenora, and is about 27 miles south of Wabigoon on the Canadian Pacific railway. The mine can be reached from Wabigoon, via Wabigoon lake, and over a 6-mile road from the south end of the lake to Goldrock.

During the spring of 1938 some 400 feet of surface trenching and 6,782 feet of diamond-drilling from surface were accomplished.

In August, Selby Lake Mines, Limited, bought 50,000 shares of Big Master stock for $5,000 and took an option on an additional 375,000 shares at 10 cents a share. Under the agreement made between the two companies Selby Lake Mines, Limited, dewatered the shaft and examined the 3rd and 4th levels.

E. K. Fockler is consulting engineer, and C. R. Chataway is resident geologist.

Bilmac Gold Mines, Limited

Bilmac Gold Mines, Limited, was incorporated in September, 1934, with an authorized capitalization of 2,000,000 shares of no par value. The officers and directors are: L. F. Hogarth, president; G. E. McVittie, vice-president; A. C. Laing, treasurer; W. R. Marchment, secretary; Jesse Bradford, director. The head office is at 357 Bay Street, Toronto. The mine address is Shiningtree.

The property consists of 6 claims, approximately 300 acres, in Macmurchy township, West Shiningtree area, district of Sudbury.

No underground work was done in 1938. A new 80-ton mill was built and equipped. The equipment includes a 5- by 8-foot Canadian Allis-Chalmers ball mill, a Dorr classifier, a Wilfley table and amalgamation barrel.

About 15 men were employed on construction work during the first nine months of the year.

Bobjo Mines, Limited

Bobjo Mines, Limited, was incorporated in September, 1928, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 4,186,802 have been issued.

The officers and directors are: R. J. Jowsey, president; R. B. Bond, vice-president; Maurice Crabtree, secretary-treasurer; J. L. Jowsey, E. H. Sackett, Wm. H. Kinch, Wm. F. McAleese, directors. The head office is at 302 Bay Street, Toronto. The mine address is Clearwater Lake, via Sioux Lookout.

The property consists of 8 patented claims, approximately 320 acres, and 8 claims held under license of occupation, in Earngey township, East Clearwater Lake area, Patricia portion of Kenora district.

In 1928 and 1929 a shaft was sunk to a depth of 270 feet and a considerable amount of drifting and crosscutting was done on the 125- and 250-foot levels. Operations then ceased and the property remained idle until 1938.

In August, 1938, a diamond-drilling campaign was undertaken and 34 holes, having a total length of 5,504 feet, were drilled from surface. Some repairs were made to the buildings on the property, but no underground work was done.

An average force of 8 men was employed for five months under the direction of T. C. Fawcett.

Broulan Porcupine Mines, Limited

Broulan Porcupine Mines, Limited, was incorporated in March, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,194,005 have been issued. The officers and directors are: B. W. Lang, president; A. R. Caldwell, vice-president and treasurer; D. R. Michener, secretary; O. H. Barrett, assistant secretary-treasurer; J. B. Streit and G. B. Webster, directors. The head office is at 372 Bay Street, Toronto. The mine address is Pamour.

The company holds 10 claims, 415 acres, in Whitney township, Porcupine area, district of Cochrane.

Some 23,000 feet of diamond-drilling was done from surface prior to 1938, and an additional 5,730 feet was accomplished during 1938.

Construction and development work began in the fall of 1938. The buildings erected included a headframe, power-house, change-house, combined blacksmith shop and machine shop, storehouse, oil-house, fuse-house, and magazine. The following plant equipment was installed: Ingersoll-Rand double-drum hoist, 1,080-cubic-foot Canadian Ingersoll-Rand air compressor, two 200 k.v.a. English Electric transformers, and 40 h.p. vertical boiler for heating purposes.

A vertical, 3-compartment shaft was sunk 200 feet and a level was established at 173 feet. The objective depth of the shaft is 600 feet.

An average of 53 men was employed for three months under the management of J. M. C. Dunlop.

Buffalo Ankerite Gold Mines, Limited

Buffalo Ankerite Gold Mines, Limited, which was incorporated in 1932, has an authorized capitalization of 1,000,000 shares of $1 par value, of which 701,679 have been issued. The officers and directors are: E. G. Kinkel, president and managing director; Jacob Betz, vice-president; George R. Feine, secretary; Clarence H. Leo, assistant secretary; Henry Kobler, treasurer; R. P. Kinkel, assistant treasurer and mine manager; A. J. Baldeck, Everett Bristol, Harry J. Carmichael, and Henry J. Tiedt, directors. The head office and mine office are at South Porcupine. A business office is maintained at 1,750 Rand Building, Buffalo, N.Y.

The company owns 15 claims, approximately 527 acres, in Deloro township, Porcupine area, district of Cochrane. The main group, on which the mine and plant are located, comprises 9 claims or 322 acres. Of the remaining 6 claims, 5 are in one block. The company also holds controlling interests in McKay Lake Gold Mines, Limited, and Sheadore Gold Mines, Limited.

The following is taken from the report of the manager to the president for the fiscal year ending December 31, 1938:—

Production

The two mills treated 362,838 dry tons of ore yielding 84,362.659 ounces of gold with a value of $2,971,464.41, an average recovery of $8.19 per ton milled. The mine operating costs were $4.341 per ton milled, or $18.67 per ounce of gold recovered.

The mine and mills have maintained closely the planned objectives for the year 1938. This production will be maintained for 1939.

Milling

The production of both mills was maintained with certain improvements and replacements. Increased tonnages of harder and more abrasive ore decreased anticipated mill tonnages and increased crushing and grinding costs. Considerable technical study was made in the mill tending toward future improvement. Waste sorted out in both mills was 16,002 tons, or 4.22 per cent. of the ore and waste hoisted. The running time for the North mill was 98 per cent. and for the South mill was 98.21 per cent, an improvement over any other year.

The following is a summary giving the average data on each ton milled based on the total tonnage and production of both mills:—

	North mill	South mill	Total
Tons milled	236,470	126,368	362,838
Tons milled daily	647.8	346.2	994
Heads (gold $20.67)	$5.566	$4.292	$5.123
Tails (gold $20.67)	$0.322	$0.286	$0.310
Recovery per ton	$5.244	$4.006	$4.813
Premium per ton	$3.679	$2.809	$3.377
Total recovery per ton	$8.923	$6.815	$8.190
Gold, ounces per ton	0.2533	0.1935	0.2325
Recovery (gold $20.67)	$1,240,131.90	$506,304.24	$1,746,436.14
Recovery (present value)	$2,110,185.78	$861,278.63	$2,971,464.41
Average ounces per month	4,992.432	2,037.790	7,030.222

Mining, Development, and Exploration

Although during the year 1938 exploration was carried on thoroughly by diamond-drilling and otherwise to ascertain if there were any new ore bodies undiscovered above the 1,050-foot level, the result of this work indicated no new ore of consequence in this locality.

Of the mill feed, approximately 50 per cent. came from irregular stopes mined by selective methods, such as cut-and-fill, stull-stoping, and resuing. With the exception of the ore mined in the north or No. 7 vein zone, where large ore lenses were discovered, the remainder of the stopes were of about the same type as heretofore mined by the company. Considerable ore is still being salvaged from pillars and floor sills on the upper levels and particularly throughout the south vein system.

Exploration and development work were continued by diamond-drilling and drifting above the 1,050-foot level. Of most interest is the No. 805 west drift on the south No. 5 vein. This drift is entering an ore zone of a possible length of 400 to 500 feet indicated by diamond-drilling.

Horizontal diamond-drilling was carried on from the No. 5 shaft on the 1,250-, 1,400-, and 1,550-foot levels. This drilling intersected a number of veins corresponding in value and structure to the veins on the 1,050-foot level directly above. These holes were drilled from a location north and about parallel to the main ore body and were drilled primarily to locate the best position for crosscuts from the No. 5 shaft stations to the footwall veins and to indicate if it would be possible to drift south from the main crosscuts to the ore body with more than one heading. The general dip of the ore body is toward the shaft, and the proximity of the veins precludes diamond-drilling for more information without paralleling the veins.

Diamond-drill holes were driven from the 1,050-foot level to intersect the south veins and particularly the No. 3 vein at a new depth. This drilling intersected at a depth of about 1,250 feet, in a zone of 250 feet, seven distinct veins with a total width of approximately 45 feet of ore.

No. 5 Shaft.—The No. 5 shaft was completed to the 1,700-foot station at the end of the year. Before starting the shaft it was known from the location selected that approximately 500 feet of shaft would have to be sunk through soft schisted rock. To insure permanency of alignment, this section was concreted. This was done mainly through the period in which the temporary headframe was replaced with the new 145-foot steel structure. Since leaving the soft rock, the progress has been good and an excellent shaft is now available, at a location suitable also for surface operations.

No. 6 Winze.—The No. 6 South winze is being sunk from the 1,050-foot level to the 2,000-foot level to service the development and production of the South veins. A differential drum electric hoist has been purchased for permanent operation. Immediately upon the completion of the sinking a crosscut will be driven on the 2,000-foot level to the No. 5 shaft.

Waste Raise.—A waste raise to the surface from the 350-foot level was completed during the year. Utilizing the continuous stopes which finally empty to the 875-foot level, this will hold a large storage for fill for the North ore bodies. Gravel from our own claims two and a half miles south is hauled by contract for 16 cents per ton.

Five ventilation units were installed underground capable of moving a total of approximately 25,000 cubic feet of air per minute.

Major work to be accomplished by the end of 1939 is the completion of the No. 5 shaft to the 2,300-foot level; the South winze from the 1,050-foot level to the 2,000-foot level; the main crosscut between these two bodies on the 2,000-foot level, and the major primary development on levels opened up. Planned completion includes water storage sump, pumping station, the loading pockets, primary crusher station below the 2,000-foot level, and ore passes to the 1,050-foot level. Development on the 1,250-, 1,400-, and 1,550-foot levels is planned to begin during April, 1939.

	Tons
Ore broken in production	306,866
Ore broken in development	6,331
Total ore broken	313,197

The ore and waste broken in production amounted to 336,573 tons, and the cost was $1.145 per ton.

	Feet	Cost per foot
Diamond-drilling	45,427	$1.513
Drifts	2,909.5	15.325
Crosscuts	1,623.5	14.946
Raises	788	26.284
Shafts	1,110.5	196.498
	cu. ft.	cu. ft.
Stations	58,184	[1]

[1]Cost of all stations, concreting, etc., included in shaft cost per foot of $196.498.

ORE BROKEN, HOISTED, AND TRANSFERRED BY LEVELS

Levels		Production		Development		Ore hoisted and transferred	Box assay (gold at $20.67)
North mine	South mine	Ore	Waste	Ore	Waste		
		tons	tons	tons	tons	tons	
200-foot...	170-foot...	46,084	5,431	478	312	39,280	$4.49
300-foot...	300-foot...	14,315	677	1,749	4,054	28,271	3.74
475-foot...	425-foot...	2,437	92	173	625	12,483	3.24
600-foot...	550-foot...	14,119	329	1,154	1,418	29,503	4.35
725-foot...	675-foot...	8,564	100	143	145	21,282	4.07
875-foot...	800-foot...	57,098	29,768	1,376	5,375	94,825	5.25
.....	925-foot...	3,169	3,488	104	1,797	2,558	3.27
1,050-foot...	1,050-foot...	161,080	22,369	1,154	8,663	210,048	6.01
No. 5 shaft		.....	.....	.....	32,578	.....	.....
Total		306,866	62,254	6,331	54,967	438,250	$5.26

The handling of waste rock has increased from 53,541 tons in 1937 to 132,333 tons in 1938, or two and a half times as much. Comparatively, the total tons of ore and waste hoisted and transferred has increased from 452,171 tons in 1937 to 555,471 tons in 1938, an increase of 22.8 per cent.

ORE RESERVES

	Tons[1]	Value per ton at $20.67	Total value at $20.67	Total value at $35.00
Broken ore reserves.....	77,992	$4.51	$351,385.00	$594,992.00
Positive ore reserves.....	416,148	4.91	2,043,850.00	3,460,801.00
Total.....	494,140	$4.85	$2,395,235.00	$4,055,793.00

[1]Allowance for dilution calculated.

Cut- and-fill, resuing, and stull-stoping have reduced the calculated dilution from the year 1937. Broken and positive ore reserves are calculated only above the 1,050-foot level.

Mine Operating Costs

The total mine operating costs are as follows:—

	Total cost	Cost per ton milled
Exploration.....	$69,211.67	$0.190
Development.....	82,987.83	.229
Mining.....	985,737.93	2.717
Milling.....	295,639.83	.815
General expense (mine).....	141,639.75	.390
Total.....	$1,575,217.01	$4.341

Comparative data for the last four years is shown when both North and South mines were operating:—

	1935	1936	1937	1938
Total tons milled	218,763	271,736	343,093	362,838
Tons milled per day.....	600	742.5	940	994
Total operating costs.....	$970,895.68	$1,136,466.82	$1,393,410.05	$1,575,217.01
Operating costs per ton.....	$4.389	$4.182	$4.061	$4.341
Total recovery.....	$1,310,370.68	$1,888,828.96	$2,832,512.73	$2,971,464.41
Recovery per ton milled.....	$5.990	$6.951	$8.256	$8.190
Total ounces gold recovered...	37,186.849	53,876.805	80,892.926	84,362.659
Cost per ounce produced.....	$25.82	$21.09	$17.23	$18.67

N.B.—Gold calculated at present value.

It is to be noted that the operating cost has increased 7 per cent. per ton milled from the low of 1937. The nature of the ore bodies required selective methods of mining to obtain all ore available for production. By preventing dilution grade has been maintained. The gradual completion of mining above the 1,050-foot level will eliminate excessive hoisting and equipment and enable more economical operation on the lower levels.

Construction and General Improvements

The total of all capital expenditures for the year was $444,846.20. The principal construction and equipment was to serve the No. 5 shaft operation.

A 145-foot steel headframe with a 1,500-ton surge bin and shaft-house was erected following the removal of the temporary wood headframe. The surge bin, shaft-house, and the necessary part of the headframe were enclosed inside and out with galvanized sheet iron with 1-inch insulation between. A 10-inch air line was installed to a 30,000-cubic-foot air reservoir on the 1,050-foot level, which improved compressed air conditions and lowered the power costs.

A 113- by 72-foot fireproof building of concrete and tile was erected for the hoists, compressors, and electrical and control equipment. A 10-foot double-drum electric skip hoist was installed. Foundations were prepared for a 10- by 8-foot drum man cage hoist, which was delivered at the end of the year. This hoist will be equipped with a Ward-Leonard direct current control. A 2,750-cubic-foot compressor was installed. A 60,000-gallon concrete reservoir was constructed adjacent to the hoist and compressor building to preserve our water supply.

Concrete floors were laid throughout all buildings with proper conduits and main conduit between the shaft and hoist building.

Electric power was brought to the No. 5 shaft hoist building where three 750 k.v.a. 26400/2200 volt transformers were installed. From these transformers, cables conduct all power by conduits to and from switching control equipment in the substation of the main building.

No new equipment was installed in the North or South mills during the year, with the exception of conveyer scales in the North mill. After our drag shovel was overhauled thoroughly, the tailings dam wall was raised on the south and east sides.

The machine shop equipment was further augmented by a used double-spindle lathe and a 24-inch swing by 12-foot new lathe. A few mine cars were designed and built in our shops to study the best type for our future requirements. The main office building was equipped with a sprinkler system.

Water and electricity were furnished at cost to 38 resident employees on our adjoining property at McDonald Hill. A new 5-ton truck was purchased. The roads were further improved for the constantly increasing transportation.

Buildings.—Three houses were completed from the previous year. An addition was built to the manager's residence. A house was built for the mill superintendent to replace the old building occupied. A lodge was built adjoining the employees' park at McDonald lake. Grounds were improved further. The old part of the cookery and grocery store building was improved on the outside. The pump-house building at McDonald lake was enlarged for greater pumping equipment. Thirty-six garages in three units were constructed of old lumber and log slabs and rented to mine and town resident employees having cars.

The average number of men employed during 1938 was 671, of whom 411 were employed underground and 51 in the mills. E. C. Keeley is mine superintendent.

Cataraqui Gold Mines, Limited

Cataraqui Gold Mines, Limited, incorporated in September, 1936, has an authorized capitalization of 4,000,000 shares of $1 par value, of which 1,524,476 have been issued. The company succeeded Gilmour Gold Mines, Limited, the shareholders receiving one share in the new company for three shares in the old. The officers and directors are: Noah Dyment, president; W. J. Gardhouse, vice-president; W. M. Brown, secretary-treasurer; A. D. MacArthur and B. W. Squire, directors. The head office is at 21 King Street East, Toronto, and the mine address is Gilmour.

The property consists of 18 claims and half a patented lot, about 1,000 acres in all, in Grimsthorpe township, Hastings county.

Former operators had sunk a vertical, 2-compartment shaft, 85 feet deep, and an inclined, 2-compartment shaft, 210 feet deep. A considerable amount of drifting and crosscutting had been done on levels at 85, 135, and 185 feet.

In the summer of 1938 the present company dewatered the mine, took samples, and made a survey. The workings were then allowed to fill to the first

level, which was kept pumped while plans for further development work were being made.

W. Hichins was manager, employing an average of 5 men.

Central Patricia Gold Mines, Limited

Central Patricia Gold Mines, Limited, was incorporated in 1931 with an authorized capitalization of 2,500,000 shares of $1 par value, all of which have been issued. The officers and directors are: F. M. Connell, president; W. H. Connell, vice-president; Alan Cockeram, secretary-treasurer; C. R. Elliott, assistant secretary-treasurer; A. B. Mortimer, G. B. Webster, and L. Cohen, directors. The head office and the mine office are at Central Patricia, and the administrative office is at 85 Richmond Street West, Toronto.

The property consists of 134 claims, totalling 5,551 acres, including the Central Patricia mine and the Springer, or No. 2 Operation, in the Pickle-Crow area, in the Patricia portion of Kenora district. The mine is reached by airplane from Sioux Lookout or Hudson, on the main western line of the Canadian National Railways, to Pickle lake and thence 3 miles by road to the mine. Freight is transported by water from Hudson over Lac Seul, up the Root river, across a marine railway to Lake St. Joseph, and then to Doghole Bay.

In 1938 a new contract with the Hydro-Electric Power Commission of Ontario was entered into, superseding the contract of December 15, 1935. The new contract provides for the supplying of a minimum of 1,500 horse-power at $55.00 per horse-power per year for a period of 10 years, with certain provisions regarding price reductions should a larger amount of power be required. The power will be delivered late in 1939 over a new transmission line now being built from the Uchi mine to the Central Patricia mine.

Operations at the Central Patricia mine were continuous throughout 1938. The following is taken from the report of the mine manager for the year ending December 31, 1938:—

Production

The mill treated 101,376 tons of ore, from which 45,583 ounces of gold and 4,390 ounces of silver, valued at $1,606,208.19, were recovered, the average recovery being 0.45 ounces of gold, or $15.84 per ton.

The mill treated 95,410 tons from No. 1 mine and 5,966 tons from No. 2 mine, or an average of 277.7 tons per day, as compared with 211 tons per day during 1937. This increase was effected with no major alteration to the circuit. Milling costs were favourably reduced and recovery maintained at better than 97 per cent. of calculated mill heads.

Costs

A comparison of operating costs per ton of ore milled, with those of the previous year is as follows:—

	1938	1937
Bullion marketing expense	$0.23	$0.26
Surface exploration	.11	.27
Underground exploration, development, and shaft	1.85	2.33
Mining	2.52	2.17
Milling	1.58	2.05
General expense at mine	.56	.61
Administration expense	.27	.28
	$7.12	$7.97
Allowance for Dominion and Provincial taxes	.92	1.06
Depreciation and pre-production expenses written off	2.09	2.20
Prospecting in adjacent territory	.05	.....
Total	$10.18	$11.23

Mining costs show a slight increase due to the influence of the higher stoping costs in the narrow but rich vein at No. 2 mine.

Development

The known ore bodies were opened on the new levels at 1,150, 1,300, and 1,450 feet with favourable results. A new ore area east of the No. 1 fault was opened by drifts on all levels from the 1,450-foot up to and including the 625-foot. Development in this area is still in progress.

Drifting on the 625-foot level, F zone, shows three ore shoots having a total length of 212 feet grading 0.4 ounces over a width of 7 feet. Work in progress on the 875- and 1,300-foot levels is showing the continuance of the F zone to those horizons.

The deepening of No. 1 shaft was begun in November with the immediate objective of a depth of 2,150 feet. Levels will be opened at 150-foot intervals, and a skip-loading station will be cut below the 2,050-foot level. At the year end the shaft-sinking had progressed to below the 1,600-foot station.

Development work totalled 9,794 feet, compared with 7,548 feet during the preceding year. Development work consisted of the following:—

	Feet
Drifting	6,835.5
Crosscutting	741.5
Raising	2,217
	9,794
Shaft-sinking	146.3
Total	9,940.3

Of the ore milled, 23 per cent. was broken in development work.

Ore Reserves at No. 1 Mine

Ore reserves increased from 204,453 tons, with average grade of 0.53 ounces per ton, to 368,126 tons, with average grade of 0.46 ounces per ton, as tabulated below:—

	Tons	Ounces per ton
Broken reserves	11,009	0.41
Developed ore	345,975	.46
Pillar ore	7,448	.58
Probable ore	3,694	.37
Total	368,126	.46

Surface Exploration

During the summer a programme of diamond-drilling of certain areas in your company's holdings was continued with negative results.

Diamond-Drilling

	Feet
Underground at No. 1 Operation	23,576
Surface	11,062
Total	[1]34,638

Construction

Capital expenditures for the year amounted to $67,954.96 and included powder magazine, water-chlorination apparatus, additional refrigeration equipment, one staff bungalow, one employees' cottage, battery locomotive for tramming, 3 main step-down transformers and alterations to substation, 750-foot low-pressure compressor, hoisting equipment, 2 diamond-drills, and other plant and equipment.

The average number of men employed was 201. R. E. Barrett is manager, and H. B. Hicks is assistant manager.

SPRINGER OR NO. 2 OPERATION

The Springer, or No. 2 Operation, is located about 3½ miles east of the main shaft and is reached by the road between the Central Patricia and Pickle Crow mines.

[1]Includes 7,246 feet at No. 2 Operation.

The following is taken from the report of the mine manager for the year ending December 31, 1938:—

The mine was reopened in June, and the mining of developed ore was started. Mining of the ore shoots has confirmed previous estimates. The ore is sorted and trucked to the mill. Sinking commenced in December to deepen the shaft a further 600 feet. Levels will be opened at 550, 700, 850, and 1,000 feet.

The ore dump at No. 2 mine was cleaned up and showed a profitable grade. The following is a summary of production to December 31, 1938:—

Tons from dump		2,395
Tons mined		5,105
		7,500
Less: Tons waste sorted	1,408	
Tons ore in bin	126	
		1,534
Tons milled		5,966
Ounces recovered		4,288
Recovery grade	ounces per ton	0.719

Ore reserves at year end were estimated at 5,302 tons of 0.83 ounces per ton, with the average grade as set out below:—

	Tons	Ounces per ton
Broken reserves	248	1.07
Developed ore	4,227	.84
Pillar ore	827	.70
Total	5,302	0.83

A Canadian Ingersoll-Rand, single-drum sinking-hoist was installed, and the 3-compartment shaft was sunk a further 75 feet. About 410 feet of raising was done.

An average of 30 men was employed. R. E. Barrett is manager and R. S. Macdonald is resident superintendent.

Cheminis Gold Mines, Limited

Cheminis Gold Mines, Limited, was incorporated in March, 1937, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,849,991 have been issued. The officers and directors are: Wm. B. McPherson, president; E. M. Howells, secretary-treasurer; George Tough, H. R. Turner, R. S. Potter, and Howard J. Jewell, directors. The head office is at 171 Yonge Street, Toronto. The mine address is Larder Lake.

The property consists of 12 claims, 435 acres, in McVittie township, Larder Lake area, district of Timiskaming.

Between January and October, 1938, a diamond-drilling campaign was carried on, and some 14,123 feet of drilling from surface was accomplished. In November the sinking of a 3-compartment, vertical shaft to an objective depth of 300 feet was begun. At the end of the year the shaft was 39 feet deep.

New buildings constructed during the year included an office and storehouse, power-house, blacksmith shop, pump-house, change-house, cookery, powder magazine, and core-house.

The following plant equipment was installed: Sullivan No. WJ-3 compressor, 4- by 12-foot air receiver, 12 h.p. locomotive-type boiler, Canadian General Electric 75 h.p. motor, Allis-Chalmers 150 h.p. motor, Ingersoll-Rand hoist,

Canadian Fairbanks-Morse Typhoon pump, capacity 2,500 gallons per hour, and an oil furnace for sharpening steel.

Howard J. Jewell was manager, employing an average force of about 40 men.

Chesterville Larder Lake Gold Mining Company, Limited

The Chesterville Larder Lake Gold Mining Company, Limited, was incorporated in March, 1907, with an authorized capital of 1,000,000 shares of $1 par value. The capitalization was increased to 1,500,000 shares in August, 1937. The number of shares issued at December 31, 1938, amounted to 1,651,459, of which 105,000 were held in trust for the company.

The officers and directors are: L. J. Kearns, president; C. W. Casselman, vice-president; J. T. Kearns, secretary-treasurer; J. B. Streit and J. G. Weir, directors. The head office is at 330 Bay Street, Toronto. The mine address is Cheminis.

The property consists of 15 claims, approximately 624 acres, in McGarry township, Larder Lake area, district of Timiskaming.

Operations were continuous during 1938. The 3-compartment, vertical shaft was deepened from 32 to 395 feet, and levels were established at 150 and 300 feet. Some 2,545 feet of drifting, 2,397 feet of crosscutting, and 142 feet of raising were done. Diamond-drilling amounted to 4,344 feet from surface and 15,777 feet from underground.

Buildings erected during the year included a headframe, assay office, machine shop, and pump-house.

The following new equipment was installed: Denver assay furnace, assay crusher and pulverizer, Sturtevant fan, and Mather and Platt 250 g.p.m. water supply pump.

L. T. Postle was manager, employing an average of 43 men.

Clark Gold Mines, Limited

Clark Gold Mines, Limited, was incorporated in October, 1934, with an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,472,376 have been issued. The officers and directors are: W. S. Lighthall, president; D. L. Blaise, secretary-treasurer; L. T. Ragona, F. W. Hunt, Mrs. E. M. McLean, G. L. Davis, and P. W. Turner, directors. The head office is at 347 Dominion Square Building, Montreal, Que. The mine address is Dyment.

The property includes 14 unpatented and 1 patented claim, totalling 620 acres, located in the southwest corner of Melgund township, district of Kenora. The mine lies about 8 miles south of Dyment on the main western line of the Canadian Pacific Railway. A gravel road has been constructed from the Trans-Canada highway to the mine.

No underground work was done during 1938. Six diamond-drill holes, having a total length of 2,315 feet, were drilled from surface.

During the year a building to house a 35-ton mill, a trestle from the headframe to the mill building, an assay office, and a pump-house were erected.

R. S. Douglas was manager. About 5 men were employed.

Cline Lake Gold Mines, Limited

Cline Lake Gold Mines, Limited, was incorporated in August, 1936, with an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,605,005 have been issued. The officers and directors are: J. A. O'Brien, president; J. G. Dickenson, vice-president and general manager; H. A. Green, secretary-treasurer; Harold Dyment and P. A. Dyment, directors. The executive office is at 900 Victoria Building, Ottawa. The head office and mine office are at Lochalsh.

The property consists of 59 claims, 2,551 acres, in township 48, Goudreau area, district of Algoma.

Underground operations were continued throughout 1938. Stoping was begun on all levels. During the year 51 diamond-drill holes, totalling 4,389 feet, were drilled from underground. The following table shows the amount of development work accomplished prior to 1938, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	522	.....	522
125-FOOT LEVEL:			
Drifts	.....	1,092	1,092
Crosscuts	38	829	867
Raises	.....	335	335
Box-holes	.....	189	189
250-FOOT LEVEL:			
Drifts	.....	1,211	1,211
Crosscuts	250	505	755
Raises	.....	169	169
Box-holes	.....	183	183
400-FOOT LEVEL:			
Drifts	.....	1,029	1,029
Crosscuts	37	573	610
500-FOOT LEVEL:			
Drifts	.....	1,091	1,091
Crosscuts	58	469	527
Box-holes	.....	114	114

The 200-ton cyanide mill went into operation on July 16 and continued to operate for the rest of the year at an average rate of 192.52 tons per day. Of 36,678 tons of ore hoisted, 33,080 tons went to the mill and 3,598 tons to the surface ore dump.

The mill equipment includes the following: 18- by 36-inch Traylor jaw crusher; 4-foot Symons cone crusher; 2 Niagara screens, 3 by 8 feet; Canadian Link Belt conveyer system; 2 Dominion Engineering ball mills, with 7- by 6-foot grate discharge; 2 rake-type Dorr classifiers, 5 feet by 21 feet 8 inches; 2 Dorr separators, 15 by 5 feet; 5 Dorr agitators, 18 by 20 feet; 2 Dorr thickeners, 35 by 14 feet; 2 string-type Feinc filters with 19- by 14-foot drums; Merrill-Crowe precipitation unit; Goldie and McCulloch 500-cubic-foot compressor; and Goldie and McCulloch vacuum pump.

A crusher and conveyer building was built during the year. Additional plant equipment installed included a Canadian Ingersoll-Rand 1,590-cubic-foot compressor, driven by a Canadian General Electric 300 h.p. motor, and a 100 h.p. Waterous boiler for heating purposes.

The following is taken from the annual report of the general manager for the twelve months ending December 31, 1938:—

During the year, work has progressed diligently, and the property was brought into production as at July 16, prior to which date all expenditures for mine development, cost of mining property, plant, buildings, and equipment were capitalized and will be written off either as a pre-development write-off (in the case of mine development) or as depreciation (in the case of plant, buildings, and equipment).

Up to July 16, the year's activities were devoted chiefly towards the construction of a mill rated at 200 tons per day. During this same period, at the commencement of which shaft-sinking had just been completed to the fourth station at the 500-foot level, crosscutting to intersect the veins, drifting, raising, etc., was being carried out with the object of preparing stopes for supplying ore to the mill upon its completion.

Since July 16, the mill has been in continuous operation and development work systematically continued.

Production

During the year 32,344 tons of ore were treated, having an average grade of 0.2367 ounces per ton, or $8.36 with gold at $35.00 per ounce. The following table sets forth the production for the year 1938 from the commencement of milling on July 16 up to December 31, 1938, inclusive:—

	Ounces	Total value[1]
Bullion produced	7,274.017	$257,034.80
Values in process	231.420	8,178.38
Values recovered (98.05 per cent.)	7,505.437	$265,213.18
Tailings loss	149.151	5,220.29
Values in mine ore treated	7,654.588	$270,433.47

[1]Gold at $35.00 per ton.

After preliminary adjustments, the mill has been found to give a high rate of extraction (98.05 per cent.) without any metallurgical difficulties. Milling costs per ton treated have been steadily reduced and for the year have averaged $1.18 per ton, as compared with $1.01 per ton for the last four weeks of the year.

From July 16 to December 31, 1938, there were hoisted to the mill 33,080 tons, averaging $8.37 per ton, of which 23,010 tons averaging $9.45 per ton were supplied by the stopes, 5,270 tons averaging $6.01 per ton were supplied from current development headings, and 4,800 tons averaging $5.81 per ton from surface development dump.

Direct operating costs since production commenced have averaged $5.05 per ton treated, and if development and diamond-drilling costs are included, the total per ton treated was $6.14. These operating costs, before providing for plant depreciation, pre-production development write-off, and taxes, are made up as follows:—

	Total cost	Cost per ton ore treated
Current development and diamond-drilling	$35,372.79	$1.09
Extraction	84,763.89	2.62
Total mining cost	$120,136.68	$3.71
Milling	38,192.62	1.18
Surface, general and administration	36,788.00	1.14
Total operating cost	$195,117.30	$6.03
Marketing expense	3,462.76	.11
Total cost	$198,580.06	$6.14

Capital Expenditures

The principal items of capital expenditure during the year were:—

BUILDINGS, PLANT, AND EQUIPMENT:	
Mine buildings	$24,114.63
Mill buildings	35,537.63
Townsite and residences	17,110.15
Mining and miscellaneous machinery	32,341.28
Mill machinery	204,808.56
	$313,912.25
MINE DEVELOPMENT DEFERRED:	
Fourth level drive west	3,882.63
Total	$317,794.88

Ore Reserves

Under date of November 1, 1937, in the O'Brien Gold Mines, Limited, third annual report, it was stated that diamond-drilling and surface sampling during the year had indicated approximately 412,100 tons of $11.30 ore down to 500 feet, which figures were considered to be conservatively based pending confirmation by actual underground development. Since January, 1939, development has disclosed that while certain blocks of the indicated ore estimate have exceeded expectations as to grade and tonnage, others have been lower than indicated and that

so far as the Eastern ore body is concerned, the general tendency to date has been to prove a tonnage and grade below the estimate, as indicated by the original diamond-drilling and surface sampling. There are, however, a great many diamond-drill indications remaining to be opened up and developed, as well as the entire Western ore body (which is being approached by a long drive from the Main shaft west on the 500-foot level, which will be approximately 1,650 feet long). Actual development work has disclosed that many of these underground indications, while high in grade, are to date inclined to be faulted and lenticular and to consequently lack vertical and horizontal continuity. It will, however, take considerable time and much further underground development work before the amount of ore indicated by diamond-drilling can be definitely proven.

General

Underground operations have been appreciably delayed from time to time by the encountering of seams carrying water under pressure, and indications to date are that the ore-bearing ground at Cline Lake Gold Mines is host to an unusually large number of such seams. Experience to date, however, is that as the workings get deeper the head of water lying in these seams is greatly reduced, thus freeing the upper levels as the workings progress downwards. Except for lost time, these water inflows are being readily and effectively controlled.

During the year, 15 houses were completed for the accommodation of employees and their families. A school district has been organized and temporary school accommodation provided at the mine settlement.

A. H. Hinton was mine manager until October, and was succeeded by M. J. O'Shaughnessy. J. C. Shoemaker is mill superintendent. An average of 129 men was employed.

Cole Gold Mines, Limited

Cole Gold Mines, Limited, was incorporated in November, 1933, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers are: John Y. Cole, president and treasurer; Wm. Exton, Jr., vice-president; Cecily Cole, secretary. The executive office and mine office are both at Cole.

The property consists of 57 patented claims, totalling 2,500 acres, located on the southwestern shore of Pipestone bay in Red lake, some 30 miles west of the town of Red Lake in Ball township, in the Patricia portion of Kenora district.

No development work was done in 1938. Some diamond-drilling was done on the 500-foot level to prove the extension of the vein below that level. Operations were suspended early in June, and the mine was idle for the rest of the year. The following table shows the amount of lateral development work on the property when operations ceased:—

Level	Feet
200-foot	2,000
300-foot	900
400-foot	250
500-foot	2,600

John Y. Cole was manager.

Coniaurum Mines, Limited

Coniaurum Mines, Limited, was incorporated in July, 1924, with an authorized capitalization of 6,000,000 shares of no par value. The capitalization was reduced to 3,000,000 shares in 1937 by the cancellation of 3,000,000 unissued shares. At December 31, 1938, the number of shares issued was 2,766,743. The officers and directors are: Thayer Lindsley, president; A. L. Bishop, vice-president; H. Whittingham, secretary-treasurer; A. G. Fulton, assistant secretary-treasurer; H. Lindsley, Alex. Longwell, T. H. Rea, and H. S. Munroe, directors. John Redington is mine manager. The head office is at 25 King Street West, Toronto. The mine address is Schumacher.

The mine property consists of 19 claims, containing 760 acres, adjoining the McIntyre-Porcupine mine, in Tisdale township, Porcupine area, district of Cochrane. The company also holds three additional claims in the same township.

The following is taken from the president's report to the shareholders for the year ending December 31, 1938:—

The net working capital at the end of the year amounted to $664,044.96, which is an increase of $49,464.39 from the previous year. The issued shares now stand at 2,766,743, showing an increase of 36,296 shares. The increase of capital stock issued was due to the completion of the purchase of 50.01 per cent. interest in Ridgely Mining Company, Limited, whose properties adjoin the Coniaurum claims on the east.

Operations

The profits for the year show a decided increase over any previous year. This was due to greater tonnage treated, a slight increase in grade, and a decrease in costs caused by completion of shaft-sinking. Since extensive areas above the 5,000-foot level are now accessible for exploration, heavy expenditures for further sinking will not be required for a number of years. There remains, however, the 500 feet of sinking required to bring the Bishop subshaft from the 4,500-foot level to the 5,000-foot level.

The following is an extract from the mine manager's report for the year ending December 31, 1938:—

Development and Exploration

Some sort of development or exploration work has been done on most of the levels of the mine from the 400-foot down to the 5,000-foot, but the greatest emphasis has been placed on work from the Goldale winze. This work has pretty well delimited, vertically at least, the favourable zone, which showed its maximum action on the 4,000-foot level.

The bottom of this zone is now known to be somewhat below the 4,250-foot level. The ore occurrences on this level are small as compared with the 4,000-foot, and are completely cut off by the easterly plunging porphyry a little below the level in No. 2 winze section. There are still possibilities to the west in No. 21 region.

However, between the 4,000- and 3,000-foot levels in this zone, there are many good shoots of ore, and undoubtedly more will be found as exploration continues.

Through diamond-drilling, another favourable zone has been indicated on the 5,000-foot level, much farther east, only about 600 feet westerly from the vertical extension of the Bishop shaft. Drifting is in progress towards this zone, which should be fairly well explored during 1939.

Work is proceeding to explore two other occurrences, which have been indicated by diamond-drilling, viz: (1) No. 3 winze is being sunk from the 2,000- to the 2,750-foot level to explore favourable country in the West Goldale claim, where several drill intersections indicate ore. (2) On the 400-foot level, diamond-drilling from surface indicated a considerable shoot of ore remote from the then workings on this level. A crosscut is being driven south to explore this occurrence. Neither of these is expected to be of major importance, but each will probably contribute considerably to the ore supply.

During the past year new porphyry masses, previously unknown, have been found well to the north of the trend of the Pearl lake and Coniaurum masses; and another shear zone—roughly parallel and north of the main shear, in which some 90 per cent. of the ore has been found—has been suggested by work in the McIntyre mine. To explore the possibilities of these features, a long crosscut northwesterly from the Bishop shaft on the 3,500-foot level is in progress. This work is, of course, entirely speculative.

The total footage of all classes of development and diamond-drilling has exceeded any year in the mine's history.

Summary of Development

	Feet
Winze-sinking	248
Drifting	3,442
Crosscutting	7,818
Raising	5,171
Diamond-drilling	45,605

Footage driven in ore was 1,075 feet with an average value of 5.6 pennyweights per ton over a width of 5 feet; raising in ore 1,711 feet, over a width of 4 feet; average assay value 5.5 pennyweights per ton.

Broken Ore Reserves

Stoping methods are gradually changing from shrinkage to cut-and-fill below the 3,000-foot level; therefore broken ore reserves are 13,197 tons less than that of last year. The broken reserves at the end of 1938 were 138,688 tons at 5.4 pennyweights per ton. Last year's reserves were 151,885 tons at 5 pennyweights per ton.

Milling

During the year the mill treated 188,975 tons of ore with an average recovery of $8.857 per ton, extracting 95.79 per cent. of the gold content; operating 364.16 days, or 99.8 per cent. of possible running time.

Summary of Comparative Results for the Last Five Years

	1934	1935	1936	1937	1938
Tonnage milled	138,114	151,055	168,715	166,980	188,975
Recovery per ton (net)	$7.04	$7.42	$8.14	$8.65	$8.75
Working cost per ton	$5.47	$6.27	$6.59	$7.15	$5.98
Working profit per ton	$1.57	$1.15	$1.55	$1.50	$2.77
Development work:					
Drifting, crosscutting, and raising...feet	13,542	8,711	11,749	15,137	16,431
Sinking...feet	.....	1,338	1,561	1,039	248
Diamond-drilling...feet	17,757	12,942	30,903	43,175	45,605
Dividends paid	.....	.....	.....	$273,044.70	$411,381.85

The average number of men employed during the year was 373, of whom 271 were underground and 26 in the mill.

Consolidated Mining and Smelting Company of Canada, Limited

The Consolidated Mining and Smelting Company of Canada, Limited, which was incorporated in January, 1906, has an authorized capitalization of $20,000,000 divided into 4,000,000 shares of $5 par value. The officers and directors are: Jas. J. Warren, president; Sir E. W. Beatty, vice-president; S. G. Blaylock, vice-president and general manager; Jas. E. Riley, secretary-treasurer; Henry Joseph, R. H. McMaster, Sir Herbert Holt, Hon. R. R. Bruce, L. A. Campbell, Thayer Lindsley, F. Gordon Osler, R. S. McLaughlin, Sir Chas. Gordon, W. N. Tilley, and J. C. Hodgson, directors. The head office is at 215 St. James Street West, Montreal, Que. An office is maintained at 302 Bay Street, Toronto.

Addington Mine

The Addington mine, also known as the Rich Rock, in Kaladar township, Lennox and Addington county, is owned by Addington Mines, Limited, and operated under the control of the Consolidated Mining and Smelting Company of Canada, Limited. The property consists of 298 acres in lots 24 and 25, concession VI. A reference to the organization of Addington Mines, Limited, appears on page 72 of this report.

The mine operated throughout 1938. The main, or No. 1 shaft has an inclined depth of 535 feet, with five levels at vertical depths of 77, 168, 254, 356, 458, and 703 feet. During 1938 a winze, collared at the 5th level about 600 feet north of the shaft, was sunk for a distance of 273 feet. Levels were established at 625 and 750 feet. The total lateral development work done during the year amounted to 1,709 feet of drifting and 975 feet of crosscutting. Some 602 feet of raising was accomplished. About 275 feet of surface trenching was done, and 15 diamond-drill holes, having a total length of 3,052 feet, were drilled from underground. A total of 15,200 tons of ore and waste was hoisted.

A corrugated iron boiler-house, 36 by 20 feet, was erected during the year.

New plant equipment included a Goldie and McCulloch 75 h.p., horizontal return tubular boiler; a 6- by 8-inch Ingersoll-Rand utility hoist; and a Gardner Denver caterpillar-driven compressor.

C. E. White was manager, employing an average of 44 men throughout the year.

Cordova Mine

The Consolidated Mining and Smelting Company of Canada, Limited, owns and operates the Cordova mine on the east half of lot 20, concession I, Belmont township, Peterborough county.

The main, or No. 3, shaft on this property is 1,000 feet in inclined depth, with nine levels at vertical intervals of 100 feet. During 1938 a 2-compartment, inclined winze, No. 912, was sunk from the ninth level to the tenth, 152 feet on the incline, 1,120 feet below the surface. A total of 3,284 feet of drifting, 948 feet of crosscutting, and 172 feet of raising was accomplished during the year. Diamond-drilling amounted to 11 holes, totalling 2,317 feet, drilled from underground. Some 2,815 tons of ore and 18,925 tons of waste were hoisted.

C. A. Seaton was superintendent, employing an average of 60 men throughout the year.

Hermiston-McCauley Option

The Consolidated Mining and Smelting Company of Canada, Limited, operated the Hermiston-McCauley property, under option, from January 1 to November 30, 1938, following which the option was dropped. The property consists of 2 claims, approximately 104 acres, in Strathy township, district of Nipissing.

A Canadian Ingersoll-Rand 310-cubic-foot compressor was added to the plant equipment.

The vertical, 3-compartment shaft was sunk a further 273 feet to a total depth of 457 feet, and a new level was established at 350 feet. Lateral development during the year amounted to 2,102 feet of drifting and 790 feet of crosscutting. Thirty-one diamond-drill holes, having a total length of 3,488 feet, were drilled. Some 1,421 tons of ore and 13,151 tons of waste were hoisted.

E. D. O'Brien was superintendent, employing an average of 26 men for eleven months.

New Golden Rose Mine

The property owned by New Golden Rose Mines, Limited, in Afton township, Timagami Forest Reserve, district of Sudbury, is operated under the direction of the Consolidated Mining and Smelting Company of Canada, Limited. A list of the officers and directors of the company appears on page 171 of this report.

Operations were carried on throughout 1938. The development work accomplished to the end of December, 1937, during 1938, and the total, are shown in the following table:—

DEVELOPMENT WORK

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	735	.....	735
66-FOOT LEVEL (adit):			
Drifting	9	.....	9
Crosscutting	323	86	409
216-FOOT LEVEL:			
Drifting	172	213	385
Crosscutting	330	.....	330
Raising	75	167	242
316-FOOT SUBLEVEL:			
Drifting	30	152	182
Raising	.....	83	83
341-FOOT LEVEL:			
Drifting	1,442	376	1,818
Crosscutting	564	151	715
Raising	313	45	358

DEVELOPMENT WORK—*Continued*

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
396-FOOT SUBLEVEL:			
Drifting	323	1,002	1,325
Crosscutting	95	92	187
Raising	16	136	152
466-FOOT LEVEL:			
Drifting	1,249	570	1,819
Crosscutting	559	160	719
Raising	276	185	461
591-FOOT LEVEL:			
Drifting	.....	412	412
Crosscutting	155	61	216
Raising	.....	57	57
716-FOOT LEVEL:			
Drifting	.....	802	802
Crosscutting	217	271	488

The following table shows the amount of diamond-drilling accomplished during the year:—

	No. of holes	Feet
Surface	14	5,315
Underground	38	4,351
Total	52	9,666

A total of 40,181 tons of ore was hoisted and milled. An average of 127 men was employed during the year. D. C. McKechnie is manager, and W. E. Aitchison is mine superintendent. The mine address is Glen Afton.

Continental Kirkland Gold Mines, Limited

Continental Kirkland Gold Mines, Limited, was incorporated in December, 1927, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 3,590,156 have been issued. The officers and directors are: H. A. Guess, president; G. A. Brockington, secretary; J. C. Emison, treasurer; C. W. Bell, A. W. Holmested, and R. F. Goodwin, directors. The head office and mine office are at Kirkland Lake.

The property consists of 27 claims in Lebel township, Kirkland Lake area, district of Timiskaming.

Operations were carried on continuously throughout 1938. Some 1,714 feet of drifting, 244 feet of crosscutting, and 113 feet of raising were accomplished. A 2-compartment, inclined winze, No. 821, was started at the 800-foot level and sunk a distance of 180 feet. A level was established at 925 feet. Fourteen diamond-drill holes, totalling 6,778 feet, were drilled from underground.

An average of 24 men was employed under the direction of M. W. Hotchkin, mine manager.

Cook Lake Gold Mines, Limited

Cook Lake Gold Mines, Limited, which was incorporated in October, 1936, has an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,219,238 shares had been issued at November, 1938. The officers and directors are: C. H. Palmer, Jr., president; H. G. Donley, secretary; W. H. Stanley, G. G.

Barber, and E. J. McKenna, directors. The head office is at 350 Bay Street, Toronto. The mine address is Schreiber.

The property consists of 17 unpatented claims, comprising about 800 acres, and is situated about 4 miles north of Schreiber on the main line of the Canadian Pacific Railway, in the district of Thunder Bay.

The 2-compartment shaft had reached a depth of 115 feet at the end of 1937. Operations in 1938 were carried on from January 1 to April 30 and from May 18 to May 31. A level was established at 112 feet, and 500 feet of drifting was done.

A. L. Kemp was manager during the period of operation, employing 4 men.

Craig Gold Mines, Limited

Craig Gold Mines, Limited, was incorporated in May, 1934, with an authorized capitalization of 5,000,000 shares of $1 par value.

In February, 1938, the company went into bankruptcy, and the property in Tudor township, Hastings county, was sold to W. Blamire and associates.

During the rest of 1938 a small force of men was employed on maintenance work at the mine. No further development work was done. At the end of the year plans were being made for the formation of a new company known as Kudore Gold Mines, Limited, to resume active operation of the mine.

The mine address is Madoc.

Credo Porcupine Gold Mines, Limited

Credo Porcupine Gold Mines, Limited, was incorporated in April, 1938, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 1,998,667 have been issued. The company succeeded Arcadia Gold Mines, Limited, the stock transfer being made on a basis of 1 share of the new for 5 of the old. The officers and directors are: P. M. Macklin, president; E. V. D. Sullivan, vice-president; G. H. Creveling, secretary-treasurer; Peter Igoe, W. A. Bennett, A. P. Goldsmith, and Dr. H. M. Weaver, directors. The head office is at 25 King Street West, Toronto. The mine address is South Porcupine.

The property, which is in the Porcupine area, consists of 44 claims in Shaw and Carman townships, district of Cochrane, and Eldorado and Langmuir townships, district of Timiskaming, and includes the claims formerly held by Arcadia Gold Mines, Limited.

Former operators sank two shafts on the Shaw township claims; one of these, the Tommy Burns shaft, is on claim P. 8,300, and the other is on claim P. 8,301. Some lateral work has been done from both shafts. The workings were pumped out and sampled in 1937, and allowed to refill.

During 1938 the present operators sank a test pit 15 feet deep and did 5,015 feet of diamond-drilling from surface. No underground development work was done.

The work was carried on under the supervision of A. M. Bilsky.

Deep Lake Gold Mines, Limited

Deep Lake Gold Mines, Limited, was incorporated in March, 1938, with an authorized capitalization of 3,000,000 shares of no par value, of which 1,000,005 have been issued. The officers and directors are: F. D. Forsyth, president; C. F. Schnee, secretary; Ellis B. Gill, treasurer; D. K. La Port and H. L. Bowman, directors. The head office is at 109 North Union Street, Akron, Ohio. The mine address is Gold Park.

The company acquired the property of Deep Lake Gold Mines Syndicate, consisting of 418 acres, in township 29, range 23, Michipicoten area, district of Algoma.

The former operators sank a 2-compartment, 33-degree shaft to a depth of 155 feet and did 435 feet of drifting and 60 feet of crosscutting on the 100-foot level.

Underground work in 1938 was carried on from January to June and from August to December. During these periods the shaft was deepened to 200 feet, at which depth a second level was established. A small amount of lateral work was done. The mill operated for a few days in the spring, treating about 15 tons of ore.

A 24- by 30-foot bungalow was built during the year, and a 25-ton Gibson ball mill was added to the equipment.

Two men were employed underground, 2 in the mill, and 2 on construction work. A. M. George was manager.

Delnite Mines, Limited

Delnite Mines, Limited, which was incorporated in November, 1934, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,363,767 have been issued. The officers and directors are: E. L. Koons, president; W. L. Marcy, vice-president; C. L. Ingham, treasurer; W. S. Walton, secretary; W. V. Moot, managing director; Harry Yates, Jas. Savage, and Jas. E. Day, directors. The head office is at 603 Royal Bank Building, Toronto. The mine address is Timmins.

The property consists of 7 claims, 262 acres, in Deloro township, Porcupine area, district of Cochrane, three miles southeast of the town of Timmins.

The property has been developed through two shafts located 800 feet apart. No. 1 shaft is 391 feet and No. 2 shaft 1,032 feet in depth. The shafts are connected by crosscuts on the 250- and 275-foot levels. Mine levels are uniformly spaced at 125, 250, 375, 500, 625, 750, 875, and 1,000 feet. The first level, developed entirely from No. 1 shaft, is not directly connected with the No. 2 shaft.

The following is taken from the report of the manager for the fiscal year ending March 31, 1939:—

PRODUCTION

Ore treated.....tons		91,749
Gross value.....		$785,063.52
Bullion recovered:		
Gold (20,324.390 ounces at $35.21).....	$715,751.07	
Silver (1,845.53 ounces at $0.417).....	769.77	
Total value.....		$716.520.84
Value per ton (0.243 ounces at $35.21).....		$8.56
Recovery per ton (0.222 ounces gold).....		$7.81
Extraction per cent.....		91.20

PRODUCTION SINCE MILLING COMMENCED IN 1937

	10 months, June 1, 1937, to March 31, 1938	Fiscal year ending March 31, 1939
Tons milled.....	57,689	91,749
Value per ton.....	$7.01	$8.56
Gross value.....	$404,484.39	$785,063.52
Recovery per ton.....	$6.41	$7.81
Total value.....	$369,678.75	$716,520.84
Average price per ounce.....	$35.17	$35.21

SUMMARY OF ORE AND WASTE HOISTED

	Ore	Waste
	tons	tons
Development	20,002	3,144
Stopes	65,657	442
Surface ore dump	6,213	.....
Total	91,872	3,586

Broken Ore Reserves

Broken ore reserves are estimated at 37,005 tons at a grade of 0.177 ounces, or 3.54 pennyweights per ton. All the ore is cleaned up from the surface ore dump.

Development and Exploration

	Year ending March 31, 1939	Year ending March 31, 1938	Total to date
	feet	feet	feet
Drifts	5,270.5	3,200	14,172
Crosscuts	435.5	1,879.5	5,993.5
Sublevel drifts	109.5	41	240.5
Raises	731.5	71	2,311.5
Shaft-sinking	.....	370.5	1,423.5
Stations	.....	55	299
Ore passes	91	52.5	143.5
Total	6,638	5,669.5	24,583.5
Diamond-drilling	8,299	.....	30,561
		cu. ft.	cu. ft.
Sumps	.....	1,220	1,220

Costs

	Total costs	Cost per ton milled		Cost per fine ounce gold produced, 1939
		1939	1938	
OPERATING COSTS:				
Development and exploration	$95,278.49	$1.038	$1.167	$4.688
Mining	177,972.30	1.940	2.039	8.756
Milling	95,669.67	1.043	1.170	4.707
General mine charges after deducting sundry revenue	33,788.40	.368	.469	1.662
Administrative expense (partly mine)	14,331.46	.156	.157	.705
Bullion marketing expense, including mint handling and refining charges	8,765.05	.096	.086	.432
Total	$425,805.37	$4.641	$5.088	$20.950
OTHER COSTS:				
Interest on notes and debentures, including debenture discount and expense written off	$46,500.24	$0.507	$0.622	$2.288
Provision for depreciation	47,011.77	.512	.585	2.313
Preliminary development (written off)	45,874.50	.500	.500	2.257
Reserve for Ontario mining and corporation tax	8,900.00	.097	.036	.438
Total	$148,286.51	$1.616	$1.743	$7.296
Total costs	$574,091.88	$6.257	$6.831	$28,246

Additions to Plant Buildings and Equipment

Three houses were built for members of the staff. One set of crushing rolls together with a vibrating screen and the necessary conveying equipment was installed. All necessary machine-shop equipment was purchased and installed temporarily in the hoist and compressor building. A new tailings disposal line was installed and placed in service. The necessary equipment for an experimental laboratory was installed in the mill. The 300 k.v.a. outside transformers were replaced with 500 k.v.a. transformers.

Summary

Development throughout the year has been very encouraging with 64.2 per cent. of all drifting, for a total of 3,384 feet, being in ore at a grade of 3.94 pennyweights, or 0.197 ounces over 5.9 feet. Diamond-drilling has indicated the possibility of other lenses of ore in the main ore zone.

To permit deeper development, a new and larger hoist has been ordered and will be placed in service at the No. 2 shaft in July.

The mill tonnage has been gradually increased throughout the year to the present rate of about 300 tons per day.

The following is taken from the report of the directors, for the fiscal year ending March 31, 1939:—

During the year the mill tonnage has been increased to 300 tons per day and, as indicated by the manager's report, grade and recovery have shown some improvement. The ore developed on the lower levels throughout the year continued to be a little better in grade and width than on the upper levels, and a total of approximately 5,000 linear feet of ore has been developed in drifting on the five lower levels. During the year it was decided to deepen the shaft for a further distance of 500 feet and, anticipating an ultimate shaft depth of about 2,500 feet, a new hoist capable of 3 tons capacity to 2,500 feet is now on order, together with a new steel headframe. Some time during the summer it is expected that the installation of this equipment will be complete and that sinking operations to 1,500 feet will be under way. The necessary additions to the hoist-house, supply shops, compressor room, and machine shop are at present in course of construction and an addition to the change-house, it is planned, will be completed before fall.

The character of the ore is not simple. The resulting recovery has accordingly been less satisfactory than in other mines where the ore is more easily treated. Experiments are being conducted at the mine, at Ottawa, and elsewhere, and all possible steps are being taken to improve recovery, and full reports on this work will be received shortly. During the past year improvement in recovery has been attained and further improvement is hoped for.

K. C. Gray was manager until November, when he left to take charge of Sylvanite Gold Mines, Limited, and John Beattie succeeded him as manager. An average of 128 men was employed throughout the year, 85 of whom were in the mine and 9 in the mill.

De Santis Porcupine Mines, Limited

De Santis Porcupine Mines, Limited, has an authorized capitalization of 3,000,000 shares of $1 par value, 2,600,000 of which have been issued. The officers and directors are: Theodore Pomeroy, president; Jos. V. Friel, vice-president; G. Guistini, secretary-treasurer; J. A. Devaney, Peter De Santis, Frank Prest, and Q. A. Shaw McKean, directors. The head office of the company is at 42½ Second Avenue, Timmins. The mine address is Timmins.

The company owns 21 claims, 850 acres, in Ogden and Turnbull townships, Porcupine area, district of Cochrane. Mining activities have been centred on the Ogden township claims.

During 1938 no underground or surface work was done. The pumps were kept working, and the necessary men for repair and maintenance work were employed. The foundations for a mill had been laid in 1937, and plans for its erection and equipment are being proceeded with

C. M. Beck was manager.

Devon Gold Mines, Limited

Devon Gold Mines, Limited, was incorporated in October, 1937, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,300,000

have been issued. The officers and directors are: A. M. Beatty, president; L. A. Peto, vice-president; G. F. Racine, secretary-treasurer; J. M. Walker, H. C. Crow, and A. P. Earle, directors. The head office is at Matheson, and the executive office is at 388 St. James Street West, Montreal, Que. The mine address is Matheson.

The company holds 10 patented claims, formerly owned by Coulson Consolidated Gold Mines, Limited, in Coulson and Beatty townships, district of Cochrane.

There are two shafts on the property. The No. 1 or North shaft, 450 feet in depth, has not been pumped out for some years. The No. 2 or South shaft, from which all of the recent development work has been done, is 450 feet deep, with levels at 160, 300, 425, and 550 feet. A winze 130 feet in depth has been sunk from the 550-foot level, and from it a level is established at 650 feet. Prior to 1938 about 2,950 feet of crosscutting and 5,200 feet of drifting had been done.

During 1938 underground operations were carried on from January 1 to April 4, and from September 1 to November 30. A total of 5,500 feet of drifting, 3,550 feet of crosscutting, and 550 feet of raising was accomplished.

In the mine manager's report to the president, under date of November 21, 1938, ore reserves are estimated at 41,000 tons, having a value of $445,000. The report states, "On the basis of the above estimate, it is found justified to continue plans for immediate mill erection."

H. Reinecke is manager, employing an average of 12 men.

Dome Mines, Limited

Dome Mines, Limited, was incorporated under Dominion charter in 1923, to succeed the Dome Mines Company, Limited. In 1938 the 1,000,000 shares of no par value which made up the authorized capitalization of the company were divided into 2,000,000 shares of no par value, all of which have been issued. Of the issued shares, 53,332 were held in trust for the company, but were transferred on August 20, 1938, to the Employees Pension Fund. All dividends payable on these shares are returnable to the company, but amounts equivalent thereto will be contributed by the company to the trustees until such time as the said fund is certified to be actuarily sound in accordance with the terms of the Pension Trust Agreement, after which date the 53,332 shares will be returned and held in trust for the company freed from the provisions of the said agreement.

The officers and directors are: Jules S. Bache, president and treasurer; G. C. Miller, first vice-president; Morton F. Stern, second vice-president; J. H. Stovel, third vice-president; Alex. Fasken, secretary; E. P. Goetz, assistant treasurer and assistant secretary; C. C. Calvin, assistant secretary; John B. Robinson, assistant secretary; George H. Harris, Frank E. Maulson, Simon N. Stein, J. G. Baragwanath, and A. D. McRae, directors. The president's office is at 42 Broadway, New York. The secretary's office is at 36 Toronto Street, Toronto. The mine office, mine, and plant are at South Porcupine, in the townships of Tisdale and Whitney, Porcupine area, district of Cochrane. The property consists of 52 patented claims, containing 2,085 acres.

The following is an extract from the president's report to the shareholders for the year ending December 31, 1938:—

> The net excess of current assets (bonds and shares at market price, except shares in Sigma Mines (Quebec), Limited, which are carried at cost) over current liabilities (including dividends payable on January 20 and April 20, 1939, $1,946,668.00) is the sum of $6,249,850.48.

The following is taken from the report of the general manager for the year ending December 31, 1938:—

During the year 664,700 tons of rock was hoisted, of which 601,700 tons was ore which was treated in the mill. The balance, 63,000 tons, was waste, which was dumped into the open pit and thence drawn into old stopes. Of this 63,000 tons, 50,000 tons was mined and the balance, 13,000 tons, was drawn from old stopes as fill for a stope at a higher horizon. In addition to the waste brought to the surface, 25,000 tons was mined and dumped directly into old stopes and 36,000 tons was transferred underground between old stopes.

The 601,700 tons of ore milled yielded bullion containing 206,956.764 ounces of gold, the yield being 0.3439 ounces, or 6.878 pennyweights per ton.

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, 1938

EARNINGS:		
Bullion production		$7,293,288.73
OPERATING AND MAINTENANCE EXPENDITURE:		
Development and exploration	$573,077.95	
Mining, including hoisting	958,104.22	
Crushing and conveying	127,315.79	
Milling	516,954.19	
Refining and marketing	90,320.00	
Fire protection	5,800.10	
Warehouse expense	19,272.62	
Auditing expense	4,030.00	
Administrative expense:		
Mine office	105,124.75	
Executive office	72,553.86	
Registrar and transfer fees and expenses	24,818.96	
Municipal taxes	28,214.36	
Insurance	14,964.01	
Ontario corporations capital tax	3,400.00	
United States capital stock tax	3,263.87	
Current contributions to pension fund	14,784.68	
		2,561,999.36
NET OPERATING PROFIT FOR THE YEAR		$4,731,289.37

As during the previous year, all production came from above the 15th level. Investigation of old stopes was continued and considerable ore was won from this source.

The Ankerite vein system produced 125,652 tons of an average grade of 5.43 pennyweights per ton. While the grade of this system shows a sharp drop, its importance as a reserve is growing.

The Schumacher area produced 95,991 tons of an average grade of 9.71 pennyweights per ton. This property has now returned, with liberal interest, its purchase price.

The balance of the mine produced 380,057 tons of an average grade of 6.93 pennyweights per ton. Stopes not drawn on during the year contain 166,739 tons of broken ore.

Costs

The expenditure on mining was $958,104.22, or $1.59 per ton milled. The expenditure on development was $573,077.95, or $0.95 per ton milled. The operating charges for the year were $4.258, as compared with $4.903 for the previous year. The greater part of this decrease was due to the fact that the heavy part of the expenditures for No. 6 and No. 3 shafts were completed during 1937.

Pension Plan

At the last annual meeting the shareholders authorized the putting into effect of a pension plan for our employees. This plan became effective on August 1, 1938, and is now in full operation. Over 90 per cent. of our employees have joined the plan. Six of our employees were placed on pension at once, and several more are due their pensions very shortly.

All costs of pensions for services prior to the date of the inception of the plan are borne by the company. The costs of pensions for current services are contributed to by the employees and by the company. The contributions of the employees and of the company are placed in a trust fund which is administered by trustees who will always be the president, the general manager, and three directors of this company. The company had the benefit of the services of a competent actuary, Mr. H. H. Wolfenden, throughout the forming of this plan, and everything has been done to place the plan on a sound actuarial basis so that our employees' pensions will be properly safeguarded.

Development

The following table sets forth the details of the development work accomplished during the year:—

SUMMARY OF DEVELOPMENT BY LEVELS FOR YEAR 1938

Level	Drifts	Cross-cuts	Drift and crosscut slab	Raises	Winzes	Miscellaneous	Box-holes	Raise, winze, and box-hole slab	Total	Diamond-drilling
	feet	feet	feet	feet	feet	feet	feet	feet	feet	feet
1st	.....	.....	.....	118	.....	.....	.....	25	143	.....
3rd	503	.....	191	.....	.....	.....	.....	.....	694	600
5th	638	245	82	295	.....	.....	211	50	1,521	3,881
6th	864	160	166	252	6	.....	920	144	2,512	5,365
7th	496	57	90	371	.....	.....	688	84	1,786	1,562
8th	1,281	73	95	608	.....	.....	455	54	2,566	1,932
9th	1,055	8	61	30	.....	.....	.....	1	1,155	1,470
10th	789	43	124	27	7	.....	82	7	1,079	1,032
11th	515	.....	114	414	.....	.....	825	183	2,051	204
12th	382	95	78	226	.....	.....	1,035	270	2,086	.....
13th	579	239	142	386	.....	.....	547	223	2,116	1,036
14th	813	762	215	280	41	.....	804	105	3,020	1,537
15th	986	263	102	580	4	.....	810	169	2,914	153.5
16th	.....	.....	47	32	.....	.....	.....	.....	79	.....
17th	64	.....	93	.....	.....	.....	.....	.....	157	.....
19th	415	8	27	.....	.....	.....	.....	.....	450	.....
20th	337	15	47	282	.....	.....	.....	1	682	.....
21st	316	.....	127	310	.....	.....	.....	2	755	.....
22nd	341	8	168	310	.....	.....	.....	.....	827	.....
23rd	.....	.....	.....	.....	.....	.....	.....	5	5	.....
25th	.....	.....	.....	.....	.....	.....	.....	.....	.....	634
26th	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,902
28th	260	.....	94	155	.....	.....	.....	1	510	.....
29th	212	8	56	199	.....	.....	.....	1	476	.....
No. 3 shaft	.....	.....	.....	.....	.....	45	.....	66	361	.....
No. 6 shaft	.....	.....	.....	.....	.....	132	.....	.....	132	.....
Total	10,846	1,984	2,119	5,125	58	177	6,377	1,391	28,077	22,308.5

The foregoing table shows the location of the 28,077 feet of development work accomplished. All of the work done below the 16th level was in connection with No. 3 and No. 6 shaft programmes. This work, some of which was above the 16th level, accounted for 5,174 feet. Diamond-drilling completed during the year amounted to 22,308.5 feet.

No. 3 Shaft Programme

The excavation of the loading pocket and the crusher station below the 16th level has been completed, and the necessary equipment has been installed and is now in satisfactory operation. The ore and waste passes from the 12th to the 13th levels and from the 14th to the 15th levels were completed, and this permits all ore and waste being handled from the loading pocket below the 16th level. All the ore is crushed by the newly installed crusher before entering the loading pocket.

In driving the connection between the new loading pocket and the crusher station at the 16th level some very bad ground was encountered. In order to prevent any further trouble at this point, as trouble here might well shut down the mine, it was decided to line this section with reinforced concrete and to protect the concrete from wear by lining it with manganese steel plates. This was done, but it caused a delay of the programme at No. 6 shaft by about two months, since the crusher at the 12th level of No. 3 shaft could not be released for moving to the 29th level of No. 6 shaft until the crusher and loading pockets below the 16th level were in service.

No. 6 Shaft Programme

The crusher station below the 29th level was excavated and lined with reinforced concrete. The crusher foundations were installed. Ore and waste passes were worked on continuously during the year, and all that now remains to be completed are the ore and waste passes from the 18th to the 19th level and the ore pass from the 27th to the 28th level. By the time the crusher is installed, this is being proceeded with at once, this section of the mine will be ready for further development work.

Ore Production

During the year the mine produced 601,700 tons of ore, which averaged 7.0581 pennyweights per ton. The stopes produced 512,300 tons, averaging 7.54 pennyweights per ton; and development work produced 89,400 tons, averaging 4.32 pennyweights per ton.

Ore Reserves

The ore reserves are estimated at 2,620,000 tons, a decrease over last year of 5,000 tons. This figure includes 890,000 tons of broken ore.

The following table gives the percentage of the ore reserves in the various parts of the mine:

	Per cent.
Ankerite veins	17.5
Schumacher area	20.3
Area below the 23rd level	18.2
Balance of mine	44

Mill

The following are the milling results:—

Ore treated	tons	601,700
Average grade ore treated	dwt. per ton	7.0581
Recovery	per cent.	97.46

Many minor changes have been made in the mill, which are resulting in an appreciable decrease in total milling costs.

Capital Expenditure

The details of changes in capital assets for 1938 are as follows:—

	Increase	Decrease
MINE BUILDINGS, MACHINERY AND EQUIPMENT:		
Two loading stations	$24,346.21	.....
Hoisting equipment	17,634.51	.....
Pumping equipment	7,463.75	.....
Crushing equipment	10,235.41	.....
Mine ventilation	5,747.99	.....
REDUCTION BUILDINGS, MACHINERY AND EQUIPMENT:		
Magnet in crusher-house	895.99	.....
Refinery elevator	1,953.76	.....
Refinery vault	1,832.56	.....
Refinery vault alarm	1,677.70	.....
Pump in mill	1,012.73	.....
Written off:		
Refinery vault	.....	$457.93
Miscellaneous	.....	288.26
POWER BUILDINGS, MACHINERY AND EQUIPMENT:		
Written off:		
Two steam engines and generators	.....	36,276.80
SHOP BUILDINGS, MACHINERY AND EQUIPMENT:		
Radial drill for machine shop	2,508.84	.....
Plate shop	16,207.47	.....
Written off:		
Plate shop	.....	5,639.14
Miscellaneous	.....	379.10
CAMP AND GENERAL BUILDINGS AND EQUIPMENT:		
Team of horses	567.68	.....
Additions to warehouse	4,871.87	.....
Written off:		
Refrigerating equipment	.....	4,030.58
X-ray equipment	.....	6,393.35
Six buildings	.....	3,996.20
Team of horses	.....	488.85
OTHER MACHINERY AND EQUIPMENT:		
Steam lines	16,263.40	.....
Spare parts (formerly carried in mining and milling supplies)	60,300.95	.....
Written off:		
Steam lines	.....	8,696.24
	$173,520.82	$66,646.45
WRITTEN OFF PLANT	66,646.45	.....
NET INCREASE	$106,874.37	.....

Exploration

Early in the year a prospecting party of four men headed by one of our exploration men, Walter Cliff, was sent into the Yellowknife district. On July 2 a discovery was made and a compact group of 43 claims was immediately staked in what is now known as the Pensive Lake area. A diamond-drill was shipped at once to the location, and drilling was commenced August 3. A total of 4,296 feet was drilled in 23 holes, the deepest of which was 468 feet. In addition to diamond-drilling a small crew was continuously engaged, after the discovery, in trenching, sampling, and generally prospecting the ground staked. Several showings, in addition to the original discovery, were uncovered, but they did not stand up well under sampling.

The bulk of the work was concentrated on the original discovery. At surface this showing is 225 feet long and averages approximately 23 feet in width. Surface sampling of this showing gave an average value of $8.37 per ton. Diamond-drilling below the showing disclosed the vein in place, but the values obtained from the core were erratic and not nearly as high as those obtained from channel-sampling at the surface.

The results obtained in the work on this group were by no means conclusive but, we feel, were sufficiently encouraging to warrant some further expenditure. The group of 43 claims has been surveyed, and it is proposed to return to the field this year and do further work on the original showing and to carefully prospect the area staked. No plant will be taken in, and we will not commit ourselves to any great expense unless further disclosures made indicate that this is justified.

Late in the fall an option was arranged on a group of claims not far from our Pensive Lake holdings. On November 11, Mr. Cliff moved the drill and his crew to this property, where they were engaged till December 6. During this time considerable surface-trenching and sampling was done, and a total of 859 feet of diamond-drilling in 14 holes was completed. The results obtained were not such as to justify going on with the option as drawn, and the owners were so notified before the end of the year. Work in this area was suspended for the season on December 11.

Several other properties were looked at during the year, and an option was taken on a property in northwestern Quebec. The investigation of this property is still in progress.

Sigma Mines (Quebec), Limited

It is anticipated that the advances made by this company and the Read-Authier Mine, Limited, to Sigma Mines (Quebec), Limited, will be cleared off before July 1, 1939. From that time on 60 per cent. of the profit realized will eventually find its way into the treasury of this company.

Edwards Consolidated Mines, Limited

Edwards Consolidated Mines, Limited, was incorporated in February, 1938, to succeed Edwards Gold Mines, Limited. The company has an authorized capitalization of 3,000,000 common shares of no par value, of which 1,339,568 have been issued, and 227,166 preferred shares of $1 par value, all of which have been issued. The officers and directors are: H. C. Orton, president; R. G. Orton, secretary; Wayne Johnston, treasurer; E. A. Fitz, Wayne Johnston, S. F. Weiser, T. B. Schmid, M. L. Martyn, O. G. Schrup, and H. H. Dodd. The head office and mine office are at Lochalsh.

The property consists of 9 claims in township 48, Goudreau area, district of Algoma.

No underground operations have been conducted since October, 1937. Activities in 1938 were confined to geological mapping.

M. H. Frohberg is manager. Four men were employed on surface.

Elizabeth Gold Mining Company, Limited

The Elizabeth Gold Mining Company, Limited, which was incorporated in February, 1936, to succeed the Elizabeth Gold Syndicate, has an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,235,230 have been issued. The officers and directors are: Wm. L. Doyle, president; C. D. Cummings, vice-president; W. L. Anderson, secretary-treasurer; C. A. Mills, T. B. Jones, A. L. Eskelson, Wm. Kerber, and P. A. Porter, Jr., directors. The head office is at 156 Yonge Street, Toronto. The mine address is Atikokan.

The property includes 480 acres of unpatented claims and 373 acres of patented claims, on which is situated the old Elizabeth mine. It is located in Freeborn township, district of Rainy River, about 3 miles north of the Fort

Frances branch of the Canadian National Railways, about 4 miles northwest of Atikokan.

No underground work was carried on at this property during 1938. Operations were confined to surface work and diamond-drilling, which totalled 1,100 feet.

There were 2 men employed on the property. W. N. McClintock was in charge.

Elmos Gold Mines, Limited

Elmos Gold Mines, Limited, was incorporated in March, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,220,005 have been issued. The officers and directors are: A. W. Burt, president; E. D. Birchard, secretary-treasurer; Philip Kraft, managing director; Franz Schneider, Jr., and T. J. Day, directors. The head office is at 6 King Street East, Toronto. The mine address is Geraldton.

The property consists of 57 claims, approximately 2,370 acres, in Errington township, Little Long Lac area, district of Thunder Bay. It adjoins the western boundary of the Little Long Lac mine.

The mine is operated under the control of the Newmont Mining Corporation, through its subsidiary, the Northern Empire Mines Company, Limited.

Operations began in February, 1938, and continued throughout the year. Shaft-sinking began on April 22 on an island just off the shore of Little Long Lac. The 3-compartment, vertical shaft had reached a depth of 350 feet at August 3. Levels were cut at 195 and 315 feet and drifting was begun, some 15 feet being accomplished on the 195-foot level and 1,999 on the 315-foot. Diamond-drilling during the year amounted to 400 feet from surface and 1,030 feet from underground.

Buildings on the property include a hoist-house, compressor-house, bunkhouse, cookery, boiler-house, magazine, and one residence.

The following plant equipment has been installed: 550-cubic-foot Ingersoll-Rand compressor, driven by a 150 h.p. Dominion Crossley Diesel engine; Westinghouse 60-cycle, 550-volt, 37.5 k.v.a. generator, also attached to the drive; Ingersoll-Rand, 6- by 8-inch, double-drum steam hoist; and a 60 h.p. horizontal steam boiler.

An average of 29 men was employed. B. R. Frisbie is superintendent, and Arthur Kendall is mine manager.

Faulkenham Lake Gold Mines, Limited

Faulkenham Lake Gold Mines, Limited, was incorporated in July, 1936, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 3,000,000 have been issued. The officers and directors are: Colin A. Campbell, president; E. K. Twombly, vice-president; W. M. Gordon, secretary-treasurer; F. P. Davis, T. C. Crea, and E. J. Knorl, directors. The head office is at 10 Adelaide Street East, Toronto, and the mine address is Red Lake.

The company holds 14 claims, 585 acres, in Ball township and 18 claims, 726 acres, in Baird township, and has a working option on 16 adjoining claims, known as the Starratt-Olsen group, in Baird township, Red Lake area, Patricia portion of Kenora district.

To date only surface exploration and diamond-drilling have been done on the claims in Ball township, and no work was done in 1938.

On the Baird township group a shaft has been sunk to a depth of 344 feet, with levels at 125, 225, and 325 feet. No underground work was done on these claims in 1938, operations being confined to 2,629 feet of diamond-drilling from surface.

A considerable amount of surface exploration and diamond-drilling had been done on the Starratt-Olsen claims by the Val D'Or Mineral Holdings, Limited. Under the terms of the option secured in the spring of 1938 the Faulkenham company agreed to sink a shaft and do some development work, following which a new company is to be formed by arrangement between the two companies. In August the mining plant was moved from the original Baird township claims and installed at the Starratt-Olsen property. The sinking of a 3-compartment, vertical shaft to an objective depth of 325 feet was begun. At the end of the year the shaft had reached 220 feet and a level had been established at 175 feet. During the year a total of 1,194 feet of diamond-drilling was done from surface and 150 feet from underground.

The mining plant includes a 500-cubic-foot Ingersoll-Rand compressor; an 8- by 6-inch, single-drum Ingersoll-Rand hoist; a 120 h.p. locomotive-type boiler; a 70 h.p. Scotch marine-type boiler; and a 40 h.p. vertical boiler.

The following new buildings were erected: 38-foot headframe, hoist-house, boiler-house, dry-house, office, blacksmith shop, powder magazine, cookery, and bunk-house.

An average of 5 men was employed on the original group of claims from January to August and an average of 31 men on the Starratt-Olsen property from August to December. A. H. Honsberger is manager.

Faymar Porcupine Gold Mines, Limited

Faymar Porcupine Gold Mines, Limited, was incorporated in July, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,400,000 have been issued. Funds for the operation of the property were supplied by a deal with Polaris Gold Mines (Canada), Limited. The officers and directors are: Mark Harris, president; H. S. Maynard, secretary; J. C. Moons, treasurer; P. W. Seiler and Jerome Harris, directors. The head office and mine office are at Timmins.

The company holds 5 claims, H.R. 1,166–1,170, containing 175 acres, in Deloro township, Porcupine area, district of Cochrane.

Following a campaign of diamond-drilling, a mining plant was installed, and the sinking of a 3-compartment, vertical shaft, near the western boundary of claim H.R. 1,169, was commenced in the spring of 1938. The shaft was sunk to a depth of 382 feet, with levels at 225 and 350 feet, on which a total of 1,068 feet of drifting, 1,617 feet of crosscutting, and 156 feet of raising were accomplished. The diamond-drilling done during the year amounted to 4,394 feet.

The mining plant includes an 8- by 12-inch Jenckes reversible hoist, manufactured by the Canadian Ingersoll-Rand Company, Limited; 750-cubic-foot Sullivan compressor; 120 h.p. Canadian Fairbanks-Morse Diesel engine; Robb Engineering Works steam engine; 50 h.p. locomotive-type boiler; marine-type boiler; 3 air receivers, 110 pounds capacity; 110-volt General Electric generator.

The following buildings have been erected: shaft-house, power-house, assay office, blacksmith shop, powder magazine, cap-house, carbide-house, oil-house, core shed, dry-house, storehouse and garage, staff-house, residence, bunk-house, cookery, and outside refrigerator building.

S. F. Monck was manager, employing an average of 43 men.

Federal Kirkland Mining Company, Limited

The Federal Kirkland Mining Company, Limited, was incorporated in September, 1927, with an authorized capitalization of 4,000,000 shares of $1 par value, of which 3,540,508 have been issued. The officers and directors are: Jas.

E. Day, president; F. L. Heard, secretary-treasurer; R. R. Brown, Jas. Savage, Gordon F. Summers, S. J. Bird, and J. M. Macintosh, directors. J. H. Botsford is mine manager. The head office is at 85 Richmond Street West, Toronto. The mine address is Kirkland Lake.

The property consists of 10 claims in Teck township, Kirkland Lake area, district of Timiskaming.

The shaft on the property is 740 feet deep, and drifting and crosscutting have been done on the 200-, 550-, and 700-foot levels. No development work was done in 1938, but 3 diamond-drill holes, having a total length of 3,112 feet, were drilled from the 700-foot level.

In December an agreement was completed with Toburn Gold Mines, Limited, and Kirkland Combined Mines, Limited, for the purpose of carrying on further exploration. The Kirkland Combined claims adjoin the Federal Kirkland mine to the east, and the agreement provides for the combining of the two properties to form one long belt running along the north side of the Sylvanite, Toburn, and Continental Kirkland properties. A crosscut will be run from the 1,100-foot level of the Toburn mine through the Federal Kirkland property. Toburn Gold Mines, Limited, will do the work and, if the results of the exploration are satisfactory, will supply the funds necessary to develop and equip the property for production. An average of 8 men was employed for the first five months of the year.

The company owns 88,000 shares of Delnite Mines, Limited, and 200,000 shares of Brock Gold Mines, Limited, whose property adjoins the Upper Canada mine on the west.

Fernland Gold Mines, Limited

Fernland Gold Mines, Limited, was incorporated in May, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,100,005 have been issued. The officers and directors are: G. P. Campbell, president; George Tough, vice-president; Wm. B. McPherson, secretary-treasurer; L. W. Oughtred and Howard J. Jewell, directors. The head office is at 171 Yonge Street, Toronto. The mine address is Larder Lake.

The property consists of 13 claims in McVittie township, Larder Lake area, district of Timiskaming.

The vertical, 3-compartment shaft, begun in December, 1937, was sunk to a depth of 547 feet in 1938, with levels at 150, 275, 400, and 525 feet. The following table shows the amount of lateral development work, by levels, done during the year:—

Level	Drifts	Crosscuts
	feet	feet
275-foot	349	254
400-foot	779	93
525-foot	537	128
Total	1,765	475

Diamond-drilling consisted of 48 holes, totalling 3,060 feet in length, drilled from underground. On surface 150 feet of trenching of an average depth of 3 feet was done. About 12,546 tons of ore and waste were hoisted.

The following buildings were erected: 60-foot headframe, hoist-house, Diesel- and compressor-house, combined blacksmith shop and boiler- and dry-house, powder magazine, warehouse, and manager's residence.

Howard J. Jewell was manager, employing an average of 37 men.

Gillies Lake-Porcupine Gold Mines, Limited

Gillies Lake–Porcupine Gold Mines, Limited, was incorporated in 1933, with an authorized capitalization of 2,000,000 shares of $1 par value. In May, 1937, the capitalization was increased to 2,750,000 shares of $1 par value, and in September, 1938, was again increased to 5,000,000 shares of $1 par value. At December 31, 1938. the number of shares issued was 3,924,900.

The officers and directors are: J. F. Conroy, Jr., president; E. H. Walker, vice-president and managing director; Samuel B. Darlich, secretary; A. W. Hodgetts, treasurer and assistant secretary; J. B. Streit, H. D. Rothwell, and W. M. Gordon, directors. The head office and mine office are at Timmins, and the Toronto office is at 19 Melinda Street,

In August, 1938, the company acquired the property of Empire Gold Mines, Limited, which adjoins the Gillies Lake–Porcupine mine on the north. The property now contains 760 acres and is situated in Tisdale township, Porcupine area, district of Cochrane.

Underground operations were resumed in April, 1938, and continued until October. During this time 913 feet of drifting and 205 feet of crosscutting were done on the 500-foot level. Diamond-drilling amounted to 6 holes, totalling 7,695 feet, drilled from surface, and 17 holes, totalling 4,590 feet, drilled from underground.

DEVELOPMENT WORK

	To December 31, 1937	1938	Total
	feet	feet	feet
Shaft-sinking	947	.....	947
Winzes, west	40	.....	40
Winzes, east	129	.....	129
Crosscutting	5,481	205	5,686
Drifting	4,413	913	5,326
Raising	1,235	.....	1,235
Diamond-drilling	7,666	12,285	19,951

At the end of October G. C. Chase succeeded C. T. Penney as manager. An average of 12 men was employed underground.

Gold Eagle Gold Mines, Limited

Gold Eagle Gold Mines, Limited, was incorporated in February, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value, 2,638,339 of which have been issued. The officers and directors are: Walter F. Stafford, president; Wm. S. Rogers, vice-president; Bruce P. Davis, secretary; Millard C. Dorntge, treasurer; Reginald Halladay and Wm. Kelly, directors. The head office is at 85 Richmond Street West, Toronto. The mine address is McKenzie Island.

The company holds 30 claims, about 1,005 acres, adjoining the property of McKenzie Red Lake Gold Mines on the south and west, on Mackenzie island in Red lake, Dome township, Patricia portion of Kenora district. The mine is reached by airplane from Winnipeg, Kenora, or Sioux Lookout.

Operations were continuous throughout 1938. The shaft was sunk a further 234 feet to a total depth of 759 feet, and two new levels were established, at 600 and 700 feet.

The following table shows the development work accomplished on the property to December 31, 1937, during 1938, and the total to the end of 1938:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
125-FOOT LEVEL:			
Drifts	681	.....	681
Crosscuts	135	.....	135
Raises	199	108	307
250-FOOT LEVEL:			
Drifts	848	.....	848
Crosscuts	145	.....	145
Raises	397	.....	397
375-FOOT LEVEL:			
Drifts	1,222	.....	1,222
Crosscuts	132	.....	132
Raises	386	14	400
500-FOOT LEVEL:			
Drifts	2,435	197	2,632
Crosscuts	1,861	.....	1,861
Raises	463	303	766
600-FOOT LEVEL:			
Drifts	.....	340	340
Crosscuts	.....	228	228
Raises	.....	184	184
700-FOOT LEVEL:			
Drifts	.....	557	557
Crosscuts	.....	19	19
Raises	.....	161	161

The following is an extract from the mine manager's report for the fiscal year ending April 30, 1939:—

SUMMARY OF WORK ACCOMPLISHED

	Fiscal year ending April 30, 1939	Total from start of operations
Drifts.....feet	1,303	6,539
Crosscuts.....feet	292	2,580
Raises.....feet	1,024	2,718
Shafts and winzes.....feet	31	759
Stations.....cu. yds.	10	1,287
Slashing.....cu. yds.	412	1,618
Diamond-drilling (surface).....feet	.....	4,936
Diamond-drilling (underground).....feet	11,259	19,328

MISCELLANEOUS OPERATING DATA[1]

	Fiscal year ending April 30, 1939	Total to date from Nov. 1, 1937
Tonnage milled and sorted	57,210	81,764
Tonnage discarded by sorting	13,192	17,163
Tonnage milled	44,018	64,601
Value per ton material discarded by sorting	$0.307	$0.331
Value per ton of ore milled	$7.557	$8.408
Tailing loss per ton milled	$0.277	$0.256
Net percentage recovery per ton of ore milled	96.4	97
Total net recovery of gold and silver	$320,472.28	$526,671.50

[1]All values are figured on gold at $35.00 per ounce.

ANALYSIS OF COSTS FOR FISCAL YEAR ENDING APRIL 30, 1939[1]

	Total	Cost per ton milled	Cost per ton milled and sorted
Development	$58,113.23	$1.322	$1.03
Mining	137,603.68	3.126	2.40
Ore sorting	5,079.58	.115	.09
Crushing and conveying	6,587.70	.150	.12
Milling	49,545.88	1.125	.87
General and administration	48,478.88	1.100	.85
Total mine cost	$305,408.95	$6.938	$5.36
Head office	15,833.58	.36	.27
Total operating expense before depreciation and pre-operating charges	$321,245.23	$7.298	$5.63

[1]Cochenour Willans tonnage and costs pertaining thereto are not included in above figures.

Underground Exploration

During the fiscal year, two new levels on the East mine or shearing were explored by drifting and diamond-drilling. On the 600-foot level, 228 feet of crosscutting and 340 feet of drifting was completed and the area thoroughly explored by diamond-drilling. This work failed to show a continuation downward of the values obtained in the ore section mined on the 500-foot level. All of the vein material on the 600-foot level was in granite. On the 700-foot level, 600 feet of drifting, mainly in sediments, failed to outline any continuous section of ore, although visible gold was frequently encountered.

In January, 1939, a geological examination of the property was made by Dr. W. F. James and Dr. O. L. Backman, consulting geologists. As a result of their examination, a programme of approximately 5,000 feet of diamond-drilling was recommended and accomplished.

General

In November, 1938, an agreement was reached with the Cochenour Willans Gold Mines, Limited, whereby the Gold Eagle Gold Mines, Limited, was to mill Cochenour ore during a short period each month. In the months of February, March, and April, a total of 4,729 tons of Cochenour ore were treated at the Gold Eagle mill. This tonnage and the costs pertaining to it are not included in the above Miscellaneous Operating Data or Analysis of Costs.

Of the Gold Eagle ore milled, 7 per cent. came from development, 43 per cent. from the East mine or shearing, 44 per cent. from the Gold Eagle stopes, and 6 per cent. from the surface dump.

An average of 87 men was employed during 1938, of whom 51 were underground and 11 in the mill. H. P. Dickey is manager.

Golden Gate Mining Company, Limited

The Golden Gate Mining Company, Limited, was incorporated in July, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: Dr. T. B. Armstrong, president; W. J. Lawson, vice-president; C. H. Kemp, secretary-treasurer; T. M. Mungovan and F. Rosar, directors. The head office is at 66 King Street West, Toronto. The mine office is at Swastika. The property consists of 6 claims, 185 acres, in Teck township, Kirkland Lake area, district of Timiskaming.

There are two shafts on the property. No. 1 is an inclined, 2-compartment shaft, with levels at 100, 200, and 300 feet. No. 2 shaft, which was sunk during 1937, is vertical and has 3 compartments. The upper levels are connected between the two shafts, and there are also levels from No. 2 shaft at 475 and 600 feet.

Underground operations continued throughout 1938. A total of 983 feet of drifting, 1,264 feet of crosscutting, 244 feet of raising, and 20 feet of boxhole-cutting was accomplished. Diamond-drilling consisted of 22 holes, totalling 3,569 feet, drilled from underground.

In the early part of the year a new building was erected to house a 100-ton amalgamation-cyanidation mill, which went into operation on May 21 and

continued for the rest of the year. Of 11,216 tons hoisted, the mill treated 11,090, an average of 49.29 tons per day.

In addition to the mill the following buildings were erected: assay office, refinery, lime-house, and pump-house.

S. A. Pain was manager, employing an average of 61 men.

Gorham Gold Mines, Limited

Gorham Gold Mines, Limited, was incorporated in May, 1938, to succeed the Gorham Gold Mining Syndicate, Limited. The authorized capitalization is 2,500,000 shares of $1 par value, of which 1,075,000 have been issued. The officers and directors are: J. D. Wright, president; J. E. Crawford, vice-president; A. Miner, secretary-treasurer; J. L. Gilbert and K. M. McVey, directors. The head office is at 330 Bay Street, Toronto. The mine address is 204 North Franklin Street, Fort William.

The property consists of 160 acres, 9 miles north of Port Arthur, in concession II, Gorham township. district of Thunder Bay.

A compressor-house, blacksmith shop, magazine, and combined office and bunk-house were built, and a small mining plant was installed.

About 4,000 feet of surface-trenching, 3 feet deep, was done, and 4,340 feet of diamond-drilling was accomplished. Encouraging results were obtained in the exploration work, and in September the driving of an adit, following the vein into the hillside, was begun. At the end of the year the adit was 86 feet long.

J. D. Wright was manager, employing an average of 8 men from May to the end of December.

Hallnor Mines, Limited

Hallnor Mines, Limited, was incorporated in April, 1936, with an authorized capitalization of 2,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: J. Y. Murdoch, president; J. R. Bradfield, secretary; R. G. Rudolf, treasurer; F. M. Connell, A. L. Ellsworth, Leo. H. Timmins, and J. E. Perrault, directors. The head office and mine office are at Pamour.

The property consists of 160 acres, in the north half of lot 7, concession V, Whitney township, Porcupine area, district of Cochrane, adjoining the west boundary of Pamour Porcupine Mines, Limited.

Underground operations continued throughout 1938. The 3-compartment shaft was sunk a further 214 feet to a total depth of 1,000 feet, and stations were cut at 760 and 960 feet. The following table shows the amount of development work up to the end of 1938:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
Shaft	786	214	1,000
Drifting	7,016	4,099	11,115
Crosscutting	3,953	1,109	5,062
Raising	276	2,393	2,669
Diamond-drilling:			
Surface	11,615	.....	11,615
Underground	8,889	[1]16,530	25,419

[1]73 holes.

Two raises for ventilation and auxiliary exit purposes were broken through to the surface, and concrete collars were put in. The rest of the raising was in ore sections and to provide an ore-pass from the second to the fifth levels. Stoping was done on the first, second, and third levels, both square-set and shrinkage methods being used. At the end of the year 42,020 tons of ore had been broken and 26,874 tons had been drawn off, leaving 15,130 tons broken in the stopes.

Ore reserves are estimated at 470,000 tons of an average grade of 0.56 ounces.

The construction of the 400-ton mill was completed and the mill operated from June 10 to the end of the year at an average daily rate of 297.4 tons. A total of 60,979 tons was treated, of which 23,232 tons came from the surface stock pile and 37,747 tons from stopes and development work. The total value of the bullion produced was $1,369,304.38, representing an average recovery of $22.45 per ton milled.

The mill equipment includes the following: a 500-ton steel ore bin; 30,000-gallon steel water-tank; two 5- by 8-foot Dominion Engineering ball mills; 8- by 20-foot Dorr classifier; 16- by 24-inch Denver jig; two 8-cell Denver flotation machines; 10- by 30-foot agitator, four 14- by 30-foot agitators, 30-foot triple-deck thickener, 22-foot triple-deck thickener, and two 24-foot solution tanks, 18 feet deep, all built by Toronto Iron Works, Limited; and a Canadian Ingersoll-Rand low-pressure air compressor. In the crusher-house the following equipment is installed: Canadian Allis-Chalmers electro-magnetic vibrating feeder, 16 by 36 inches; Canadian Allis-Chalmers jaw crusher, 24 by 36 inches; 4-foot Symons cone crusher; 4- by 10-foot double-deck vibrating screen; and the necessary conveying apparatus. An assay office was also built and equipped.

In addition to the buildings already mentioned there were constructed a 30-foot addition to the headframe, machine-shop, dry-house, addition to the power-house, outdoor substation, dry-house to accommodate 200 men, boiler-house, 3 duplex houses, and 2 sleeping-camps. A waterworks system for domestic use was installed.

Other new plant equipment includes three 26,400-volt, 750 k.v.a. Bepco transformers; 20 h.p., 550-volt General Electric motor generator set; the necessary switching apparatus; Leonard steel heating boiler; and two No. 4 Iron Firemen.

An average of 201 men was employed, of whom 92 were underground, 10 in the mill, 43 on general surface work, and 45 on construction work done by the company. A. L. Sharp is manager.

Hard Rock Gold Mines, Limited

Hard Rock Gold Mines, Limited, which was incorporated in January, 1934, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,990,074 have been issued. The officers and directors are: T. H. Rea, president; W. S. Walton, secretary-treasurer; A. B. Gordon, H. R. Aird, and G. W. Rayner, directors. The head office and mine office are at Geraldton. The secretary's office is at 603 Royal Bank Building, Toronto.

The property consists of 17 claims, 854 acres, in Ashmore township, Little Long Lac area, district of Thunder Bay. It is accessible by automobile road from Geraldton, 4½ miles north of the property on the Longlac–Port Arthur branch of the Canadian National Railways.

Development work in 1938 was concentrated on the workings from No. 2 shaft. Most of the ore for the mill was taken from stopes on Nos. 1 and 2 veins in the No. 2 shaft area, but in December this work was temporarily suspended,

and two back stopes on the 450-foot level at the No. 1 shaft were mined. The following table shows the development work at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
No. 1 Shaft	475	.....	475
200-foot level:			
Drifts	1,108	.....	1,108
Crosscuts	511	.....	511
325-foot level:			
Drifts	949	.....	949
Crosscuts	442	.....	442
Raises	55	.....	55
450-foot level:			
Drifts	2,043	.....	2,043
Crosscuts	598	.....	598
Raises	65	.....	65
Winze	141	.....	141
575-foot level:			
Drifts	636	.....	636
Crosscuts	102	.....	102
No. 2 Shaft	506	.....	506
150-foot level:			
Drifts	3,926	58	4,484
Crosscuts	1,911	.....	1,911
Raises	688	341	1,029
250-foot level:			
Drifts	2,381	1,077	3,458
Crosscuts	1,011	934	1,945
Raises	595	58	653
360-foot level:			
Drifts	817	777	1,594
Crosscuts	305	76	381
Raises	155	251	406
475-foot level:			
Drifts	1,757	1,207	2,964
Crosscuts	654	1,116	1,770
Raises	.....	477	477
Sublevel drifting	.....	115	115
Diamond-drilling:			
Surface	.....	4,404	4,404
Underground	14,159	6,689	20,848

During the year 88,286 tons of ore were hoisted, and 76,074 tons were milled, the mill operating at an average rate of 208.4 tons per day.

The following equipment was added for the purpose of converting the mill to the flotation-cyanidation process: 300-ton Denver flotation unit, two Oliver filters, two Dorr thickeners and pumps; Canadian Allis-Chalmers ball mill; and the necessary motors, manufactured by the English Electric Company.

An addition to the mill, a mill warehouse, and a cottage, all of frame construction, were built.

The following is taken from the president's report to the shareholders for the year ending December 31, 1938:—

Mine

The major development during the year was the discovery of the No. 30 vein system, known as the north ore body. This was found in exploratory diamond-drilling from the 250-foot level on indications by dip-needle survey of the big iron formation band north of the No. 2 shaft workings.

The first drill results indicated the probability that a large ore body existed. Accordingly, development work was curtailed in the rest of the mine and concentrated on this area. The work was pushed with all possible speed from the 250- and 475-foot levels, and, as a result, a large

ore body has been proven to exist. Expenditure in this connection, which amounted to $105,000, has been fully justified.

The north zone is by no means fully developed. We have concentrated on one vein system, although we know of parallel occurrences which are important. The ore, as opened up, has an approximate length of 600 feet, and the widths vary from 20 to 130 feet. This ore is a heavy sulphide replacement in and around a folding in the iron formation. The character of the deposit is such that an accurate estimate of tonnage and grade is not possible at present, but on the 250-foot level, while silling out of a section of the vein, car sampling of all material taken out averaged $9.16 per ton over a width of 30 feet and a length of 350 feet, and a section of it on the 475-foot level gave results of $20.87 per ton over a width of 18 feet for a length of 140 feet. These results are given as examples and are not to be taken as the average for the body. They represent a part only of the known ore lengths in each case.

One diamond-drill hole has been drilled below the 475-foot horizon in the north zone and returned results which compare favourably with conditions above the level.

In other parts of the mine, only minor development work was done. It was felt that the size and grade of the new No. 30 system justified concentration of effort there, as in bodies of this size costs can be substantially reduced and profits increased accordingly.

A long drive connected No. 1 shaft and No. 2 shaft on the 475-foot horizon giving a total length of 4,000 feet opened up along the strike of Nos. 1 and 2 vein systems. All this length is very favourable prospecting ground and will be explored as time goes on, after the picture in the north system is more complete.

During the year, ore was milled from the various parts of the mine as follows:—

	Per cent.
No. 1 shaft area	3.3
No. 2 shaft area:	
No. 1 vein	44
No. 2 vein	37.5
No. 30 vein	15.2

Mill

During the first three months of the year, the mill feed was from the No. 2 shaft area, No. 1 vein and No. 2 vein; 13,776 tons of ore were milled, yielding an average recovery of $11.10 per ton with a tailing loss of 37 cents per ton, which was considered quite satisfactory.

However, in the succeeding months varying amounts of ore from No. 30 vein were treated and it was found that the process, as originally planned, did not give satisfactory results on this type of ore.

From the time that this ore was found to be refractory, extensive research work and testing have been carried on, both at the mine and elsewhere, to determine the most economical method of treatment. These tests demonstrated that the refractory mineral is arsenopyrite, which contains approximately 30 per cent. of the values in the ore, in which the gold occurs in submicroscopic form and that it could be separated from the remainder of the ore by selective flotation treatment, if deemed advisable.

In order to treat this ore our mill has been converted to the flotation-cyanidation process with a capacity of 300 tons. In November, the new process went into operation. While adding the necessary equipment for this process, foundations were poured and other provisions were made, which will enable us to raise the capacity of the plant to 600 tons by installing further equipment. At the present time, an experimental roaster unit is under construction for the treatment of the flotation concentrate, either arsenical or bulk. This unit, costing approximately $25,000, will, it is estimated, have a capacity of 10 tons of concentrate per day.

Estimated Statement

	Production	Operating cost[1]	Tons milled	Production per ton	Cost per ton milled[2]	Heads
First quarter	$152,873.35	$101,126.91	13,776	$11.10	$7.34	$11.47
Second quarter	154,864.16	127,352.88	17,768	8.72	7.17	9.38
Third quarter	162,856.50	135,601.72	21,492	7.58	6.31	8.50
Fourth quarter, estimated	[3]177,544.41	132,208.96	23,038	7.71	5.74	10.09
Total	$648,138.42	$496,290.47	76,074	$8.52	$6.52	$9.73

[1]Before taxes, depreciation and write-offs of preliminary development, and including development costs of $155,852.

[2]Before taxes, depreciation and write-offs of preliminary development, and including development costs of $2.05 per ton milled.

[3]Some 397 tons of arsenical concentrate were stored for further treatment with an estimated recoverable value of $12,500.

During 1938 there was an average of 165 men employed, of whom 103 were underground and 13 in the mill. J. C. Dumbrille is manager, R. G. McKelvey is mine superintendent, and F. Horton is mill superintendent.

Hasaga Gold Mines, Limited

Hasaga Gold Mines, Limited, was incorporated on October 18, 1938, with an authorized capitalization of 5,000,000 shares of $1 par value; 2,500,000 shares have been issued, all of which are pooled. The company was formed to take over the J. E. Hammell property, formerly known as the McIntyre Red Lake, and the Red Lake Gold Shore mine. The shareholders of Red Lake Gold Shore Mines, Limited, received 1 share of Hasaga stock, subject to pool, for 18 of Red Lake Gold Shore. The officers and directors are: J. E. Hammell, president; Robert Fennell, vice-president and secretary-treasurer; John Bland, assistant secretary-treasurer; B. H. Budgeon, A. G. Hattie, and Eola Hammell, directors. The head office is at 25 King Street West, Toronto. The mine address is Box 320, Red Lake.

Early in February, 1938, the sinking of a vertical, 3-compartment shaft, known as No. 1, was begun on the Hammell property, near the west boundary of the Howey mine. On March 1, following the collaring of No. 1 shaft, the sinking plant was moved some 2,500 feet to the west, and work on a second 3-compartment, vertical shaft, known as No. 2, was begun. In June, when the shaft was 230 feet deep, operations were suspended pending the installation of an electrically driven plant. An electric plant was installed at No. 1 shaft and sinking operations were resumed. At the end of the year the shaft was 535 feet deep, with levels at 125, 250, 375, and 500 feet. Sinking at No. 2 shaft was resumed on August 6 and continued to a depth of 235 feet. A level was established at 200 feet. The following table shows the total amount of development work done:—

	Drifts	Crosscuts	Raises	Box-holes
	feet	feet	feet	feet
No. 1 SHAFT:				
125-foot level	385	173	.....	.....
250-foot level	430	158	29	.....
375-foot level	356	158	130	80
500-foot level	443	207	.....	.....
No. 2 SHAFT:				
200-foot level	376	785	.....	.....
Total	1,990	1,481	159	80

The following diamond-drilling was done from underground:—

	Feet
No. 1 shaft	876
No. 2 shaft	2,479
Total	3,355

The mill on the Red Lake Gold Shore property was operated from December 2 to December 31 and treated 3,206 tons of ore, an average of 110 tons per day. The mill is about a mile from the No. 1 shaft, and the ore is transported in trucks.

Buildings erected at No. 1 shaft include a headframe, hoist-house, assay office, boiler-house, machine shop, office and warehouse, dry-house, powder magazine, fuse-house, thaw-house, carbide-house, conveyer building, and electrical shop.

The mining plant consists of an Alley and MacLellan 750-cubic-foot compressor, driven by a 150 h.p. English Electric motor; a Canadian Ingersoll-Rand,

42- by 30-inch, double-drum hoist, driven by a 100 h.p. English Electric motor; and a 40 h.p. locomotive-type boiler for heating.

At No. 2 shaft the following buildings were erected: headframe, hoist-house, boiler-house, dry-house, fuse- and cap-house, magazine, and carbide-house.

The mining plant includes a 360-cubic-foot Ingersoll-Rand compressor, driven by a 75 h.p. Ingersoll-Rand Diesel engine, and a 25 h.p. vertical-type boiler for heating. The single-drum Ingersoll-Rand hoist, which was moved from No. 1 shaft, was converted to electricity and is driven by a 60 h.p. English Electric motor.

Operations on the Red Lake Gold Shore property were carried on by the Red Lake Gold Shore Mines, Limited, until the end of August, 1938. An account of the work done appears on page 189 of this report. All underground work had ceased and the workings had been allowed to flood when Hasaga Gold Mines, Limited, acquired the property. The new company has not done any underground work on this part of its holdings.

An average of 50 men was employed at Nos. 1 and 2 shafts, 25 of whom were on surface work and 25 underground. Eight men were employed in the mill during December. H. L. Edwards is manager.

Hiawatha Gold Mines, Limited

Hiawatha Gold Mines, Limited, was incorporated in September, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,021,671 have been issued. The officers and directors are: F. A. Enders, president; Hans F. Wreidt, vice-president; H. J. Evans, secretary-treasurer; R. I. Ferguson, J. M. Charpentier, and J. Lanning, directors. The head office and mine office are at Oba. A business office is maintained at 404 McKinnon Building, Toronto.

The property consists of 34 claims, 1,142 acres, in Lizar township, Oba area, district of Algoma, about 30 miles southwest of Oba by river and lake.

At the end of 1937 the vertical, 3-compartment shaft had reached a depth of 260 feet and a station had been cut at 150 feet. In 1938 the shaft was continued to 299 feet and a second level was established at 275 feet. The following table shows the lateral work done to the end of 1938:—

Level	Drifts	Crosscuts
	feet	feet
150-foot	603	796
275-foot	1,532	801
Total	2,135	1,597

Diamond-drilling consisted of 12 holes, having a total length of 2,940 feet, drilled from underground. About 275 feet of surface-trenching of an average depth of 2½ feet was done.

P. W. Meahan was manager, employing an average of 32 men, 15 of whom were underground.

Hollinger Consolidated Gold Mines, Limited

Hollinger Consolidated Gold Mines, Limited, has an authorized capitalization of 5,000,000 shares of $5 par value. At December 31, 1938, outstanding shares numbered 4,920,000. The officers of the company are: Jules R. Timmins,

president; John B. Holden, vice-president and treasurer; P. C. Finlay, secretary. The directors are: W. L. McDougald, Leo. H. Timmins, Wilson Bell, James Y. Murdoch, Allen A. McMartin, John I. Rankin, N. A. Timmins, and John B. McMartin. John Knox is general manager, and A. H. Wohlrab is assistant manager. The mine office and head office are at Timmins. The general office is at 602 Royal Bank Building, Toronto.

The main property operated by the company is located in Tisdale township, Porcupine area, district of Cochrane, and includes part of the ground underlying the town of Timmins. The company has numerous other holdings and interests. It owns and operates the Ross mine in Hislop township, district of Cochrane, and controls and operates Young-Davidson Mines, Limited, in Powell township, Matachewan area, district of Timiskaming.

During 1938 the new No. 26 shaft at the Hollinger mine was sunk an additional 1,263 feet, to a depth of 2,450 feet, and a level was established at 2,000 feet. No. 21 internal shaft, which is collared at the 1,500-foot level, was sunk a further 266 feet to 4,265 feet, with levels at 4,100 and 4,250 feet. A total of 54,230 feet of drifting, 17,350 feet of crosscutting, and 299 feet of raising was added to the development work. Diamond-drilling amounted to 1,450 feet from surface and 238,933 feet from underground. Two axial flow fans, 70,000 c.f.m. and 250,000 c.f.m., were added to the underground ventilation system.

The following is taken from the report of the general manager for the year ending December 31, 1938:—

PROFIT AND LOSS STATEMENT
for the year ending December 31, 1938

SOURCES OF 1938 INCOME:		
Gold and silver produced	$15,496,803.65	
Interest on investments and other income	213,348.46	
		$15,710,152.11
DISPOSAL OF 1938 INCOME:		
Milling charges	$1,106,012.33	
Mining charges	6,274,088.87	
Marketing bullion	170,181.55	
Workmen's compensation	50,762.88	
Silicosis assessment	63,725.80	
General charges	769,869.30	
		8,434,640.73
		$7,275,511.38
DEDUCT:		
Taxes—		
Dominion of Canada income tax	$638,299.07	
Province of Ontario:		
Corporation tax	45,342.74	
Mining profits tax	163,442.73	
Royalties:		
Town of Timmins	52,129.11	
Township of Tisdale	14,254.11	
Municipal:		
Town of Timmins	79,059.04	
Township of Tisdale	3,536.84	
Miscellaneous	79.48	
Dominion, provincial, and municipal, reserved for	72,813.96	
		1,068,957.08
Net profit from operations before depreciation		$6,206,554.30
Depreciation:		
Plant	$230,938.08	
Interest in other companies and properties written down	190,297.57	
Expenditures on properties abandoned	149,407.26	
		570,642.91
NET PROFIT FROM OPERATIONS CARRIED TO SURPLUS ACCOUNT		$5,635,911.39

SURPLUS ACCOUNT

Balance brought forward, January 1, 1938	$6,182,568.88
Net profits from operations	5,635,911.39
Net profits from the sale of securities and other assets	17,020.76
	$11,835,501.03
Paid out in dividends	5,412,000.00
Balance carried forward, December 31, 1938	$6,423,501.03

BULLION STATEMENT

Inventory, Janauary 1, 1938:		
Gold in process ($20.67)	$216,120.60	
Premium on gold in process	145,245.88	
Silver bullion on hand	452.98	
		$361,819.46
Gross values produced in 1938:		
Ore milled	$16,071,709.73	
Tailings loss	574,906.08	
		15,496,803.65
		$15,858,623.11
Inventory, December 31, 1938:		
Gold in process ($20.67)	$211,620.29	
Premium on gold in process	144,122.82	
Silver bullion on hand	3,195.90	
		$358,939.01
Bullion shipped during 1938		15,499,684.10
		$15,858,623.11

Yearly Average Costs

Account	Sundries	Labour	Stores	Total	Per ton ore milled
General miscellaneous charges and administration	.....	$285,157.76	$131,779.67	$416,937.43	$0.2404
Surface services	.....	71,797.06	60,847.53	132,644.59	.0765
Insurance, fire	$43,484.30	.....	.....	43,484.30	.0251
Insurance—group, sickness and accident, and medical	.....	176,802.98	.....	176,802.98	.1019
Marketing bullion	170,181.55	.....	.....	170,181.55	.0981
Workmen's compensation	.....	50,762.88	.....	50,762.88	.0293
Silicosis assessment	.....	63,725.80	.....	63,725.80	.0367
Milling charges	.....	483,999.71	622,012.62	1,106,012.33	.6376
Mining charges	.....	4,489,831.96	1,784,256.91	6,274,088.87	3.6169
Total charges	$213,665.85	$5,622,078.15	$2,598,896.73	$8,434,640.73	$4.8625

Employees

The average number of men employed during the year has been 2,937, distributed as follows:—

Miners:		Mechanics:		General:	
Exploration	37	Operation	132	Mill and refinery	204
Development	412	Maintenance	229	Technical	98
Production	1,528			Clerical	41
				Miscellaneous	174
				Outside properties	82
Total	1,977	Total	361	Total	599

In addition, there were 90 men employed at the Ross mine and 7 at the Burton operation

The Mill

The milling results were as follows:—

Ore milled	tons	1,734,647
Average value per ton		$9.27
Gross value	$16,071,709.73	
Deduct loss in tailings	574,906.08	
Net value recovered		$15,496,803.65

Average tons per day		4,792
Per cent. of possible time run		92
Tons per 100 per cent. running time		5,209
Solution precipitated per ton ore	tons	1.04
Value per ton tailings		$0.33
Cyanide consumed per ton of ore	lbs.	0.502
Zinc consumed per ton of ore	lbs.	0.044
Zinc consumed per ton of solution	lbs.	0.042
Lime consumed per ton of ore	lbs.	2.159
Lead acetate per ton of ore	lbs.	0.010
Average value of pregnant solution		$8.57
Average value received per ounce of gold sold		$35.19

Ore Reserves

Our ore reserves on December 31, 1938, consisted of 7,506,750 tons, of a total value of $51,361,872.00, having an average value of 0.3309 ounces, or $6.84 per ton. These figures compare with 7,260,091 tons of a total value of $49,779,926.00, having an average value of 0.3319 ounces, or $6.86 per ton at the end of 1937. In the calculations dealing with ore reserves, the price of gold at $20.67 per ounce has been taken as the basis of value, and the same minimum ore grade, namely $4.00, as used in former years continued.

Hollinger Mill

The new primary grinding plant has been in operation during the year and is exceeding the estimates on efficiency and reduction in costs. The question of transferring the concentrate grinding to the new plant is under consideration as a proportional increase in economy is indicated.

Hollinger Mine

During the year 38.8 per cent. of the ore milled came from above the 800-foot level. The crosscuts below the 3,950-foot mentioned in the last report have reached the ore zones. Development on the 4,100-foot level indicates that over the area explored to date the tonnage and grade equal that in the corresponding area on the level above. Below the 4,100-foot level the drives have been extended east and west and crosscuts driven to the main ore zone. The developments indicate a continuation of similar conditions. There is an increase in ore reserves of 240,000 tons, having a value of approximately $2,689,000.

The grade of ore milled was $9.27 per ton, as compared with $8.99 for the previous year. This increase in grade is attributable in part to the cleaning up of the grinding units in the old mill, which were replaced by the units in the new plant. The new shaft, which will be referred to as No. 26, has been completed to the 2,450-foot level.

Exploration

The policy of looking for other mines has been continued as formerly. Some of the options in the Opeepeesway area would seem to have considerable merit, but developments have not proceeded far enough to make any definite statement.

General

The Hollinger Employees Medical Services Association and the Hollinger non-occupational sickness and accident insurance plans have operated in a satisfactory manner throughout the year, contributing greatly to the welfare of the employees and their families.

Young-Davidson Mine

Some 359,266 tons were milled, being an average of 992 tons per day, with a recovery of $3.48 per ton. There are 122,753 tons of broken ore in the stopes, and the mine has been prepared to maintain the daily production at the current rate. As the result of operations the money advanced by your company has been repaid and there is now a small credit balance. During the year 252,703 tons came from pit operations and 106,563 tons from underground.

Ross Mine

There have been no important ore discoveries during the year. A diamond-drill campaign was conducted on adjoining properties during the summer, but nothing of commercial importance was indicated.

As mentioned in the last report additional tonnage has been milled from the west ore body and it is now proposed to raise the daily tonnage from 135 tons to 225 tons. Some 44,399 tons of ore were milled, yielding $10.53 per ton. The total profit for the year was $143,832.43. The ore reserves as of December 31 were 590,485 tons of a grade of 0.227 ounces, or $7.95 per ton.

The following development work was accomplished during the year: drifting, 301 feet; crosscutting, 674 feet; raising, 483 feet. The No. 2 winze was raised from the 450-foot level to the 300-foot.

Two new duplex houses for employees were erected, and a 25- by 36-foot addition to the mill was built to accommodate a new agitator. New mill equipment included a 13,000-cubic-foot Dorr agitator, a 150-ton Gates ball mill, three 45-ton Fagergreen flotation cells, a Denver conditioner, and a 670 c.f.m. Goldie and McCulloch vacuum pump.

J. J. Caty is mine superintendent.

Howey Gold Mines, Limited

Howey Gold Mines, Limited, was incorporated in March, 1926, with an authorized capitalization of 5,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: R. T. Birks, president; W. S. Cherry, vice-president; H. C. McCloskey, secretary-treasurer; B. E. Martin, assistant secretary-treasurer; G. A. La Bine and John A. Northway, directors. F. D. Reid and E. Futterer are general managers. The executive office is at 833 Federal Building, Toronto, and the head office and mine office are at Red Lake.

The company's holdings, consisting of 41 claims, lie along both sides of the boundary between Dome and Heyson townships, at the southeast corner of Red lake, in the Patricia portion of Kenora district. The greater part of the town of Red Lake is built on Howey property. Red Lake is reached by airplane daily from Hudson, Kenora, or Winnipeg. Freight is transported from Hudson, via the Lac Seul water route.

The following table shows the amount of development work to the end of 1937 and during 1938, by levels:—

Level	Drifts		Crosscuts		Raises	
	To Dec. 31, 1937	1938	To Dec. 31, 1937	1938	To Dec. 31, 1937	1938
	feet	feet	feet	feet	feet	feet
125-foot	1,889	.....	996	18	934	90
250-foot	1,918	.....	987	11	815	.....
375-foot	3,225	.....	1,091	.....	881	158
500-foot	2,514	.....	2,709	.....	694	.....
625-foot	810	.....	478	.....	432	.....
750-foot	1,897	354	972	66	1,093	.....
875-foot	1,927	96	687	27	1,388	.....
1,000-foot	2,940	56	800	133	2,279	34
1,050-foot	.....	.....	.....	.....	62	.....
1,175-foot	1,740	.....	312	.....	1,429	.....
1,265-foot	1,659	.....	694	14	417	.....
1,315-foot	1,215	118	177	14	1,379	65
1,500-foot	818	.....	138	.....	.....	.....
1,700-foot	459	.....	68	.....	.....	.....
1,850-foot	.....	.....	14	.....	.....	.....
2,000-foot	1,391	38	88	.....	.....	.....

The diamond-drilling done during 1938 was as follows:—

	Holes	Feet
Surface	3	697
Underground	8	921

The following is taken from the report of the general managers for the year ending December 31, 1938:—

As a result of our "group" arrangement we have been able to keep in close touch with mining developments in the provinces of Ontario and Quebec at a comparatively low cost. We have in

all (including "group" activities) examined 249 properties and considered an additional 81 reports on other properties. Of the properties examined, seven were optioned and explored by diamond-drilling and otherwise. Nothing of a promising nature has been developed during the year.

SUMMARY OF WORK ACCOMPLISHED

	1938	1937	1936
Drifts, crosscuts, raises, etc.....feet	4,033.1	3,446.4	2,731
Shafts and winzes.....feet	.....	.....	423.5
Shaft-stations, slashing, etc.....cu. yds.	.....	.....	170.6
Diamond-drilling (underground).....feet	921.2	6,257	5,255
Diamond-drilling (outside exploration).....feet	697.2	1,600	2,341
Box-holes.....feet	.....	212.5	410.5
Ore broken.....tons	199,065	414,834	648,812
Low-grade material discarded by sorting.....tons	90,329	88,605	89,884
Milled after sorting.....tons	448,115	447,344	438,644
Broken reserves in stopes (January 1, 1939)....tons	182,355	446,628	568,742

EARNINGS STATEMENT

	1938	1937	1936
Total receipts from sale of gold and silver.....	$1,198,046.57	$1,084,590.64	$1,239,134.33
Total operating cost, including Toronto office expense.....	732,937.46	740,027.95	779,872.11
Operating profit.....	$465,109.11	$344,562.69	$459,262.22

ANALYSIS OF COSTS

	1938 (538,444 tons)		1937 (535,949 tons)		1936 (528,528 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.. ...	$353,635.41	$0.657	$384,364.34	$0.717	$426,564.87	$0.807
Outside exploration..	.....	.....	3,487.15	.007	6,824.72	.013
Crushing and conveying.....	42,914.01	.080	38,472.19	.072	38,141.88	.072
Ore sorting.....	13,357.37	.025	17,147.41	.032	14,922.50	.028
Milling.....	221 661.30	.410	203,576.49	.380	207,781.84	.393
General expense.....	73,508.16	.137	62,356.02	.116	56,741.30	.108
Total plant cost.	$705,076.25	$1.309	$709,403.60	$1.324	$750,977.11	$1.421
Toronto office salaries and general expense	27,861.21	.052	30,624.35	.057	28,895.00	.055
Total operating expense before depreciation, Dominion and provincial taxes, and pre-operating charges..	$732,937.46	$1.361	$740,027.95	$1.381	$779,872.11	$1.476
Dominion and provincial taxes.....	31,533.63	.059	13,559.76	.025	29,273.69	.056
Depreciation.....	188,561.72	.350	137,118.96	.256	136,751.88	.258
Pre-operating charges	58,766.34	.109	107,189.80	.200	105,705.60	.200
Outside exploration..	11,053.99	.021	9,187.00	.017	.....	.....
Total cost.....	$1,022,853.14	$1.900	$1,007,083.47	$1.879	$1,051,603.28	$1.990

MISCELLANEOUS OPERATING DATA[1]

	1938	1937	1936	Total from start of operations
Tonnage milled and sorted	538,444	535,949	528,528	3,581,134
Tonnage discarded by sorting	90,329	88,605	89,884	551,083
Tonnage milled	448,115	447,344	438,644	3,030,051
Value per ton hoisted	$1.40	$1.30	$1.52	$2.18
Value per ton material discarded by sorting	$0.21	$0.21	$0.21	$0.272
Value per ton ore milled	$1.64	$1.51	$1.79	$2.51
Tailing loss per ton milled	$0.055	$0.065	$0.101	$0.159
Loss per ton of ore hoisted (in milling and sorting)	$0.081	$0.089	$0.119	$0.176
Net percentage recovery per ton ton of ore hoisted	94.3	93.3	92.4	91.9
Total net recovery of gold and silver[2]	$1,198,046.57	$1,084,590.64	$1,239,134.33	$10,237,727.35

[1]All values are figured on gold at $20.67 per ounce.
[2]Includes premium paid by the Government.

Exploration

The west surface pillar has been channel-sampled at 10-foot intervals along 300 feet of its length. Results to date are up to expectations. Thirty thousand tons of ore have been proven, averaging $6.18 per ton with gold at $35.00 an ounce. The main haulage on the 1,315-foot level was driven 169 feet farther west, and 4 diamond-drill holes (245.4 feet) put in across the strike of the dike. No ore of importance was found.

Three diamond-drill holes drilled from the east end of the 2,000-foot level completed the exploratory programme on this level. No ore was found.

Additional diamond-drilling was done from the surface to test a favourable area. Results were negative. We now feel that all reasonable chances of finding additional ore have been eliminated.

Ore Reserves

The broken ore reserve in the mine as of December 31, 1938, amounted to 182,355 tons, compared to 446,628 tons the previous year. The unbroken reserve is 581,145 tons, making a total reserve of 763,500 tons. In addition to this, another 100,000 tons of ore will probably be recovered from the south wall of the 1,000-foot west stope, in that portion over the 1,315-foot centre stope, and from pillars.

General

The value of the ore hoisted for the year 1938 was $2.37 (gold at $35.00), as compared to $2.20 per ton the previous year. The average operating cost for the year 1938 was $1.361 per ton, compared to $1.381 per ton for 1937, a reduction of 2 cents per ton hoisted.

An average of 185 men was employed, of whom 11 were underground and 44 in the mill. R. E. Sullivan is mine superintendent.

Hoyle Gold Mines, Limited

Hoyle Gold Mines, Limited, was incorporated in February, 1938, with an authorized capitalization of 4,000,000 shares of no par value, 2,940,005 of which have been issued. The company is controlled by Ventures, Limited, and Sudbury Basin Mines, Limited. The officers and directors are: B. W. Lang, president; A. R. Caldwell, vice-president and treasurer; D. R. Michener, secretary; O. H. Barrett, assistant secretary-treasurer; R. W. Pingle, director. The head office is at 372 Bay Street, Toronto. The mine address is Pamour.

The company holds 32 claims, 1,280 acres, in Whitney, Cody, and Matheson townships, Porcupine area, district of Cochrane. These were acquired from Hoyle Mines, Limited, Wineva Gold Mines, Limited, and the Mespi Syndicate.

The property acquired from Hoyle Mines, Limited, includes that formerly known as the Lang mine, which adjoins the Pamour Porcupine property on the east. Hollinger Consolidated Gold Mines, Limited, had an option on the property in 1935, 1936, and 1937. During that time an extensive diamond-drilling campaign was carried on and a 2-compartment shaft was sunk to a depth of 259 feet, with a level at 220 feet, on which about 1,028 feet of crosscutting and

1,240 feet of drifting were done. The option was terminated in May, 1937, and the mining plant was removed.

In February, 1938, the present company commenced operations. The shaft was enlarged to 3 compartments and sunk to a depth of 1,400 feet, with levels at 375, 575, 775, 955, 1,155, and 1,355 feet. At the end of the year sinking was being continued to an objective depth of 1,850 feet.

The following table shows the diamond-drilling done prior to 1938, during 1938, and the total:—

	Prior to 1938		1938	
	Holes	Feet	Holes	Feet
Surface	43	39,300	.....	.....
Underground	11	2,500	15	3,500
Total	54	41,800	15	3,500

The following buildings were erected: 56-foot steel headframe, power-house, office, magazine, fuse-house, machine shop, blacksmith shop, carpenter shop, oil-house, core-house, bunk-house, dry-house, cookery, and ice-house.

The mining plant includes a 1,030-cubic-foot Babcock-Wilcox and Goldie-McCulloch compressor, 1,580-cubic-foot Ingersoll-Rand compressor, and a 48-by 36-inch double-drum Ingersoll-Rand hoist.

An average of 44 men was employed, 17 of whom were underground. J. M. C. Dunlop is manager.

Jellicoe Consolidated Gold Mines, Limited

Jellicoe Consolidated Gold Mines, Limited, was incorporated on January 15, 1936, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 3,725,005 have been issued. The officers and directors are: Hon. W. A. Gordon, president; S. G. Tobin, vice-president; G. G. Blackstock, secretary-treasurer; W. T. McEachern and S. J. Kidder, directors. The head office is at 25 King Street West, Toronto. The mine address is Geraldton.

The property consists of 54 patented claims, adjoining the Bankfield and Tombill properties on the west, in Lindsley and Errington townships, Little Long Lac area, district of Thunder Bay. It is reached by a 7-mile automobile road from Geraldton on the Longlac–Port Arthur branch of the Canadian National Railways.

Underground development work and diamond-drilling were continued in 1938, until November 18. The following table shows the development work accomplished prior to 1938, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT (3-compartment, vertical)	536	.....	536
225-FOOT LEVEL:			
Drifting	269	2,136	2,405
Crosscutting	157	73	230
Raising	.....	331	331
350-FOOT LEVEL:			
Drifting	274	1,309	1,583
Crosscutting	182	110	292
Raising	.....	435	435
500-FOOT LEVEL:			
Drifting	205	909	1,114
Crosscutting	175	216	391
Raising	.....	48	48

Some 19,976 tons of ore and waste were hoisted. Diamond-drilling amounted to 120 holes, having a total length of 15,757 feet, drilled from underground.

A Babcock-Wilcox and Goldie-McCulloch centrifugal pump, having a capacity of 150 gallons per minute, driven by an English Electric motor, was installed.

Following the cessation of underground operations 7 men were employed in keeping the mine pumped out and maintaining the equipment. At the end of the year an attempt was being made to reach an agreement with some of the other companies operating in the area whereby the ore from this mine could be treated in a neighbouring mill to supply funds to carry on further operations.

M. A. Twidale is manager. An average of 42 men was employed during the period of operation.

J-M Consolidated Gold Mines, Limited

J-M Consolidated Gold Mines, Limited, was incorporated in February, 1932, with a capitalization of 3,500,000 shares of $1 par value. In April, 1938, the capitalization was decreased to 2,000,000 shares and again increased to 3,000,000 shares of $1 par value. At December 31, 1938, the number of shares issued was 2,750,000. The officers and directors are: J. E. Day, president; Charles Taylor, vice-president; T. J. Day, secretary-treasurer; F. L. Hutchinson, W. A. Taylor, J. McFetrick, and D. M. Thomson, directors. The head office is at 85 Richmond Street West, Toronto. The mine address is Jackson Manion.

The property, located in Dent, Mitchell, Corless, and Knott townships, Woman Lake area, Patricia portion of Kenora district, may be reached by water from Hudson, through Lac Seul, Pakwash lake, Trout Lake river, and Woman river, to Woman lake, or by airplane from Hudson or Sioux Lookout, on the main western line of the Canadian National Railways.

The property continued to operate during 1938. Operations at the No. 1 shaft were carried on from January 1 to the first week in March, during which time 2,439 tons of ore were hoisted from stopes. No development work was done from this shaft. No. 2 shaft was sunk a further 9 feet to complete the sump, bringing the total depth to 391 feet, and a new level was established at 375 feet. Stoping operations in the No. 2 shaft area were begun on the 250-foot level. Ore and waste hoisted amounted to 16,271 tons, of which 14,726 tons were milled.

The following is an extract from the report of John W. Shaw, the consulting engineer, for the fiscal year ending March 31, 1939:—

Work was started in the spring of 1938 on what is known as the Rowe vein, which lies some 2,000 feet north of the No. 1 shaft. The No. 2 shaft has been sunk to a depth of 375 feet, with levels established at 125, 250, and 375 feet. In March of 1938 milling was suspended to allow time to develop the ore indicated by exploration work in the No. 2 shaft workings. This work has been carried on continuously and on the 15th of August, 1938, stoping operations had reached the stage where we were justified in resuming milling operations. The mill has been running since that date.

The following is a summary of underground operations:—

	125-foot level	250-foot level	375-foot level
	feet	feet	feet
Drifting on main shear north	76	251	.....
Drifting on main shear south	338	.....	.....
Drifting on east shear south	118	354	436
Crosscutting	17	.....	101
Raising	.....	.....	144
Diamond-drilling	.....	.....	1,743
			tons
Tonnage broken in stopes	.....	.....	24,453
Tonnage treated	.....	.....	22,018

Production from August 15, 1938, to March 31, 1939, amounted to $178,139.63, while total costs for the year amounted to $219,227.92. This shows a net loss for the year of $41,188.29. It should be borne in mind, however, that during the year the mill was not in operation for a period of five and a half months.

Power at the company's plant is generated by Diesel electric motors, which adds considerably to costs and restricts to a very great extent the amount of development work that the company can carry on. It is hoped that in the early future the company can make arrangements with the Hydro-Electric Power Commission of Ontario whereby the company will be supplied with hydro-electric power, which will reduce costs and give additional power to carry on an extensive development programme.

Just recently two new ore shoots have been encountered in the North drift on the 250-foot level. The first shoot has a length of 75 feet and averages $9.16 across 5 feet. The second shoot is extremely high grade but quite narrow, averaging about 1 foot in width and extending for a distance of 70 feet. Because of the very high values obtained it is impossible at this date to give an estimate as to what values might be expected. It is thought, however, that it should be well above the average mine grade. It is impossible at this early stage to judge their importance, but the drift on the 375-foot level is now being pushed to cut the downward extension of this new ore.

The following table shows the development work done to December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
No. 1 SHAFT	404	.....	404
WINZES (below 375-foot level)	286	.....	286
No. 2 SHAFT	382	9	391
125-FOOT LEVEL:			
Drifts	1,043	508	1,551
Crosscuts	241	17	258
Raises	418	50	468
200-FOOT SUBLEVEL:			
Drifts	286	.....	286
Crosscuts	53	.....	53
Raises	59	.....	59
250-FOOT LEVEL:			
Drifts	1,290	342	1,632
Crosscuts	311	66	377
Raises	355	135	490
375-FOOT LEVEL:			
Drifts	976	574	1,550
Crosscuts	243	137	380
Raises	119	.....	119
485-FOOT LEVEL:			
Drifts	245	.....	245
Crosscuts	26	.....	26
625-FOOT LEVEL:			
Drifts	853	.....	853
Crosscuts	64	.....	64

Some 1,428 feet of diamond-drilling from surface and 655 feet from underground were accomplished in the No. 2 shaft area.

W. W. Westaway was manager, employing 56 men, 25 of whom were in the mine and 4 in the mill.

Kenricia Gold Mines, Limited

Kenricia Gold Mines, Limited, was incorporated in April, 1936, with an authorized capitalization of 2,000,000 shares of no par value, of which 1,500,000 have been issued. The officers and directors are: Jos. Errington, president; D. M. Hogarth, vice-president; L. A. Macdonald, secretary-treasurer; W. S. Morlock and C. W. Greenland, directors. The head office is at 25 King Street West, Toronto. The mine address is Kenora.

The property consists of 13 claims, including the old Three Ladies mine, on the south shore of Clearwater bay, Lake of the Woods, district of Kenora. The mine can be reached by road from Kenora.

Underground operations ceased temporarily on December 8, 1937, and were not resumed in 1938. An agreement was reached with the Winnipeg Electric Power Company to supply electric power to the mine, and the construction of a 5-mile branch line to the property was started in November. In December the erection of a building to house a 100-ton cyanide mill was begun. It is the company's intention to resume underground operations as soon as the mill is completed.

D. A. Duff is manager. An average of 8 men was employed on surface from January to the end of October. During November and December the number was increased to 28.

Kerr-Addison Gold Mines, Limited

Kerr-Addison Gold Mines, Limited, was incorporated in April, 1936, with an authorized capitalization of 5,000,000 shares of $1 par value, 4,729,401 of which have been issued. The officers and directors are: Geo. B. Webster, president; J. H. Colville, vice-president; G. A. Cavin, secretary-treasurer; A. H. Cockeram, F. M. Connell, André Dorfman, H. S. Munroe, and J. H. C. Waite, directors. The head office is at 38 King Street West, Toronto. The mine address is Larder Lake.

The property consists of 27 claims, 848 acres, in McGarry township, Larder Lake area, district of Timiskaming.

Operations continued throughout 1938. The following table shows the amount of shaft-sinking, drifting, and crosscutting completed to December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
Reddick shaft	85	.....	85
No. 1 (Kerr-Addison) shaft	750	.....	750
No. 3 shaft	773	37	810
Drifting	5,387	4,187	9,574
Crosscutting	4,922	974	5,896

The following table shows the development work accomplished during 1938, by levels:—

	Shaft-sinking	Drifts	Cross-cuts	Raises	Box-holes	Sub-drifts	Diamond-drilling
	feet	feet	feet	feet	feet	feet	feet
Surface	.....	.....	.....	.....	.....	.....	11,310
No. 3 shaft	37	.....	.....	.....	.....	.....	.....
175-foot level	.....	11	266	386	.....	.....	3,180
300-foot level	.....	1,791	563	945	729	414	6,254
500-foot level	.....	2,385	145	636	171	31	2,767
700-foot level	.....	.....	.....	180	.....	.....	9,306
Total	37	4,187	974	2,147	900	445	32,817

The following is taken from the report of the manager for the year ending December 31, 1938:—

Mine

Underground work, during the first four months of the year, was concentrated on stope preparation and development work immediately essential to production. No. 3 shaft was completed, a loading pocket was installed below the 700-foot level, a jaw-crusher was installed below the 500-foot level, and ore passes were completed from the loading pocket through to the 300-foot level. Hoisting of ore to the crushing plant was started on May 1. During the year 234,603 tons of ore was broken, exclusive of development rock, and at the end of the year a reserve of 121,392 tons of broken ore had accumulated in the stopes.

During the summer months a series of short diamond-drill holes was put down from surface to probe various sections of the Reddick area above the 300-foot level. Later in the year a series of deeper holes was put down testing the same area to the 850-foot horizon. The combined result of diamond-drilling from surface and underground and of mine development work is that proven ore reserves are greatly increased and that further large tonnages of ore are indicated.

ORE RESERVES

	Tons	Value per ton		Total value	
		Uncut	Cut	Uncut	Cut
Surface to 60-foot level	101,490	$8.08	$6.77	$820,161	$687,105
60-foot level to 175-foot level	244,116	8.09	6.53	1,974,386	1,593,024
175-foot level to 300-foot level	243,956	8.60	5.93	2,097,459	1,446,354
300-foot level to 500-foot level	605,875	11.25	7.00	6,814,183	4,239,205
500-foot level to 700-foot level	253,750	13.77	8.68	3,493,469	2,201,699
Total unbroken ore	1,449,187	$10.49	$7.02	$15,199,658	$10,167,387
Broken ore reserves	121,392	6.09	6.09	738,726	738,726
Total	1,570,579	$10.15	$6.94	$15,938,384	$10,906,113
Total after adding 10 per cent. for dilution	1,727,637	$9.23	$6.31	$15,938,384	$10,906,113

Apart from the foregoing ore reserves, diamond-drilling has indicated ore to the extent of 844,622 tons, having an indicated grade of $7.86 uncut or $6.25 cut. The development schedule for 1939 is planned to open up this ore.

Following the start of production, lateral development work was scheduled to open the known ore bodies on the 500-foot level and to develop the Reddick area east of the main ore body on the 300-foot level.

Construction

Erection of the steel frames of the No. 3 shaft headframe, shaft-house, crushing-house, screen-house, conveyerways, and mill was started on January 13 and was completed on March 11. During the same period a double-drum electric hoist was installed for service at No. 3 shaft. By May 1 the installation of essential equipment had been completed, and hoisting and crushing of ore began on that date. On May 2 the 500-ton cyanide mill was started and has been in continuous operation since.

Production

In May during the tuning-up period, the mill was fed somewhat less than 500 tons of ore daily. Since that time tonnage milled has been increased to and standardized at approximately 20,000 tons per month.

SUMMARY OF PRODUCTION MAY 2 TO DECEMBER 31

Tons milled	148,642
Average tons milled per day	609.2
Average mill head value (from belt samples; gold at $35.00 per ounce)	$7.32
Total value recovered	$985,641.23
Average recovery per ton	$6.631
Average tailing loss per ton	$0.434

Cost Summary

These costs are direct operating costs for the production period May 1 to December 31, 1938:

	Total cost	Cost per ton milled
Diamond-drilling	$39,785.17	$0.268
Development	94,247.91	.634
Stope development	50,859.95	.342
Mining	155,465.22	1.046
Hoisting	25,782.38	.173
Crushing and conveying	28,353.73	.191
Milling	115,151.43	.775
General expenses	23,717.21	.159
Bullion marketing expense	13,326.71	.090
Head office	26,013.24	.175
Total	$572,702.95	$3.853
Depreciation	$114,831.70	$0.772
Deferred development	74,432.72	.501
Total costs	$761,967.37	$5.126

EARNINGS STATEMENT

	Total	Per ton milled
Total production	$985,641.23	$6.631
Operating costs	572,702.95	3.853
Operating profit	$412,938.28	$2.778
Depreciation and deferred development	189,264.42	1.273
Net operating profit, before provision for taxes	$223,673.86	$1.505

General

During the last quarter of the year, new ore developments and ore indications were encouraging enough to warrant a more rapid development campaign. In 1939 approximately 2½ miles of lateral development work will be done on the existing four levels. No. 3 shaft will be deepened 750 feet and 5 new levels established at 150-foot intervals. A second jaw-crusher will be placed at the 1,300-foot level and a second loading pocket at 1,500 feet depth. The accomplishment of this programme of development will result in increased costs for a few months and will place the mine in splendid physical condition ready to produce a much increased daily tonnage of ore when required.

The following is taken from the president's report for the year ending December 31, 1938:—

Virginiatown now has a population of over 400. There was expended during the year, on its development, approximately $85,000.00 in roads, waterworks, sewage system, and other improvements. Three hundred and one lots were laid out, of which number 72 were set aside for sale to employees at a low price. Of these 44 have been sold, and 33 houses have been built upon them to date. In all, 132 lots have been sold for $68,050.00, of which $61,763.24 has now been paid. Buildings valued at $180,000.00 have been erected. This townsite is operated by your company's wholly owned subsidiary, Kerr-Addison Properties, Limited.

An average of 256 men was employed, of whom 111 were in the mine. W. S. Row is manager.

Kirkland Lake Gold Mining Company, Limited

The Kirkland Lake Gold Mining Company, Limited, was incorporated in November, 1915, with an authorized capitalization of 5,500,000 shares of $1 par value, of which 5,326,669 have been issued. The officers and directors are: J. B.

Tyrrell, president; R. V. Le Sueur, vice-president; H. F. Cassidy, secretary-treasurer; V. H. Emery, managing director; A. C. Matthews, J. A. Dalton, J. C. Haight, and W. S. Walton, directors. The head office and mine office are at Chaput Hughes. The executive office is at 1314 Metropolitan Building, Toronto.

The property consists of 11 claims, 334 acres, in Teck township, Kirkland Lake area, district of Timiskaming.

The following is taken from the report of the managing director for the year ending December 31, 1938:—

ANALYSIS OF OPERATING COST

	Total cost	Cost per ton milled
Development and exploration	$115,075.95	$1.24
Stoping	174,192.65	1.88
Transporting ore, hoisting, etc.	124,663.80	1.35
Milling	111,120.42	1.19
Marketing bullion	17,726.79	.19
General and undistributed charges (maintenance mine buildings, administration and management, insurance, workmen's compensation, assaying, and miscellaneous)	78,274.99	.85
Total	$621,054.60	$6.70

Gold produced	ounces 42,102.777
Cost per ounce	$14.75

Taxes charged against operations (not included above) totalled $113,924.07, or at the rate of $1.23 per ton milled and $2.70 per ounce of gold produced.

SUMMARY OF WORK DONE IN MINE

Ore broken	tons	88,615
Drifting	feet	4,095
Crosscutting	feet	2,493
Raising	feet	436
Sinking	feet	358
Slashing	cu. ft.	27,623
Station-cutting	cu. ft.	7,528
Diamond-drilling	feet	12,017

The distribution of work done for the year was as follows:—

	Ore broken	Development
	per cent.	per cent.
1st hoisting lift (surface to 2,400-foot level)	40	3
2nd hoisting lift (2,400-foot level to 4,100-foot level)	60	97

There is a small reduction in the broken ore reserves to 39,461 tons. The flat-lying nature of the hanging wall veins does not allow for any accumulation of ore in the stopes. The ore has to be taken out as broken.

MILLING STATISTICS

Tons of ore milled	92,665
Average value per ton	$16.77
Gross value	$1,554,067.99
Recovery per ton	$16.77
Loss in tailings	$70,298.66
Net value recovered	$1,483,769.33
Average tons milled per day	254
Value in tailings per ton	$0.76
Per cent. extraction	95.5

During the year the old portion of the mill building was completely rebuilt, and a new steel ore bin with a capacity of 500 tons was erected in the mill. An automatic sprinkler system was installed in the buildings. The saving made on insurance premiums will pay for the sprinkler installation in about five years, besides very greatly minimizing the fire hazard.

To enable a more aggressive development campaign to be undertaken, a new 1,500-cubic-foot air compressor was added to the plant toward the end of the year. The addition made to the agitating capacity of the mill, which at December 31 had been operating for 13 months, has more than produced the results expected. The actual saving from the increased extraction for the 13 months amounted to $96,420.19. The cost of this addition was about $35,000.00.

PRODUCTION

	Tons milled	Bullion value	Recovery per ton
1st quarter	22,743	$341,390.78	$15.02
2nd quarter	22,706	351,336.98	15.47
3rd quarter	23,283	365,231.96	15.68
4th quarter	23,933	425,809.61	17.79
Total	92,665	$1,483,769.33	$16.01

An important development during the year consisted of the completion of the development of the known hanging-wall veins on the 3,750-foot level and driving to and partially opening up these veins on the 3,875-foot level.

Another major development consisted of the sinking of the No. 3 winze in the western portion of the property, starting from the 3,600-foot level, with the present objective being the 4,450-foot level. This winze was sunk 358 feet, stations were cut on the 37th and 38th levels, and crosscuts driven to the main break where a small amount of drifting was done, which is showing good ore. Sinking has been resumed, and at the same time development is continuing on the two levels opened up.

The long drive west from the central workings on the 4,450-foot level to intersect the winze at this horizon has been proceeding. When completed, this will give ventilation and a double entry into the workings from the winze between the 36th and 44th levels.

Exploration in the hanging wall from this drive has given very encouraging results, showing a highly fractured condition containing important hanging-wall veins. In this section, at the year end, there had been developed 435 feet of ore, averaging $13.40 over a width of 5 feet. Development work on these veins is proceeding.

The persistency of the ore in these hanging-wall veins as compared so far with the ore shoots along or adjacent to the main break, make possible an estimate of ore reserves in these veins.

Last year in these hanging-wall veins there was reported to be at the year end 112,516 tons, having a gross value of $2,799,068.00. At the end of this year, in spite of the increased production, there are estimated ore reserves in these veins of 161,133 tons, having a gross value of $3,906,843.80.

No ore reserves have been allowed below the 38th level. The development of the hanging-wall veins on the 44th level cannot conservatively be included in ore reserves until the area between the 38th and 44th levels has been opened up.

The amount of ore that went to the mill from these hanging-wall veins in 1938 was 33.5 per cent. of the total.

Kirkland Basin Gold Mines, Limited

During the year the Kirkland Basin Gold Mines, Limited, in which your company owns 443,718 shares of the 1,000,000 share capital authorized, gave an option to purchase and entered into an agreement with Lake Shore Gold Mines, Limited, whereby the latter would thoroughly explore the property at depth through the Lake Shore workings. This work is being aggressively undertaken by the Lake Shore company, and a crosscut is being driven as a base for exploration through the property on the 3,000-foot horizon. At the end of the year this crosscut had been driven into the Basin property a distance of 902.6 feet, and had intersected some interesting breaks.

Conclusion

The mine has again concluded another record year, in both production and net profits. It is gratifying to know that while achieving this, the physical condition of the mine has appreciably improved during the year, also the foundation has been laid and preparations made for the development of promising new sections during the coming year.

An average of 183 men was employed during the year, 130 of whom were in the mine and 12 in the mill.

Kir-Vit Mines, Limited

Kir-Vit Mines, Limited, which was incorporated in February, 1937, to succeed Kir-Vit Gold Mines, Limited, has an authorized capitalization of 3,500,000 shares of $1 par value. The officers and directors are: R. H. Mollenberg, president; E. J. Kiefer, vice-president; C. C. Tyx, secretary-treasurer; John Grainger and Ira Scheifley, directors. The head office is at 702 Excelsior Life Building, Toronto. The mine address is Larder Lake.

The property consists of 17 claims in McVittie township, Larder Lake area, district of Timiskaming. Four of the claims were acquired from Kirkland Consolidated Mines, Limited, for 750,000 shares and the other 13, known as the Grainger-Yuill group, were bought for $125,000 cash.

There is a shaft 276 feet deep on the property, with levels at 125 and 250 feet, on which some drifting and crosscutting have been done.

During 1938 the workings were dewatered and examined under the direction of J. W. Robertson. All operations ceased before the end of the year.

Lake Rowan Gold Mines, Limited

Lake Rowan Gold Mines, Limited, was incorporated in September, 1934, with an authorized capitalization of 3,000,000 shares of no par value, of which 1,975,407 have been issued. The officers and directors are: L. E. Schlemm, president; Dr. J. W. Bell, vice-president; C. G. Macartney, secretary-treasurer; S. W. Fairweather, Mostyn Lewis, H. M. Wallis, W. H. Hay, and G. A. Rowan, directors. The head office is at 1178 Phillips Place, Montreal, Que. The mine address is Golden Arm.

The property consists of 42 claims, totalling 1,800 acres, in Todd township, Pipestone Bay section of Red Lake area, Patricia portion of Kenora district. The mine is reached from the town of Red Lake by boat or airplane to Golden Arm and thence over a 2-mile tractor road.

In 1938 operations were carried on from the beginning of the year until May 31, when they were suspended pending arrangements for further financing. The following table shows the development work done to the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
Shaft (3-compartment, vertical)	433	.....	433
100-foot level (adit):			
Drifts	624	.....	624
250-foot level:			
Drifts	.....	245	245
Crosscuts	.....	40	40
400-foot level:			
Drifts	.....	270	270
Crosscuts	.....	50	50

Twelve diamond-drill holes, having a total length of 1,132 feet, were drilled from underground.

A. J. McLaren was superintendent during the period of operation, employing an average of 26 men. At the end of the year plans were under way for the resumption of operations, and W. J. Hacker was appointed superintendent.

Lake Shore Mines, Limited

Lake Shore Mines, Limited, was incorporated in February, 1914, with an authorized capital of 2,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: Dr. W. P. St. Charles, president and treasurer; W. H. Wright, vice-president; A. L. Blomfield, managing director; Albert Wende and Ernest Martin, directors. Kirkland Securities, Limited, is secretary. E. W. Todd is mine superintendent. The head office and mine office are at Kirkland Lake. The property consists of 8 claims and 4 fractions, 287.15 acres, in Teck township, Kirkland Lake area, district of Timiskaming.

During the calendar year 1938 No. 5 shaft was sunk a further 409 feet, bringing it to its complete depth of 3,950 feet. No. 6 shaft, which serves as the downward extension of No. 5 shaft below the 3,950-foot level, was sunk 443 feet. Some 28,473 feet of underground diamond-drilling, 13,324 feet of drifting, 3,782 feet of crosscutting, and 6,269 feet of raising were done during the year.

The following is taken from the report of the superintendent for the fiscal year ending June 30, 1939:—

During the fiscal year 413,987 ounces of gold and 105,224 ounces of silver were recovered from 898,894 dry tons of ore milled. Recovery amounted to $16.25 per ton, for a total value of $14,608,714.60.

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	16,026,108.57	8,000,000
July 1, 1935, to June 30, 1936	12	873,101	16,361,529.69	8,000,000
July 1, 1936, to June 30, 1937	12	879,559	15,692,652.85	12,000,000
July 1, 1937, to June 30, 1938	12	928,036	15,030,273.43	10,000,000
July 1, 1938, to June 30, 1939	12	898,894	14,608,714.60	8,000,000
Total	.....	9,218,353	$156,403,779.87	$77,020,000

[1]Includes exchange premiums.

Development

In the two principal vein zones the total footage of development drifting accomplished during the year amounted to 9,893 feet, of which 4,671 feet, or 47.2 per cent., were driven in ore having an average grade of 0.79 ounces per ton over an average width, before slashing, of 53.5 inches.

In the south or No. 1 vein zone 3,589 feet of drifting exposed 1,325 feet of ore, averaging 1.04 ounces per ton over a width of 56.4 inches. In the north vein zone 6,304 feet of drifting produced 3,346 feet of ore, having an average grade of 0.68 ounces per ton across an exposed width of 52.4 inches.

In addition to further opening of the main veins in the lower levels, considerable exploration was done on subsidiary and branching fractures in both zones on various levels below the 800-foot horizon, which accounts for the lower percentage of ore developed for the drifting done as compared with preceding periods. Much work of a similar nature remains to be accomplished. In the lowest level, at the 4,450-foot horizon, the total drift advance of 3,278 feet exposed 2,364 feet

of ore, having an average grade of 0.78 ounces per ton across an exposed width of 53 inches. In the next period, development of the main veins and subsidiary fractures will be continued to a depth of 4,450 feet, and during the latter part of the year a start will be made on two new levels below the 4,450-foot horizon.

Less drifting was done during the year than in the preceding two years, which were abnormal because of the fact that it was considered desirable to quickly open up a number of new levels in order to establish a steep-rill system of stoping. This method of mining, made necessary by changing ground conditions, distributes the working places over a greater vertical extent and requires that development be carried further ahead of stoping operations.

NEW ORE EXPOSED DURING THE YEAR

Level	Advance	Ore	Width	Grade, ounces per ton
	feet	feet	inches	
1,000-foot	132	.....	.....	.....
1,200-foot	133	50	63.7	0.572
1,600-foot	306	52	52.2	.322
2,000-foot	321	.....	.....	.....
2,200-foot	227	33	80	.929
2,325-foot	128	27	54.8	.467
2,450-foot	100	100	50.1	.818
2,700-foot	181	116	55.4	.766
2,825-foot	931	221	54.8	1.151
2,950-foot	619	190	55.8	1.589
3,075-foot	491	125	51	.717
3,200-foot	307	209	53.7	1.684
3,575-foot	522	262	52.4	.533
3,700-foot	288	173	49.2	.724
3,825-foot	93	41	65	1.332
3,950-foot	587	293	53.2	.547
4,075-foot	514	169	55.5	.695
4,200-foot	897	545	54.1	.514
4,325-foot	668	275	49.6	.547
4,450-foot	2,448	1,790	53	.769
Total	9,893	4,671	53.5	0.789

DEVELOPMENT FOOTAGE FOR THE YEAR 1938–39

Level	Drifting	Crosscutting	Raising	Boxholing	Subdrifting	Ore and waste passes	Shaft-raising	Shaft-slashing	Shaft-sinking	Total footage	Diamond-drilling	Station-cutting
	feet	feet	feet	feet	feet	feet	feet	feet	feet	feet	ft. ins.	cu. ft.
Surface	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	352 9	.....
200-foot	.....	113.1	.....	.....	.....	342.6	.....	.....	.....	455.7	411 4	.....
400-foot	.....	393.8	533.2	.....	222.8	.....	.....	.....	.....	1,149.8	706 4	.....
600-foot	.....	.....	.....	.....	143.7	.....	.....	.....	.....	143.7	250 2	.....
800-foot	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	915 10	.....
1,000-foot	131.9	119.1	.....	.....	296.3	.....	.....	.....	.....	547.3	3,511 5	.....
1,200-foot	132.7	.....	639.6	.....	867.8	.....	.....	.....	.....	1,640.1	2,433 2	.....
1,400-foot	.....	.....	274.9	.....	338.7	.....	.....	.....	.....	613.6	2,434 5	900
1,600-foot	306.1	.....	68	.....	27.3	.....	.....	.....	.....	401.4	1,011 11	.....
1,800-foot	.....	.....	102.5	.....	104.5	.....	.....	.....	.....	207	740 11	.....
2,000-foot	321.3	484.8	.....	.....	.....	.....	.....	.....	.....	806.1	769 10	9,300
2,200-foot	227.2	251.5	126.8	152	12.5	.....	.....	.....	.....	770	585 8	.....
2,325-foot	127.5	160.9	10	.....	.....	.....	.....	.....	.....	298.4	62	.....
2,450-foot	99.9	.....	45	.....	23.7	.....	.....	.....	.....	168.6	145 4	.....
2,575-foot	.....	.....	81.5	.....	45.5	.....	.....	.....	.....	127	746 3	708
2,700-foot	181.4	19	204	.....	60	.....	.....	.....	.....	464.4	49	1,824
2,825-foot	932.1	173	283.5	.....	383.5	.....	.....	.....	.....	1,772.1	583 7	1,956
2,950-foot	619.5	297.5	156.5	.....	131	.....	.....	.....	.....	1,204.5	2,178 5	1,956
3,075-foot	1,761.5	848.1	95	.....	50.5	.....	.....	.....	.....	2,755.1	4,897 6	2,892
3,200-foot	307.4	.....	329.3	.....	212.3	.....	.....	.....	.....	849	260 4	.....
3,325-foot	.....	.....	151.1	.....	32.8	.....	.....	.....	.....	183.9	602 2	.....
3,450-foot	.....	168.1	118	.....	275.3	.....	.....	.....	.....	561.4	343 4	.....
3,575-foot	521.4	.....	299.2	.....	97.5	.....	.....	33	.....	951.1	724 10	52,212
3,700-foot	287.8	.....	433.3	.....	35.1	3.5	.....	116	.....	875.7	89 2	.....
3,825-foot	92.8	.....	513.4	.....	101.5	.....	55	115	.....	877.7	789 3	1,860
3,950-foot	587.2	111.1	470.3	.....	212	.....	.....	118	.....	1,498.6	2,023 2	19,992
4,075-foot	515.8	.....	444.1	.....	30.2	.....	.....	117	.....	1,107.1	365 2	624
4,200-foot	895.2	7.8	274.5	.....	.....	.....	.....	117.9	.....	1,295.4	862 2	.....
4,325-foot	668.4	.....	159.5	.....	.....	184	118	186.6	.....	1,316.5	1,075 10	6,084
4,450-foot	2,448.5	19	.....	.....	.....	168.1	117.6	.....	124.2	2,877.4	1,465	9,684
4,575-foot	.....	.....	.....	.....	.....	.....	.....	.....	125	125	.....	3,036
4,700-foot	.....	32	.....	.....	.....	.....	.....	.....	17	49	.....	3,756
Total	11,165.6	3,198.8	5,813.2	152	3,704.5	698.2	290.6	803.5	266.2	26,092.6	31,386 3	116,784

SUMMARY OF DEVELOPMENT WORK PERFORMED SINCE THE BEGINNING OF OPERATIONS

	Feet
Drifting	174,660
Crosscutting	49,637
Raising	101,939
Subdrifting	29,220
Ore and waste passes	13,200
Shaft-sinking	8,260
Shaft-raising	5,873
Shaft-slashing	4,998
Winze-sinking	1,151
Diamond-drilling	202,015
	cu. ft.
Box-holing	353,757
Station-cutting	1,175,921
Sumps	68,660

SUMMARY OF ORE TRAMMED FOR THE YEAR 1938–39

Level	Development	Stoping	Total
	tons	tons	tons
400-foot	1,139	14,778	15,917
600-foot	488	9,427	9,915
800-foot	.....	6,256	6,256
1,000-foot	1,144	26,479	27,623
1,200-foot	7,019	20,137	27,156
1,400-foot	2,463	24,141	26,604
1,600-foot	1,141	22,988	24,129
1,800-foot	433	10,016	10,449
2,000-foot	279	2,220	2,499
2,200-foot	1,071	3,602	4,673
2,325-foot	254	10,136	10,390
2,450-foot	773	6,068	6,841
2,575-foot	513	8,642	9,155
2,700-foot	2,057	8,747	10,804
2,825-foot	4,686	49,251	53,937
2,950-foot	2,937	62,606	65,543
3,075-foot	2,145	50,056	52,201
3,200-foot	3,347	51,643	54,990
3,325-foot	113	35,781	35,894
3,450-foot	2,538	45,806	48,344
3,575-foot	6,337	53,955	60,292
3,700-foot	6,381	50,679	57,060
3,825-foot	6,483	69,868	76,351
3,950-foot	8,888	68,054	76,942
4,075-foot	8,499	42,844	51,343
4,200-foot	7,210	28,670	35,880
4,325-foot	3,655	25,499	29,154
4,450-foot	9,013	2,199	11,212
Total	91,006	810,548	901,554

STATEMENT OF COSTS FOR THE YEAR

	Cost per ton
Development	$0.844
Mining	3.982
Milling and refining	1.233
Marketing bullion	.196
General and administrative expense	.135
Operating cost	$6.390
Depreciation	.496
	$6.886
Provision for taxes	1.521
Total cost	$8.407

Shaft Work

During the year, No. 6 internal shaft was completed to a depth of 4,590 feet. This is the main hoisting shaft, designed to serve as a downward continuation of No. 5, which extends from surface to the 3,950-foot horizon. The No. 4 internal development shaft was extended to a depth of 4,700 feet during the year.

Mining

The sources of the ore sent for treatment are shown in the Summary of Ore Trammed. Production, including development ore, was distributed between the two vein zones as follows: No. 1 zone, 39.8 per cent.; No. 2 zone, 60.2 per cent.

Intensive research work is being done on the problem of ground movements, and considerable success has been achieved in adapting development programmes and mining methods to changing structural features normally accompanying mining at depth under the geological conditions existing in the Kirkland Lake camp.

During the period 394,661 tons of sand and waste rock backfill were placed in stopes. The methods of mining in use for a number of years involve the placing of permanent wall support at the time the ore is extracted, thus leaving no open ground in the mine. The total length of drift backs available for stoping amounts to 16,803 feet, having an average grade of 0.601 ounces across an exposed width of 54.3 inches.

Milling

Construction of the roasting plant was completed, and during the latter half of the year concentrates from the total tonnage passing through the mill were treated. The extraction during the latter part of the year was 97.5 per cent., an appreciable increase over prior periods.

Kirkland Basin Gold Mines Option

A crosscut was driven into Kirkland Basin Gold Mines' property a distance of 1,499 feet north of the Lake Shore boundary. From near the end of this crosscut, 563 feet of drifting was done during the year. Diamond-drilling amounted to 6,640 feet. A number of strong gold-bearing fractures were discovered. Values encountered were, however, erratic, and no payable ore was developed. The exploration programme will be continued during the next period.

Supplies and Equipment Purchased

	March 1, 1918, to June 30, 1938	July 1, 1938, to June 30, 1939	Total to date
Explosives	$2,009,610	$156,007	$2,165,617
Lumber and timber	2,870,043	424,935	3,294,978
Rock drills and parts	781,695	50,864	832,559
Pipe and fittings, plumbing supplies	713,417	53,665	767,082
Electrical supplies	960,035	123,524	1,083,559
Mill supplies	3,384,831	378.810	3,763,641
Machinery and parts	4,154,028	353,275	4,507,303
Building material	779,457	92,426	871,883
Fuel	437,863	36,027	473,890
Steel products	1,987,523	196,816	2,184,339
Oil and lubricants	249,761	11,021	260,782
Groceries	595,827	8,420	604,247
Trucks and cars, and parts	70,132	4,147	74,279
Miscellaneous	1,777,914	167,429	1,945,343
Backfill	688,329	93,034	781,363
Power	4,193,026	400,766	4,593,792
Total	$25,653,491	$2,551,166	$28,204,657
Freight and express included in value of above materials	$1,957,544	$203,285	$2,160,829

An average of 2,526 tons of ore per day was milled during the year. The average number of men employed was 1,704.

Lakeside-Kirkland Gold Mines, Limited

Lakeside-Kirkland Gold Mines, Limited, was incorporated in April, 1934, with a capitalization of 3,000,000 shares of $1 par value, of which 2,080,839 have been issued. The officers and directors are: E. B. Knapp, president and managing

director; C. H. Musselman, vice-president; G. E. Eastman, secretary-treasurer; V. M. Spiller, assistant treasurer; David Gross, A. C. Wintermeyer, D. M. Briden, and Paul Mills, directors. The head office is at 23 College Street, Kitchener. The mine address is Kirkland Lake.

The property consists of 7 claims in Lebel township, Kirkland Lake area, district of Timiskaming.

There are two shafts on the property. No. 1 shaft, which was sunk in 1923 by Queen Lebel Gold Mines, Limited, is 321 feet deep, with levels at 200 and 300 feet. Several hundred feet of drifting and crosscutting were done on these levels. No. 2 shaft was deepened to 575 feet during 1938, and levels were established at 300 and 550 feet, on which about 240 feet of crosscutting was done. Diamond-drilling amounted to 936 feet drilled from surface, and 866 feet drilled from underground. Operations were suspended on May 16, and at the end of July the mine was allowed to fill with water.

An average of 27 men was employed from January 1 to the end of May, under the direction of E. B. Knapp.

Lebel Oro Mines, Limited

Lebel Oro Mines, Limited, which was incorporated in April, 1920, has an authorized capitalization of 3,500,000 shares of $1 par value, of which 3,390,929 have been issued. The officers and directors are: L. K. Fletcher, president; E. H. Watt, vice-president; A. B. Mortimer, secretary-treasurer; E. J. Dwyer and R. E. Hoddinott, directors. The head office is at 320 Bay Street, Toronto. The mine address is Box 156, Sudbury.

The property includes the Long Lake mine, located in township 69, district of Sudbury.

Operations were continued throughout 1938. The 2-compartment, vertical No. 2 shaft is 207 feet deep, with levels at 80, 180, 265, and 345 feet. The only development work done during the year was the driving of a crosscut 68 feet long on the 80-foot level, to connect with No. 2 shaft and provide a means of access to the open pit, from which practically all of the ore for the mill is being obtained. A total of 32,850 tons of ore was broken and hoisted through No. 2 shaft. The 34,472 tons hoisted included some of the ore that had been broken in the pit at the end of 1937.

The mill treated 34,627 tons, operating at an average rate of 94.8 tons per day.

In October a new surface showing was discovered about half a mile from the pit, and diamond-drilling was commenced. At the end of the year 2,939 feet of drilling had been accomplished.

Three new residences, an addition to the boiler-house, and a core-house were built.

R. P. Teare was manager, employing an average of 52 men, of whom 20 were in the mine and 12 in the mill.

Leitch Gold Mines, Limited

Leitch Gold Mines, Limited, was incorporated in July, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,850,005 have been issued. The officers and directors are: K. J. Springer, president; W. E. Segsworth, vice-president; H. J. Mackay, secretary-treasurer; Dr. J. H. C. McClelland and Russell Cryderman, directors. The head office and mine office are at Beardmore. The executive office is at 67 Yonge Street, Toronto.

The property consists of 412 acres in Eva and Summers townships, district of Thunder Bay, about 5 miles from Beardmore, on the Port Arthur–Longlac branch of the Canadian National Railways. It is reached from Beardmore by an automobile road.

Underground work was continued throughout 1938. The vertical, 3-compartment shaft was sunk a further 505 feet, and new levels were established at depths of 650, 782, 900, and 1,025 feet. Lateral development was carried out on all levels. The table below shows the development work accomplished at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	547	505	1,052
125-FOOT LEVEL:			
Drifts	881	847	1,728
Crosscuts	655	.....	655
Raises	200	82	282
225-FOOT LEVEL:			
Drifts	2,299	.....	2,299
Crosscuts	722	.....	722
Raises	227	154	381
325-FOOT LEVEL:			
Drifts	1,975	701	2,676
Crosscuts	420	.....	420
Raises	262	449	711
425-FOOT LEVEL:			
Drifts	1,853	828	2,681
Crosscuts	108	.....	108
Raises	292	227	519
525-FOOT LEVEL:			
Drifts	1,869	1,275	3,144
Crosscuts	282	7	289
Raises	291	58	349
650-FOOT LEVEL:			
Drifts	.....	1,009	1,009
Crosscuts	.....	350	350
782-FOOT LEVEL:			
Drifts	.....	531	531
Crosscuts	.....	267	267
900-FOOT LEVEL:			
Drifts	.....	942	942
Crosscuts	.....	416	416
1,025-FOOT LEVEL:			
Drifts	.....	482	482
Crosscuts	.....	288	288

The following table shows the amount of diamond-drilling done during the year:—

	Feet
Surface	3,437
Underground	4,349
Total	7,786

The following is taken from the report of the manager for the year ending December 31. 1938:—

Development and Exploration

A new vein, No. 6, similar in strike and characteristics to No. 2, was discovered and partially opened up on the 3rd, 4th, and 5th levels. Ore shoots were developed within the No. 6 vein on the above-mentioned three levels. The probabilities are that the No. 6 vein will yield similar ore to that opened on the 3rd, 4th, and 5th levels on the remaining six levels yet to be explored along this vein. There are also good possibilities that this vein will yield further ore along strike.

Ore Reserves

Ore reserves stand at 67,045 tons, averaging $26.37 per ton, for a total of $1,768,078. This is an increase of 22,407 tons, or $884,659 over the reserves at the beginning of the year.

Hoisting

Some 34,700 tons of ore were hoisted, being 25,010 tons from the stopes, 8,602 tons from development, and 1,088 tons from the surface dump; 34,429 tons of waste were hoisted.

Milling

Some 30,584 tons were milled, being an average of 84.2 tons per day. The mill operated for 363 days. From the above tonnage the mill produced 20,159.9035 fine ounces of gold, an average recovery of 0.659 ounces, or $23.21 per ton milled. Tailings loss averaged $1.09 per ton. This represents an increase of $0.24 per ton over last year. This increase in tailings is due to the increased tonnage and is more than compensated by a reduction in milling costs of $0.53 per ton. Extraction for the year was 95.46 per cent.

Plant, Equipment, and Construction

Three underground electric pumps and two air receivers were added to the underground equipment. A warehouse for heavy supplies and a change-house were constructed during the year. Bathroom additions were made to 5 of the mine residences. An addition was made to one of the mine residences, which was converted into a temporary school and placed at the disposal of the Leitch school area.

Costs

	Cost per ton milled
Exploration, development, and mining	$8.88
Milling	1.78
Total operating cost	$10.66
Preliminary and current development deferred and depreciation written off	2.47
Total cost, before taxes and head office charges	$13.13

General

During the year production was increased to a rate of approximately $60,000 per month. Development of the four new levels is yielding results comparable to the upper levels.

There are now 5 productive veins on the property, namely Nos. 1, 2, 3, 4, and 6. The discovery of No. 6 vein has greatly enlarged the ore-finding chances as well as adding considerable information on the vein and fracture system. Possibilities for new ore disclosures exist along strike from the explored sections of the above-mentioned 5 veins. Apart from these veins there is much unexplored ground favourably located with respect to the fracture system. It seems probable that the exploration of this ground will yield some new ore.

In November the rate of development was increased, with the object in view to fully develop the productive sections of the 5 known veins and then turn to exploration for new ore chances.

A. D. Dickson was manager, employing an average of 118 men, 77 of whom were in the mine and 10 in the mill.

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, of which 1,833,000 have been issued. The officers and directors are: Jos. Errington, president; Thayer Lindsley, vice-president; L. A. Macdonald, secretary-treasurer; D. M. Morin, A. B. Gordon, and D. M. Hogarth, directors. The office is at 25 King Street West, Toronto. The mine address is Little Long Lac.

The property consists of 36 claims, approximately 1,450 acres, 2 miles south of Geraldton, on the Port Arthur–Longlac branch of the Canadian National Railways, Errington and Ashmore townships, Little Long Lac area, district of Thunder Bay. There is an automobile highway from Geraldton to the mine.

Operations were continued during 1938. The 3-compartment shaft was sunk an additional 381 feet to a total depth of 1,712 feet, and new levels were established at 1,450 and 1,600 feet. A new timber headframe, 108 feet in height, and a shaft-house, 50 by 60 feet, were built. In November a new Canadian

Ingersoll-Rand double-drum electric hoist, handling combined cages and skips, was installed.

The following table shows the development work accomplished at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
126-FOOT LEVEL:			
Drifts	112	.....	112
Crosscuts	57	.....	57
Raises	50	.....	50
204-FOOT LEVEL:			
Drifts	1,625	.....	1,625
Crosscuts	930	.....	930
Raises	930	17	947
324-FOOT LEVEL:			
Drifts	1,236	49	1,285
Crosscuts	251	.....	251
Raises	450	91	541
Ore passes	133	.....	133
446-FOOT LEVEL:			
Drifts	2,338	41	2,379
Crosscuts	1,000	6	1,006
Raises	568	.....	568
Ore passes	189	.....	189
570-FOOT LEVEL:			
Drifts	1,188	91	1,279
Crosscuts	102	.....	102
Raises	225	53	278
Ore passes	30	.....	30
694-FOOT LEVEL:			
Drifts	1,071	99	1,170
Crosscuts	297	.....	297
Raises	624	.....	624
Ore passes	155	.....	155
848-FOOT LEVEL:			
Drifts	1,127	92	1,219
Crosscuts	80	.....	80
Raises	464	53	517
Ore passes	177	.....	177
998-FOOT LEVEL:			
Drifts	2,049	230	2,279
Crosscuts	1,528	.....	1,528
Raises	219	367	586
1,152-FOOT LEVEL:			
Drifts	786	452	1,238
Crosscuts	23	.....	23
Raises	.....	251	251
Ore passes	.....	176	176
1,300-FOOT LEVEL:			
Drifts	673	648	1,321
Crosscuts	.....	255	255
Ore passes	.....	172	172
1,450-FOOT LEVEL:			
Drifts	.....	263	263
1,600-FOOT LEVEL:			
Drifts	.....	63	63
Crosscuts	.....	21	21
Ore passes	.....	103	103

During the year ore was obtained from stopes from the second to the ninth level. At the end of the year the stoping was being confined to the eighth and ninth levels, and backs were being taken down on the tenth level in preparation for stoping.

The following is taken from the report of the mine manager for the twelve months ending December 31, 1938:—

Production

Tons milled		97,015
Bullion recovered	ounces	43,849.118
Total gold in residue	ounces	2,186.940
Calculated mill heads assay	ounces	0.475
Calculated mill residue assay	ounces	0.0225
Percentage recovery		95.25

The mill operated 349.81 days, or 95.84 per cent. of full operating time. It was closed for two weeks while changing over from cages to skips. Average daily tonnage milled was 277.336 tons.

Production since beginning of operations in November, 1934, is:—

Period	Tons milled	Gross production	Value per ton
Nov. 24 to Dec. 31, 1934	4,715	$85,480.39	$18.129
1935	62,073	1,108,147.61	17.852
1936	83,555	1,500,791.86	17.961
1937	98,025	1,630,532.49	16.633
1938	97,015	1,525,141.78	15.925

Development

During the year two new levels were opened up, the 11th and 12th, at 1,450 feet and 1,600 feet, respectively. Both levels are only partially developed. We have opened up 620 feet on the 1,450-foot level and 655 feet on the 1,600-foot. It would appear as far as drifting on each level has advanced that values are fully as good as the levels above.

Development work accomplished during the year, was as follows:—

Drifting	feet	2,026
Crosscutting	feet	282
Slashing	cu. ft.	13,028
Raising	feet	730.5
Ore passes	feet	549
Stations and sumps	cu. ft.	20,317
Loading pockets	cu. ft.	11,394
Shaft-sinking	feet	381
Diamond-drilling, surface	feet	9,181
Diamond-drilling, underground	feet	5,868

Exploration work and diamond-drilling was done on some of the claims on the extreme western end of the property. To date nothing of economic importance has been found. This work is still continuing, with a very large area of the most promising ground still to be explored.

Ore Reserves

	Tons	Ounces gold per ton
Proved ore	95,683	0.512
Probable ore	182,102	.535
Possible ore	115,831	.482
Total reserves	393,616	0.512

Operating Costs

	Total cost	Cost per ton milled
Development and exploration	$129,442.93	$1.3343
Mining	396,366.97	4.0856
Milling	173,060.97	1.7839
Tailings retreatment	3,679.90	.0379
Mine office and supervision	38,520.41	.3971
General expense at property	39,274.36	.4048
Administrative and general expense, Toronto office	27,697.40	.2855
Total	$808,042.94	$8.3291

Construction and Equipment Expenditure

Shaft-house and headframe enlargment	$10,359.56
New hoist	14,652.30
Crusher- and conveyer-house	587.84
Sprinkler system extensions	390.46
Employees' residences	7,171.26
Skating rink	37,566.28
Mucking machine	2,763.75
2 Mine skips	5,327.50
Electric locomotive trammer and batteries	5,924.56
Electric locomotive battery generator set	1,322.99
Mine cars	477.73
Mine air-drills	1,903.95
Mine pump and motor	911.60
Mine air ventilation fan and motor	1,273.01
Camp equipment	338.76
Machine shop equipment	101.80
Transportation equipment	317.67
Electric shop equipment	109.13
Additional expenditures on plant and equipment	926.02
Total	$92,426.17

During the year there was an average of 272 men employed, of whom 164 were in the mine and 20 in the mill. A. A. Barton is mine manager, J. M. Kilpatrick is mine superintendent, and A. Rennick is mill superintendent.

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, of which 2,300,000 have been issued. The officers and directors are: C. G. Ross, president; J. J. Gray, vice-president; S. L. Macdonald, secretary-treasurer and managing director. The head office is at 159 Bay Street, Toronto. The mine address is Swastika.

The company owns 4 claims in Teck township and has a 99-year lease on the Baldwin Kirkland property, with an option on an adjoining claim, in Eby township, Kirkland Lake area, district of Timiskaming.

Operations were carried on at the Baldwin Kirkland from May 23 to September 16, 1938. The 2-compartment shaft is 420 feet deep, with levels at 100, 200, 300, and 400 feet, on which some 4,000 feet of lateral development work has been done. During 1938 about 100 feet of raising was done from the 300-foot level, and stoping was begun. Thirteen diamond-drill holes, having a total length of 9,836 feet, were drilled from surface.

Buildings erected during the period of operations included an office, a garage and storehouse, and a carbide house.

An average of 13 men was employed under the management of S. L. Macdonald.

Macassa Mines, Limited

Macassa Mines, Limited, was incorporated in April, 1926, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,678,060 have been issued. The officers and directors are: Robert A. Bryce, president; Thomas Riggs, vice-president; L. Soliague, secretary-treasurer; H. M. Porteous, J. D. Perrin, A. G. Slaght, C. R. Leonard, and J. W. Flanagan, directors. The head office is at 85 Richmond Street West, Toronto. The mine address is Kirkland Lake.

The property consists of 10 claims in Teck township, Kirkland Lake area, district of Timiskaming.

During 1938 the sinking of a new vertical, 3-compartment shaft, known as No. 2, was begun. The objective depth of the shaft is approximately 4,000 feet, of which 513 feet was accomplished by the end of the year. A temporary timber

headframe, 45 feet high, a permanent tile and steel hoist-house, and a dry-house were erected at the new shaft. The new equipment includes a Canadian Ingersoll-Rand PG-1 hoist and an 1,850-cubic-foot Ingersoll-Rand VHE-2 air compressor. No. 1 winze, which is collared at the 3,000-foot level, was deepened from the 3,350-foot level to about 3,800 feet. An addition to the mill was built to house a new unit, which increased the mill capacity by about 200 tons.

The following is taken from the report of the manager for the twelve months ending December 31, 1938:—

Production

During the past twelve months, 110,718 dry tons of ore were milled, from which $1,769,951.42 in bullion value was recovered, equivalent to $15.98 per ton milled.

Since commencing milling operations in October, 1933, a total of 415,498 tons has been milled, from which a gross value of $6,766,892.05 in bullion has been recovered, equivalent to $16.28 per ton milled.

Exploration and Development

A summary of exploration and development work accomplished during the year and a comparison with the previous year is as follows:—

	1938	1937	Total to date
	feet	feet	feet
Drifting	5,914.5	11,402	46,699
Crosscutting	2,722.5	1,812.5	9,899.5
Raising	642.5	944	6,841.5
Shaft-sinking	513	.....	3,584
Winze-sinking (3,000-foot level)	502	.....	917
Station-cutting	165	.....	545
Total	10,459.5	14,158.5	68,486
Diamond-drilling	19,808	18,600	62,057.5

During the year the major development work consisted of deepening the winze from the 3,350-foot level to approximately 3,800 feet, cutting stations for levels at 3,475, 3,600, and 3,725 feet, and crosscutting to the vein on these three new levels. Two large ore-loading pockets below the 3,350- and the 3,725-foot level stations were installed and the raising of ore passes for these pockets was partly completed before the year end.

A large amount of lateral diamond-drilling was done during the year on the 2,575-, 2,850-, 3,000-, 3,100-, 3,225-, and 3,350-foot levels, and this has indicated many hanging-wall branch veins, which will be developed further this year together with the further exploration and development on the 6 bottom levels, 3,100 feet to 3,725 feet, inclusive.

Ore Reserves

The development work completed during the year proved more than enough ore to replace that milled during the period. The following is an estimate of the positive ore only:—

	Tons	Ounces per ton	Value per ton at $35.00
Unbroken ore	301,500	0.450	$15.75
Broken ore	42,700	.460	16.10
Total	344,200	0.451	$15.78

Milling

The new mill unit started operating during the first week of September, and the daily tonnage milled was gradually increased until it reached 400 tons early in October. A slight change in the flow-sheet has resulted in an increase of from 1 to 2 per cent. in extraction over that obtained prior to the addition. Extraction now varies from 95.5 to 96 per cent. In addition to a higher extraction, the cost per ton milled has been reduced and efforts to further improve both will be made this year.

Operating Costs

The following are the operating costs per ton milled, inclusive of all charges but before provision for taxes, depreciation, and preliminary exploration write-off, and are shown in com-

parison with the same charges for previous operating periods. They do not include any charges relating to the sinking of the new No. 2 shaft, the charges in connection with this work being written off out of surplus account. The higher mining cost is due to the extra amount of stope preparation to make provision for the increase in the daily tonnage milled.

OPERATING COSTS PER TON MILLED

	1938	1937	1936
Development and exploration	$1.84	$2.40	$2.46
Mining (stoping, tramming, pumping, etc.)	2.71	1.82	2.32
Milling	1.38	1.46	1.51
Administration and general charges (including head office, mint charges, and bullion handling charge).	.85	.94	.99
Total	$6.78	$6.62	$7.28

The average number of employees per day during the year was 250, and a total of $458,253.62 was disbursed in wages.

No. 2 Shaft

The No. 2 shaft is located approximately 800 feet west and 300 feet south of No. 1 shaft. We have installed a large new hoist and compressor plant and equipment together with auxiliary buildings complete to sink and later operate this shaft from approximately 4,000 feet deep. At the year end the shaft had reached a depth of 513 feet and the installation of a pumping plant on the 500-foot level was completed. This shaft-sinking work will be continued at the rate of approximately 200 feet a month.

Capital Expenditures

The increase in the mill capacity and preparation for sinking the new No. 2 shaft necessitated a rather heavy capital expenditure during the year. The No. 2 shaft equipment includes a 1,850-cubic-foot air compressor and a permanent hoist having a capacity for 3,800 feet of depth. The itemized list is as follows:—

No. 2 shaft buildings and equipment	$96,568.53
Mill building addition and equipment	187,295.19
Crushing and conveying plant additions	19,090.33
Mining equipment	36,309.52
Mill transformer increase	15,822.13
Mine transformer increase	9,003.25
Main shaft hoist-house	8,496.71
Surface pipe lines	5,715.47
Fire prevention	5,272.81
General surface improvements	2,500.16
Auxiliary power equipment	6,498.41
Machine and steel shop addition	1,887.89
Total	$394,460.40

The following is an extract from the report of the president for the twelve months ending December 31, 1938:—

During the year covered by this report, four quarterly dividends of 5 cents per share, together with a bonus of 5 cents in the last quarter, were paid. These disbursements amounted to $669,-517.00. This brings the total amount disbursed by the company since dividends were inaugurated in November, 1934, to the sum of $2,134,954.40.

Of the 250 men employed during the year, 153 were underground and 19 in the mill. G. A. Howes is manager.

Mace Gold Mines, Limited

Mace Gold Mines, Limited, which was incorporated in March, 1937, has an authorized capitalization of 5,000,000 shares of $1 par value, of which 2,200,005 have been issued. The officers and directors are: André Dorfman, president; Balmer Neilly, vice-president; E. D. Fox, secretary-treasurer; J. Ingram and G. C. Andrew, directors. The head office is at 15 King Street West, Toronto. The mine office address is Schumacher.

The property held by the company is in Tisdale township, Porcupine area, district of Cochrane, and consists of the Vipond mine, comprising 11 claims and

formerly owned by Anglo-Huronian, Limited, and the former property of Inspiration Gold Mines, Limited, consisting of 3 claims.

The Vipond mine continued to operate throughout 1938. The mine is 1,450 feet deep, with levels at 100, 200, 300, 400, 500, 600, 733, 866, 1,000, 1,200, and 1,450 feet. Underground development work during 1938 consisted of 1,194 feet of drifting, 1,172 feet of crosscutting, 211 feet of raising, and 69 feet of box-hole cutting. Eighteen diamond-drill holes, having a total length of 7,143 feet, were drilled from surface, and 140 holes, totalling 32,226 feet, were drilled from underground.

Operations were carried on on nearly all levels during the year. At the end of the year most of the ore was coming from the Vipond shaft area. A total of 61,980 tons was hoisted, and the mill treated 62,070 tons. On June 1 the hours of daily mill operation were cut from 24 to 8. This resulted in a decrease in monthly tonnage from 7,500 to 3,500 tons. The average rate of operation for the whole year was 170 tons per day, and from June 1 to the end of the year about 150 tons per day.

W. R. Adams was manager, employing an average of 115 men.

MacFarlane Consolidated Mines, Limited

MacFarlane Consolidated Mines, Limited, which was incorporated in November, 1938, to succeed MacFarlane Long Lac Gold Mines, Limited, has an authorized capitalization of 3,500,000 shares of $1 par value, of which 1,186,807 have been issued. One million shares were paid for the property and were distributed among the shareholders of MacFarlane Long Lac Gold Mines, Limited, on a basis of one share of the new stock for four of the old. The officers and directors are: F. J. McFarlane, president and managing director; M. L. Petry, vice-president; W. G. Chipp, secretary-treasurer; and W. B. Cumming, director. The head office is at 36 Toronto Street, Toronto. The mine address is Longlac.

The property consists of 9 claims on the east shore of Long lake, at a point about 12 miles south of Longlac station on the Longlac–Port Arthur branch of the Canadian National Railways, district of Thunder Bay. The claim numbers are T.B. 13,003–13,011.

The vertical, 2-compartment shaft at this property was sunk to a depth of 145 feet in 1937. Underground operations continued until April, 1938, and 80 feet of drifting was completed on the 135-foot level. Surface exploration consisted of 30 feet of trenching 13 feet deep. Between June 1 and the end of August, 22 diamond-drill holes, totalling 3,495 feet, were drilled from surface.

A blacksmith shop and compressor-house were built during the year, but the latter was destroyed by a storm.

An average of 11 men was employed under the direction of W. Jewitt.

McIntyre-Porcupine Mines, Limited

McIntyre-Porcupine Mines, Limited, incorporated in March, 1911, has an authorized capitalization of 800,000 shares of $5 par value, of which 798,000 have been issued. The officers and directors are: J. P. Bickell, president; Bernard E. Smith, vice-president; E. D. Fox, secretary-treasurer; Strachan Johnston, D. H. McDougall, and R. S. McLaughlin, directors. R. J. Ennis is general manager. The executive office is at 15 King Street West, Toronto. The head office and mine office are at Schumacher.

The company has numerous holdings in Canada, chief of which is the McIntyre mine in Tisdale township, Porcupine area, district of Cochrane, Ontario.

During 1938 an average of 1,317 men was employed, of whom 973 were underground, 77 in the mill, and 267 on other surface work.

The following is taken from the general manager's report for the fiscal year ending March 31, 1939:—

Production

Ore treated.....tons	871,900	
Value per ton (0.287 ounces).....	$10.10	
Gross value.....	$8,809,415.12	
Bullion recovered:		
Gold (237,071.871 ounces at $35.23).....		$8,351,958.71
Silver (55,733.37 ounces at $0.419).....		23,377.00
Total value.....		$8,375,335.71
Recovered per ton (0.272 ounces).....$9.61		
Bullion melting, refining, and handling charges.....		101,598.92
Net value of bullion recovered.....		$8,273,736.79

PRODUCTION SINCE THE BEGINNING OF MILLING OPERATIONS IN 1912

Period	Months	Tons milled	Value per ton	Gross value	Recovery per ton	Total value	Price received per ounce for gold
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	$20.67
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	21.95
Apr. 1, '32, to Mar. 31, '33.	12	736,300	8.45	6,224,493.40	8.12	5,981,714.69	22.79
Apr. 1, '33, to Mar. 31, '34.	12	776,845	10.68	8,296,704.60	10.24	7,957,252.54	31.50
Apr. 1, '34, to Mar. 31, '35.	12	862,100	10.23	8,819,660.27	9.78	8,430,670.26	34.67
Apr. 1, '35, to Mar. 31, '36.	12	873,000	9.88	8,621,410.67	9.38	8,190,639.14	35.17
Apr. 1, '36, to Mar. 31, '37.	12	864,500	10.00	8,641,205.24	9.49	8,201,416.94	34.99
Apr. 1, '37, to Mar. 31, '38.	12	871,200	9.75	8,495,286.60	9.25	8,061,906.45	34.996
Apr. 1, '38, to Mar. 31, '39.	12	871,900	10.10	8,809,415.12	9.61	8,375,335.71	35.23
Total.....	.....	11,871,563	$9.45	$112,174,472.27	$8.98	$106,593,500.66	.....

Mining

	Tons
Ore broken in stopes.....	788,486
Ore from development.....	73,495
Total.....	861,981
Ore hoisted.....	879,420

Development

Development work amounted to 29,763 feet. This includes 19,773 feet of drifting, of which 2,595 feet was on line and 17,178 feet in vein material; of this 7,642 feet was in ore, averaging 0.486 ounces per ton over drift width.

ORE RESERVES, 1938–39

	Tons	Fine ounces gold	Value at $35.00
Estimated, in place.....	3,841,545	1,226,526.4	$42,928,424
Broken ore.....	156,791	43,930.6	1,537,571
Total.....	3,998,336	1,270,457	$44,465,995
Average per ton.....	.....	0.3177	$11.12

SUMMARY OF DEVELOPMENT AND EXPLORATION, 1938–39

Period	Drifts	Cross-cuts	Raises	Winzes	Shafts	Total footage	Stations	Sumps	Excavations	Total Excavation	Diamond-drilling
	feet	feet	feet	feet	feet	feet	cu. ft.	cu. ft.	cu. ft.	cu. ft.	feet
1.....	1,344	1,182	.....	.....	.....	2,526	.....	.....	.....	.....	4,794
2.....	1,425	450	.....	.....	.....	1,875	.....	.....	1,080	1,080	4,501
3.....	1,579	710	.....	.....	.....	2,289	.....	.....	1,948	1,948	4,513
4.....	1,837	610	.....	.....	.....	2,447	.....	.....	3,352	3,352	6,004
5.....	1,372	603	62	.....	.....	2,037	.....	.....	1,848	1,848	5,397
6.....	1,447	963	172	.....	.....	2,582	.....	.....	.....	.....	5,268
7.....	1,763	753	48	.....	.....	2,564	.....	.....	.....	.....	5,433
8.....	2,326	450	.....	.....	.....	2,776	.....	.....	.....	.....	9,146.5
9.....	1,469	939	22	.....	.....	2,430	.....	.....	1,904	1,904	6,317
10.....	1,827	998	.....	.....	.....	2,825	.....	.....	8,024	8,024	5,982
11.....	1,797	650	3	.....	.....	2,450	.....	.....	.....	.....	6,356
12.....	1,587	981	394	.....	.....	2,962	.....	.....	.....	.....	6,304
Total.	19,773	9,289	701	.....	.....	29,763	.....	.....	18,156	18,156	70,015.5
Previous to date	289,486.8	142,834.8	26,794.9	612.7	14,759.4	474,488.6	1,013,582	55,039	160,254	1,228,875	594.434
Total to date	309,259.8	152,123.8	27,495.9	612.7	14,759.4	504,251.6	1,013,582	55,039	178,410	1,247,031	364,449.5

Operating Costs

	Total cost	Cost per ton ore milled
MINING:		
Exploration	$129,897.23	0.1490
Development	411,166.70	.4715
Breaking and stoping	3,016,492.64	3.4597
	$3,557,556.57	4.0802
Milling	678,907.54	.7787
Administration and general expense	100,009.12	.1147
Total	$4,336,473.23	4.9736

ANALYSIS OF MINING COSTS PER TON MILLED

	Stoping	Drifting	Cross-cutting	Raising	Total cost	Cost per ton
Labour	$1,363,956.94	$139,479.54	$63,164.30	$4,064.77	$1,570,665.55	$1.8014
Explosives	96,180.77	43,211.78	24,634.21	860.70	164,887.46	.1892
Supplies	150,264.29	2,993.39	1,544.86	23.63	154,826.17	.1776
Power	83,439.12	13,598.80	5,590.25	1,076.93	103,705.10	.1189
Timbering	402,602.82	5,493.71	1,222.92	193.25	409,512.70	.4697
Shaft repairs	23,502.48	.....	.....	.....	23,502.48	.0270
Back-filling	217,779.75	.....	.....	.....	217,779.75	.2498
Retimbering	28,972.23	1,270.04	359.74	41.45	30,643.46	.0351
Guniting	700.02	587.24	1,019.48	.....	2,306.74	.0026
Steel-sharpening	45,435.54	13,448.10	6,424.80	683.64	65,992.08	.0757
Drill repairs	24,346.38	4,123.06	1,668.79	294.71	30,432.94	.0349
Surveying and engineering	43,448.23	7,291.25	3,019.10	651.26	54,409.84	.0624
Sampling and assaying	51,469.21	2,941.70	1,193.16	236.31	55,840.38	.0640
Pumping	14,316.10	2,257.95	945.15	187.55	17,706.75	.0203
Ventilating	19,016.32	2,956.65	1,170.90	230.43	23,374.30	.0268
Fire protection	601.87	.....	.....	.....	601.87	.0007
Underground lighting	27,561.69	.....	.....	.....	27,561.69	.0316
Tramming	155,865.42	24,263.55	10,029.95	2,202.30	192,361.22	.2206
Hoisting	255,020.27	13,756.05	.....	.....	268,776.32	.3083
Underground crushing	12,013.19	759.35	.....	.....	12,772.54	.0146
Total	$3,016,492.64	$278,432.16	$121,987.61	$10,746.93	$3,427,659.34	$3.9312
Exploration	.....	.....	.....	.....	129,897.23	.1490
Unit cost per ton	$3.4597	$0.3193	$0.1399	$0.0123	$3,557,556.57	$4.0802

SUMMARY OF MILLING COSTS

	Labour	Supplies	Shop repairs and maintenance	Power	Total	Cost per ton
Crushing and conveying	$43,016.20	$37,839.46	$4,475.95	$17,550.06	$102,881.67	$0.1180
Flotation	58,275.11	153,612.95	14,338.25	61,830.88	288,057.19	.3304
Cyanidation	50,357.93	174,250.44	7,750.80	22,741.94	255,101.11	.2926
Refining	7,719.12	7,924.50	834.40	1,306.60	17,784.62	.0204
Assaying	8,269.41	3,425.14	1,212.64	2,175.76	15,082.95	.0173
Total	$167,637.77	$377,052.49	$28,612.04	$105,605.24	$678,907.54	$0.7787
Unit cost per ton	$0.1923	$0.4325	$0.0328	$0.1211	.....	.....

ADDITIONS TO PLANT BUILDINGS AND EQUIPMENT

Community hall	$169,116.49
Surface equipment	116,768.29
Underground equipment	20,853.88
Total	$306,738.66
Less buildings demolished and sold	5,312.20
Net additions	$301,426.46

General

Throughout the mine, ore development was most satisfactory, the average grade exposed being somewhat higher than usual. Levels above the 1,000-foot continue to supply over 25 per cent. of the ore treated, and several low-grade sections on the upper levels have expanded into ore bodies of considerable tonnage and better grade. The most outstanding mine development since the discovery of No. 7 vein in 1925 has been the discovery of No. 25 vein system. The area in which it is located, north of No. 11 shaft, has been a subject for study for a number of years. At frequent intervals, long holes have been drilled in a northerly direction, seeking to ascertain where a mass of quartz porphyry, outcropping at the western limit of the property, one-half mile west from No. 11 shaft, would enter a shear zone on its pitch eastward. Early this year, a flat drill-hole from the 3,875-foot level intersected a vein of high-grade ore on the margin of the porphyry where it enters the shear zone. This vein has now been opened up on the 3,625-, 3,750-, 3,875-, and 4,175-foot levels, showing ore of an average grade of 0.856 ounces per ton over a width of 12 feet.

The silicosis research work, carried on jointly by J. J. Denny and Dr. W. D. Robson of the McIntyre staff and Dr. Irwin of the Banting Institute, has been continued and is, we believe, approaching a satisfactory conclusion. The results of their recent work are summarized in a paper published by the Canadian Medical Journal in March of this year. Metallic aluminum powder in minute quantities is now being used in certain parts of the mine and is effectively reducing the solubility of the fine suspended quartz particles, thus providing real protection against the hazard of silicosis. It is hoped that during the coming year sufficient progress will be made in the technique of its application, to make the results of this discovery available to industry upon a practical basis.

During the year, a fireproof Community Building was erected on the company's property On the main floor is a heated skating arena, equipped with an artificial ice plant to maintain ice on an 80- by 190-foot surface. Sufficient chairs are provided to accommodate 2,000 spectators. On the second floor is a large community hall and two assembly rooms. This building is intended to serve as a recreational and social centre for the whole community.

BELLETERRE QUEBEC MINES, LIMITED

During the year, crosscuts were driven from No. 3 shaft to No. 12 vein on the 125-, 250-, 375-, and 500-foot levels. Drifts advanced 900 feet on the first and second levels and confirmed vein widths and values indicated by diamond-drilling. Just above the 375-foot level, the vein fracture passed from an andesitic lava to a basaltic flow and there became barren. Drilling is now under way to explore for parallel structure below the 500-foot level. No. 12 vein has been traced on the surface for a distance of 2,900 feet, and the results obtained by drilling over a distance of 1,650 feet indicate values of $11.00 per ton over an average width of 5 feet.

In July, the mill, using Diesel power, was put into part-time operation on development rock. The 1,500 h.p. hydro-electric plant was completed and the mill put into full-time operation, treating 200 tons per day, on October 1.

PRODUCTION, JULY 1, 1938, TO APRIL 1, 1939

Ore treated.....tons	45,607	
Value per ton	$8.38	
Gross value	$381,304.21	
Recovery per ton	$8.18	
Total value		$372,813.43
Bullion melting, refining, and handling charges	$4,838.69	
Operating costs, less sundry revenue	289,548.25	
Total costs		294,386.94
Operating profit before providing for depreciation		$78,426.49

Ore Reserves

Ore reserves estimated from mine development are 138,323 tons, and there is indicated by diamond-drilling east of the present mine workings an additional 100,000 tons:—

	Tons	Grade	Value
Broken ore	12,378	$8.40	$104,038.65
Estimated from mine development	125,945	9.30	1,169,902.75
Indicated by diamond-drilling eastern extension of No. 12 vein	100,000	11.00	1,100,000.00
Total	238,323	$9.96	$2,373,941.40

McKenzie Red Lake Gold Mines, Limited

McKenzie Red Lake Gold Mines, Limited, was incorporated in February, 1933, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,900,000 have been issued. The officers and directors are: W. G. Armstrong, president; F. D. Reid, vice-president; H. M. Anderson, secretary-treasurer; M. F. Fairlie, managing director; G. W. Quinn, C. A. Gentles, and A. H. Seguin, directors. The head office is at 19 Richmond Street West, Toronto. The mine address is McKenzie Island.

The property consists of 11 claims, 400 acres, at the north end of Mackenzie island in Red lake, Dome township, Patricia portion of Kenora district. Summer freight transportation is by barge from Hudson, via Lac Seul, and the property can be reached by airplane daily from Hudson, Kenora, or Winnipeg.

The mine and mill continued to operate throughout 1938. The 36-degree winze from the 450-foot level was sunk an additional 117 feet and a new level was established at 950 feet. The following table shows the development work to the end of 1937, during 1938, and the total:—

DEVELOPMENT WORK

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT (main)	461	.....	461
SHAFT (exploration)	79	.....	79
WINZE	786	117	903
150-FOOT LEVEL:			
Drifts	1,828	.....	1,828
Crosscuts	384	.....	384
Raises	475	.....	475
250-FOOT LEVEL:			
Drifts	3,326	244	3,570
Crosscuts	1,184	.....	1,184
Raises	1,285	[1]20	1,305
350-FOOT LEVEL:			
Drifts	3,036	300	3,336
Crosscuts	616	.....	616
Raises	1,470	327	1,797

[1]Box-holing only.

DEVELOMENT WORK—*Continued*

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
450-FOOT LEVEL:			
Drifts	3,240	221	3,461
Crosscuts	601	224	825
Raises	1,767	298	2,065
550-FOOT LEVEL:			
Drifts	1,906	1,426	3,332
Crosscuts	409	224	633
Raises	582	502	1,084
650-FOOT LEVEL:			
Drifts	1,717	1,825	3,542
Crosscuts	112	358	470
Raises	795	209	1,004
750-FOOT LEVEL:			
Drifts	873	901	1,774
Crosscuts	75	421	496
Raises	.....	328	328
850-FOOT LEVEL:			
Drifts	1,030	2,437	3,467
Crosscuts	158	621	779
Raises	.....	519	519

On the 950-foot level, the only work done during 1938 was the cutting of a station. The diamond-drilling done during 1938 amounted to 557 feet from surface and 16,134 feet from underground.

The following is taken from the report of the manager for the twelve months ending December 31, 1938:—

Comparison with the previous year may be noted in (1) tonnage milled, 63,321 tons against 58,001; (2) average value per ton milled, 0.410 ounces ($14.35) against 0.434 ounces ($15.19); (3) value of gold bullion recovered, $892,404.00 against $860,213.85.

Operating costs continue to show a reduction, in spite of rising prices of materials, namely $6.82 against $6.98 per ton milled.

GENERAL SUMMARY OF MINING OPERATIONS

	1938	1937	Total to date
	tons	tons	tons
Ore broken in stopes and stope development	65,107	60,403	204,786
Ore broken in development, slashing included	14,676	9,415	48,539
Total tons ore hoisted (milled and sorted)	79,783	69,818	253,325
Dry tonnage milled	63,321	58,001	209,904
Tonnage discarded by sorting	16,462	11,817	43,421

PRODUCTION

	1938		1937		Total to date	
	Ounces per ton	Value	Ounces per ton	Value	Ounces per ton	Value
Average value per ton milled	0.41	$14.35	0.434	$15.19	0.421	$14.73
Average recovery per ton milled	.4004	14.01	0.424	14.84	.411	14.38
Percentage of extraction	97.7		97.6		97.8	
Total value of bullion recovered and marketed	$892,404.00		$860,213.85		$3,029,200.80	
Total operating cost	$431,833.13		$404,789.61		$1,476,967.23	

ANALYSIS OF OPERATING COSTS

	Total cost	Cost per ton milled and sorted (79,783 tons)	Cost per ton milled (63,321 tons)
MINE OPERATIONS:			
Diamond-drilling	$16,319.04	$0.204	$0.258
Shaft, stations, winze	9,249.16	.116	.146
Surface exploration	422.58	.005	.007
Current development	122,375.15	1.534	1.932
Slashing	7,559.43	.095	.119
Stope development	2,325.84	.029	.037
Stoping	127,969.64	1.604	2.021
Total	$286,220.84	$3.587	$4.52
MILL OPERATION:			
Crushing and conveying	$11,086.28	$0.139	$0.175
Sorting	6,851.62	.086	.108
Milling	60,703.59	.761	.959
Total	$78,641.49	$0.986	$1.242
GENERAL EXPENSE:			
Maintenance of buildings, water supply, salaries and office, engineering, insurance, heating, hospital, telegraphs	$48,978.32	$0.614	$0.774
HEAD OFFICE EXPENSE:			
Salaries and expenses, travelling expense	$17,992.48	$0.226	$0.284
Total operating cost	$431,833.13	$5.413	$6.82

General Development

Results of underground development for the year ending December 31, 1938, are summarized as follows:—

On the 150-foot and 250-foot levels, no development work was carried out, though production still continues on the latter level. On the 350-foot level, some drifting south on the main shear, following favourable structure, indicated marginal grade ore in short shoots. On the 450-foot level, a further extension of the west vein ore was proven over an additional length of 160 feet.

On the 550-foot level, development of the ore, indicated by drilling and mentioned in the previous annual report, has shown a total of 325 feet of ore. The downward extension of another hanging-wall structure, previously developed on the 450-foot level, was proven at this horizon.

On the 650-foot level, a new hanging-wall structure, 450 feet west of the main shear, showed in the year's development a total of 700 feet of ore. Drifting on another hanging-wall structure 250 feet west of the main shear and north of the last-mentioned ore, indicated a length of 180 feet of ore.

On the 750-foot level, while development to date has been somewhat limited, approximately 250 feet of ore has been shown in drifting on the downward extension of the newly discovered hanging-wall vein on the 650-foot level.

On the 850-foot level, further drifting on the main shear has disclosed an ore shoot 65 feet long, 900 feet north of the winze section. This work has suggested a repetition, in this new area, of the favourable geological conditions obtaining in the more productive section of the mine. The development of two hanging-wall structures by crosscutting and drifting on this level has indicated lengths of 127 feet and 110 feet of ore respectively.

Future Development

Further exploration by diamond-drilling and underground work will be carried out in favourable hanging-wall areas. Already on the 850-foot level diamond-drilling has shown interesting intersections in a diorite zone in the hanging wall and extending north practically the full length of present drifting.

Deepening of present main winze at an inclination of 36 degrees is being continued to open up four new levels at vertical intervals of 100 feet (an inclined distance of 170 feet). The new lowest or 1,250-foot level will then have an inclined depth of approximately 2,000 feet. One level, the 950-foot, had already been reached at the year end. In opening these four new levels, it is intended during the coming year to concentrate development work on the 1,050- and 1,250-foot levels. Results will later determine the work to be carried out on the others.

Ore Reserves

It may be stated generally that development results have been unusually satisfactory in the past year, and the ore position of the previous year has been more than maintained.

Conclusion

Equipment added to the milling plant has given increased flexibility in capacity, and it is our aim to increase production as mine development warrants such action.

J. L. Ramsell was manager, employing an average of 116 men, 75 of whom were underground and 13 in the mill.

MacLeod-Cockshutt Gold Mines, Limited

MacLeod-Cockshutt Gold Mines, Limited, which was incorporated in September, 1933, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,821,490 have been issued. The officers and directors are: F. G. MacLeod, president; Jos. Errington, vice-president; J. M. Macintosh, secretary-treasurer; Dr. R. J. Manion, W. H. Marsh, D. M. Hogarth, and Arthur Cockshutt, directors. The head office is at 357 Bay Street, Toronto. The mine address is Little Long Lac.

The property consists of 21 claims about 3 miles from Geraldton, on the Longlac–Port Arthur branch of the Canadian National Railways, Ashmore and Errington townships, Little Long Lac area, district of Thunder Bay.

Operations at the property continued throughout 1938. The 500-ton mill, which had been begun in 1937, was completed and put into operation on April 19. Other buildings erected during the year included a crusher-house with machinery capable of crushing 500 tons per day, a refinery, a dry-house and a tunnel leading to the shaft-house, an office, and a boiler-house. A 50,000-gallon steel water tank was erected. A 125 h.p. Watrous Pacific boiler was added to the plant equipment.

The following table shows the amount of development work accomplished at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
No. 1 SHAFT	172	.....	172
150-FOOT LEVEL:			
Drifts and crosscuts	2,010	.....	2,010
No. 2 SHAFT	830	.....	[1]830
200-FOOT LEVEL:			
Drifts	3,381	204	3,585
Crosscuts	436	668	1,104
Raises	788	206	994
350-FOOT LEVEL:			
Drifts	2,971	87	3,058
Crosscuts	787	.....	787
Raises	929	214	1,143
500-FOOT LEVEL:			
Drifts	3,075	1,572	4,647
Crosscuts	1,804	971	2,775
Raises	871	112	983
650-FOOT LEVEL:			
Drifts	.....	11	11
Crosscuts	178	14	192
Raises	.....	37	37
800-FOOT LEVEL:			
Drifts	.....	697	697
Crosscuts	5	1,378	1,383

[1]See item in manager's report on page 158 regarding further sinking.

The amount of diamond-drilling done during the year is shown in the following table:—

	Holes	Feet
Surface	3	2,539
Underground	151	17,086

During the calendar year 139,410 tons of ore were hoisted and 126,291 tons were milled, the mill operating at an average rate of 469 tons per day.

The end of the company's fiscal year has been changed from December 31 to September 30. The following is an extract from the report of the manager for the nine months ending September 30, 1938:—

General

Mill construction started in August, 1937, and the crushing plant went into operation April 5, 1938. The mill circuit was filled and precipitation started April 19, 1938.

Production from April 6, 1938, to September 30, 1938, was:—

Tons milled	78,655
Bullion recovered	$608,520.43
Bullion recovery per ton	$7.74

Mining

Ore from stopes amounted to 56,194 tons; ore from development, 8,746 tons; ore from surface dump, 22,084 tons; ore hoisted, 87,024 tons; waste sorted, 7,486 tons. Cut-and-fill methods were used for all mining.

For the period under review 25.4 per cent. of tonnage milled came from the surface ore dumps, to give 17 per cent. of production, average grade 0.174 ounces, or $6.09 per ton; 61.4 per cent. of tonnage came from the south ore zone, to give 69.1 per cent. of production, grade 0.292 ounces, or $10.22 per ton; 12.4 per cent. of tonnage came from third level north ore zone, to give 13.5 per cent. of production, grade 0.276 ounces, or $9.66 per ton; 0.8 per cent. of tonnage came from fifth level north ore zone, to give 0.7 per cent. of production, grade 0.203 ounces, or $7.10 per ton.

Mine Operating Costs

	Total cost	Cost per ton milled
Exploration development	$53,523.05	$0.6804
Diamond-drilling	13,508.24	.1717
Mining	133,983.43	1.7038
Milling	88,847.09	1.1296
Mine office, supervision, general expense, and administration	50,985.28	.6482
Total	$340,847.09	$4.3337

Milling

The mill operated 96.1 per cent. of possible running time with satisfactory costs and metallurgical results.

Summary of Present Milling Costs

	Cost per ton milled
Sorting	$0.0214
Crushing and conveying	.1259
Grinding and classification	.3221
Flotation	.1822
Regrinding	.1625
Agitation and thickening	.0265
Filtration	.0332
Clarification	.0211
Tailings disposal	.0038
Sampling and assaying	.0385
Refining	.0284
General	.0752
Total	$1.0412

Development and Ore Reserves

The following section on development of the property covers the period from September 30, 1937, to September 30, 1938, excepting the section on the north zone on the 500-foot and 800-foot levels, which is up to March 31, 1939. During this period development consisted of 2,383 feet of crosscutting, 2,530.5 feet of drifting, 1,118.5 feet of raising, 110,369 cubic feet of slashing, and 22,201 feet of diamond-drilling.

Development on the south or original zone consisted almost entirely of stope preparation, and since the mill went into operation, of stoping; therefore there is little change in ore reserves other than the amount of ore mined. Reserves in the south zone are estimated to contain 304,000 tons, averaging $8.99 per ton of probable ore.

Plant Buildings and Equipment Expenditures

Mill	$260,037.81
Crusher-house	67,107.76
Headframe and ore bins	44,603.94
Compressor- and hoist-house	78,949.39
Substation	27,351.66
Assay office	6,951.42
Warehouse	5,061.45
Office	12,982.66
Plant power and light lines	6,039.18
Plant pipe lines	23,605.86
Dry-house and tunnel to shaft	36,031.10
Refinery	8,010.85
Mill conveyers	13,143.01
Heating plant (two 125 h.p. high-pressure boilers)	20,641.47
Water tank and pump-house	18,233.94
Cookery and 2 bunk-houses	45,165.04
Seven employees' residences	24,565.72

The following is taken from the manager's supplementary report of the development of the north ore zone, to March 31, 1939:—

To date the north ore zone has been explored on the 500-foot and 800-foot levels only and, as exploration is incomplete, an estimate of ore tonnage and grade on each level only is given; this covers all work to March 31, 1939. The ore in this zone is associated with a band of iron formation and is probably controlled by a westerly plunging drag fold, the general geologic structure and ore association being similar on both levels.

On the 500-foot level the ore body lies near and continues beyond the east boundary of the property, and that portion of the ore body that lies on the property has been largely explored, giving 1,858 tons for each foot of vertical height of the ore body of a grade of $9.66 per ton.

On the 800-foot level that portion of the ore body lying from 200 to 700 feet west of the east boundary of the property has been explored to date giving 1,514 tons for each foot of vertical height of the ore body of a grade of $10.01 per ton uncut, or $9.00 per ton after cutting all high assays down to one ounce. This level has not been as extensively developed as the 500-foot level.

On the 200-foot level a flat drill-hole to the north (No. 1-192), located 93 feet from the east boundary of the property, cut the following sections, (starting at a point 123 feet north of No. 113 north crosscut), 22 feet of ore averaging $10.01, followed by 18 feet of waste, then 2.5 feet of ore averaging $12.95, then 5.9 feet of low-grade, then 8.1 feet of ore averaging $20.47. The above section totalling 56.5 feet in width averages $7.63. Following this there was 56 feet of waste, then 5 feet of ore averaging $13.33, then 6.3 feet of waste, followed by 3.7 feet of ore averaging $7.60.

Another drill hole (No. 1-193) put out from the same set-up (at a bearing of N. 23° W.)to cut the ore at about 80 feet west of hole No. 1-192, cut the following sections (widths given are core lengths, whereas true width will be about 10 per cent. less): 27 feet of ore averaging $12.32, followed by 15 feet of waste, then 7.5 feet of ore averaging $12.91. The above section, totalling 49.5 feet, averages $8.68. At a point 61.8 feet further, one foot of ore was cut which averaged $12.25.

Sinking of the No. 2 shaft has been completed to 1,000 feet, with a station cut at 950 feet. Ore pockets are now installed below the 800-foot level.

A. A. Barton is mine manager, J. M. Kilpatrick is mine superintendent, and R. Gegg is mill superintendent. An average of 228 men was employed, of whom 104 were in the mine and 7 in the mill.

Madsen Red Lake Gold Mines, Limited

Madsen Red Lake Gold Mines, Limited, which was incorporated in March, 1935, has an authorized capitalization of 5,000,000 shares of $1 par value, of

which 3,386,507 have been issued. The officers and directors are: Jos. McDonough, president; F. R. Marshall, vice-president; W. G. Hughson, secretary-treasurer; C. D. Kaeding, managing director; W. J. Ryan, Marius Madsen, D. M. Hogarth, and W. R. Askwith, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Macsen.

The property consists of 31 claims in Baird and Heyson townships, Red Lake area, Patricia portion of Kenora district. The mine is about 7½ miles southwest of the Howey mine and may be reached by road from Red Lake.

Underground operations, which had been discontinued in the fall of 1937 to permit activity to be concentrated on the building of a mill, were resumed in January, 1938, and continued throughout the year.

The following table shows the underground development work accomplished at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
100-FOOT LEVEL:			
Drifts	177	34	211
Crosscuts	236	.....	236
Raises	.....	451	451
212-FOOT LEVEL:			
Drifts	874	170	1,044
Crosscuts	150	.....	150
Raises[1]	.....	393	393
325-FOOT LEVEL:			
Drifts	835	.....	835
Crosscuts	150	.....	150
437-FOOT LEVEL:			
Drifts	280	.....	280
Crosscuts	63	.....	63
550-FOOT LEVEL:			
Drifts	215	.....	215
Crosscuts	76	.....	76

[1]Including box-holes.

During the year 17 diamond-drill holes, totalling 828 feet, were drilled from underground.

The installation of the milling equipment was completed on August 10, and the mill went into operation the following day.

Other buildings erected during the year included 2 crusher-houses, a conveyer-house, an assay office, a refinery, a machine shop, and a residence for the superintendent.

The following is taken from the report of the superintendent for the period from January 1, 1938, to February 28, 1939:—

Mill construction started on January 25, 1938, and was completed in time for mill operation to start on August 11, somewhat in advance of schedule. During this period of mill construction the necessary underground work was done to prepare the mine for production.

The first month of the mill operation demonstrated that while the capacity of the crushing plant was limited to its rating of 300 tons per day, the milling plant was capable of handling a tonnage considerably in excess of this amount. It was decided to take advantage of this extra capacity of the mill and a larger secondary crusher was installed by November 1, which has enabled the mill to handle as much as 380 tons per day. The average milling rate since the new crusher was installed has been 347.2 tons per day.

Due apparently to a defective casting, the new crusher broke down during February. This necessitated using the old secondary crusher for a period of eleven days until repair parts were received and installed. During this 11-day period the mill rate was reduced by approximately 75 tons per day.

During the period of production a total of 65,460 tons of ore was hoisted and milled, from which was produced a total of 13,908.561 ounces of gold and 3,321.23 ounces of silver.

Mine Development

The development work completed during the year 1938 was confined to preparing the ore for stoping. The second-level drifts were straightened and slashed out for motor haulage. A loading station was established below the second level and an ore pass driven up to the second level, where a grizzley and car tipple were installed.

Box-holes were put in on both the A and B ore shoots on the second level, and raises were driven in both ore shoots from the second level to the surface. By the end of July the mine was ready for production, using the shrinkage method of stoping.

Prior to the end of January, 1939, it was impossible to carry on any underground exploration work owing to the fact that the whole available air supply was required for the stoping operations. the installation of a second compressor, however, made it possible to expand underground operations the first of February. Drifting both east and west was resumed on the second level, and considerable diamond-drilling was done between first and second levels to explore certain areas which were believed to have ore-bearing possibilities. One new ore body has already been outlined by this work in the area to the west of the B ore shoot.

The following is a summary of the development work completed during the year:—

Drifting	feet	489.9
Raising	feet	951.5
Diamond-drilling (underground)	feet	1,931
Slashing	tons	2,043
Box-holes	units	19

Ore Reserves

The mining operations during the year have indicated that the grade of the ore is somewhat higher than the grade shown in the previous ore reserve estimate. Apparently the system used in adjusting the high erratics erred on the conservative side; consequently the ore reserves have been recalculated, adjusting the high erratics in the light of the additional information obtained in the mining operations during the year.

Since the beginning of February, 1939, we have indicated an additional 20,925 tons of ore to the west of the 2-B stope by diamond-drilling between the first and second levels.

The calculated ore reserve above second level is as follows:—

	Solid	Broken	Grade
	tons	tons	ounces
A ore shoot	97,380	64,000	0.220
B ore shoot	92,870	13,790	.165
B-West ore shoot[1]	20,925	.....	.138
C ore shoot	14,220	.....	.162
Total	225,395	77,790	0.192

[1]New ore developed since February 1, 1939.

While the lack of definite information in regard to the block between the third and second levels precludes the inclusion of this block in the calculated ore reserve, the available data, interpreted in the light of the information gained during the stoping operation to date, indicates a possible tonnage in this block as follows:—

	Possible tonnage	Probable grade
		ounces
Block between 3rd and 2nd levels	60,000	0.121

In calculating the grade of the ore reserve, allowance has been made for 20 per cent. dilution.

Milling

The mill has operated very satisfactorily since operations started on August 11. No major difficulties have been encountered in the milling of the ore. The details of the mill operation are shown in the following summary:—

Dry tons treated	65,460
Per cent. operating time	98.88
Tons treated per mill day	325.7
Average gold assay of heads ounces	0.2272
Average gold assay of tails ounces	0.0148
Percentage recovery	93.5

Operating Results and Costs

August 11, 1938, to February 28, 1939

Tons milled	65,460
Excess of tons broken over tons milled	77,790
Total gold in mill feed ounces	14,874.641
Gold lost in tails ounces	1,966.080
Gold produced ounces	13,908.561

	Cost per ton milled
Development	$0.227
Mining, including tramming and hoisting	2.087
Crushing and conveying	.233
Milling	.976
Mine general expense	.387
Head office expense	.060
Total gross cost	$3.970
Credit for broken ore reserve at 65 cents per ton	.770
Net total cost	$3.200

General

The result of the year's operation has been very satisfactory. The mill operated very smoothly with the recovery fully up to that indicated by the test work. The grade of the mill feed to date has been considerably higher than the calculated grade of the ore reserves, largely due to the fact that dilution will not become an important factor until the broken ore is being drawn from the stopes.

During the year a townsite for mine employees was surveyed. There have been 14 private dwellings erected, and are now occupied by our employees.

An average of 118 men was employed at the property throughout the year, of whom 41 were in the mine. There were 16 men employed in the mill from August 11 to the end of the year. E. G. Crayston is superintendent.

Magnet Consolidated Mines (1936), Limited

Magnet Consolidated Mines (1936), Limited, which was incorporated in April, 1936, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,165,005 have been issued. The officers and directors are: A. W. Burt, president; Fred Searls, Jr., vice-president; H. E. Dodge, secretary-treasurer; T. M. Mungovan, director. The head office is at Empire. The mine address is Geraldton.

The company owns 42 claims, 1,840 acres, in Errington township, Little Long Lac area, district of Thunder Bay, adjoining the property of Bankfield Consolidated Mines, Limited, to the south and east, about 2 miles southwest of Bankfield station on the Port Arthur–Longlac branch of the Canadian National Railways. It can be reached from Geraldton by a 4-mile automobile road.

Operations were continued throughout 1938. The 3-compartment, vertical shaft was sunk a further 320 feet to a total depth of 700 feet, and new levels were established at 480 and 630 feet. The following table shows the amount of underground development work done at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	380	320	700
200-FOOT LEVEL:			
Drifts		1,009	1,009
Crosscuts	65		65
Raises		35	35
330-FOOT LEVEL:			
Drifts		1,835	1,835
Crosscuts	80		80
Raises		70	70
480-FOOT LEVEL:			
Drifts		1,162	1,162
630-FOOT LEVEL:			
Drifts		230	230

A total of 2,946 tons of ore was hoisted, and was sent to the mill of the Tombill Gold Mines, Limited, for treatment. At the end of the year plans were being made for the erection of a 100-ton flotation-amalgamation mill on the Magnet property.

New buildings constructed during the year included a hoist-house, bunkhouse, 25,000-gallon water tank, and an electric substation.

The following new plant equipment was installed: Worthington Duplex 2-stage, 1,000-cubic-foot compressor, driven by a 175 h.p. Westinghouse synchronous motor; Ingersoll-Rand PE-1, double-drum, electric hoist, driven by a 150 h.p. Westinghouse motor; 75 h.p. Cameron centrifugal pump, capacity 200 gallons per minute.

An average of 43 men was employed, of whom 22 were underground. Arthur Kendall is mine manager, and J. A. Pike is mine superintendent.

Manor Gold Mines, Limited

Manor Gold Mines, Limited, was incorporated in 1937, with an authorized capitalization of 5,000,000 shares of $1 par value. In 1936 the capitalization was reduced to 2,666,831 shares of $1 par value, the shareholders receiving 1 new share for 10 of the old and the debentures being paid off with stock. At October, 1938, 1,660,005 shares had been issued.

The officers and directors are: Wm. H. Yates, president; J. E. Riffer, vice-president; J. Connelly, secretary-treasurer; S. W. Somerville, A. L. Smith, A. W. Bate, and E. Cerson, directors. The head office is at 1701 Metropolitan Building, Toronto. The mine address is Boston Creek.

The property consists of 15 claims, approximately 600 acres, in Skead township, Larder Lake area, district of Timiskaming.

There is a 2-compartment shaft, 485 feet deep on the property, from which the following lateral work was done some years ago:—

Level	Drifting	Crosscutting
	feet	feet
200-foot	60	544
340-foot		35
460-foot	70	166
Total	130	745

No development work was carried on during 1938. Between January 1 and March 28 some diamond-drilling was done from the 200-foot level.

E. S. MacCarthy was manager, employing an average of 15 men for three months.

Martin-Bird Gold Mines, Limited

Martin-Bird Gold Mines, Limited, was incorporated in May, 1936, with an authorized capitalization of 4,000,000 shares of $1 par value, of which 3,480,005 have been issued. The officers and directors are: S. J. Bird, president; L. O. Lumbers, secretary-treasurer; G. D. O'Meara, T. W. Jull, and R. M. Stephens, directors. The head office is at 200 Bay Street, Toronto. The mine address is Larder Lake.

The property consists of 13 claims, 415 acres, in Hearst township, Larder Lake area, district of Timiskaming.

During 1938 a further 238 feet of raising was accomplished in No. 2 shaft. This shaft is now complete from the 375-foot level to the surface, with levels at 125, 250, and 375 feet. It has two compartments from the surface to the 125-foot level, and three compartments below 125 feet. The No. 1 shaft is 375 feet deep, with levels connecting with No. 2 shaft. A development raise has been driven from the 375-foot level, and a sublevel has been established at a depth of 320 feet. The following table shows the underground development work done during 1938:—

Level	Drifts	Crosscuts	Development raising
	feet	feet	feet
125-foot	639	178	10
250-foot	1,915	549	34
320-foot sublevel	21	.....	.....
375-foot	1,292	343	29

Diamond-drilling amounted to 3,264 feet from surface and 12,380 feet from underground.

D. M. MacPhail was manager, employing an average of 76 men throughout the year.

Matachewan Consolidated Mines, Limited

Matachewan Consolidated Mines, Limited, was incorporated in July, 1933, with an authorized capitalization of 4,000,000 shares of no par value, of which 3,430,000 have been issued. The officers and directors are: Thayer Lindsley, president; H. H. Sutherland, vice-president; H. Whittingham, secretary-treasurer; Jos. Errington, C. W. Moodie, and H. S. Munroe, directors. The head office is at 25 King Street West, Toronto. The mine address is Matachewan.

The property consists of 21 claims, approximately 860 acres, in Powell and Cairo townships, Matachewan area, district of Timiskaming.

Operations continued throughout 1938. The 3-compartment No. 3 shaft was sunk a further 106 feet to a total depth of 796 feet, and a new level was established at 788 feet.

The following is taken from the report of the manager for the twelve months ending December 31, 1938:—

Mine Development

Development work performed during the year was as follows:—

	Feet
Shaft-sinking	106
Drifting	4,227.5
Crosscutting	937.5
Raising	1,839.5
Box-holes	506.5
Total	7,617

Work was started in November to deepen the main entry, No. 3 shaft, to the 1,050-foot level. Tentative plans are to open up three more levels below our present bottom level, the 5th or 650-foot level. This work will be well advanced before the end of 1939.

Development work was carried on during the year to open up the following number of stopes:—

	No. of stopes
1st level	6
2nd level	6
3rd level	3
4th level	5
Total	20

Of this number, 10 have been mined to completion, as well as have 6 older stopes. These stopes contain most of our broken ore reserve.

Work has just been started to open up a large good-grade body of ore on the extreme east end of the second level. This body gives promise of being one of the largest developed in the history of the mine.

Work was pushed early in the year on the fourth level, both east and west, to approximately the lateral extent of the first level. Diamond-drilling on the west end was discouraging as only two ore bodies of small dimensions were disclosed. Results were much better on the east end, where one abnormally large ore body, indicated by diamond-drilling last year, has so far exceeded the most optimistic expectations.

The fifth level east drift is being driven but has not yet reached what is considered to be the best area.

Both the second east and west drifts are being advanced into new country beyond limits previously explored. The west drift has reached its objective, the large porphyry mass near the west boundary. About 125 feet of mineralization has been traversed by the drift, but insufficient work has been done to justify a conclusion as to grade or extent. It is hoped that a core in the porphyry may be found which can be mined at a profit.

The second east drift is being advanced through No. 2 diabase dike to explore what is considered to be good ground east of the dike. This project is highly speculative, since very little is known of the area other than the structure on the surface.

Diamond-drilling

The total footage drilled underground during the year was 34,751 feet. No surface drilling was done this year, but an aggressive programme was carried on underground. Practically all of the holes were drilled systematically on our series of vertical sections, either flat or at an incline up or down. All of the ore bodies discovered during the year were first disclosed in diamond-drill holes. Diamond-drilling was used a little more extensively this year in order to outline the ore bodies more accurately. This resulted in better stope layouts and a considerable saving in other development work.

Ore Reserves

The probable ore reserves as of December 31, 1938, show an apparent reduction from the estimate as of December 31, 1937. This is largely due to the fact that further work during 1938 on three bodies, estimated at a total of approximately 35,000 tons included in the December 31, 1937, figures, proved them to be below ore grade. This tonnage has now been removed from probable ore reserve figures and placed with the possible low-grade reserve, which may at some future time be mined at a profit. This material averages from 0.06 ounces to 0.10 ounces per ton, or less than $3.50 at the present price of gold.

As at December 31, 1938, probable ore reserves, including broken ore, are estimated as follows:—

	Tons
Ore reserves, December 31, 1937	304,220
Added during 1938	98,908
Total	403,128
Less hoisted during 1938	154,608
Ore reserves as at December 31, 1938	248,520

The average estimated grade of reserves is 0.178 ounces. The average grade is estimated from diamond-drill holes and underground openings plus 20 per cent. dilution.

An additional quantity of low-grade material classed above as "possible low-grade reserve" has been indicated by diamond-drilling and underground openings, amounting to approximately 100,000 tons of an average grade of 0.08 ounces per ton.

Mining

A summary of mining operations for the year is given below:—

BROKEN ORE

	Tons
Broken during 1938	195,027
Less hoisted from stopes and development during 1938	154,608
Added to broken reserve during 1938	40,419
Carried over from 1937 (adjusted)	38,078
Broken ore reserve, December, 1938 (average estimated grade, 0.159 ounces)	78,497

ORE HOISTED

	Tons
From stopes	145,791
From development	8,817
Total to mill, 1938	154,608

Ore hoisted from the west contact and dike zones was 27 per cent. and ore from the central and east zones was 73 per cent. of the total. The proportion from each level was as follows: first, 17; second, 47; third, 25; and fourth, 11 per cent.

Milling

The mill performance for the year was as follows:—

Tons ore milled	154,409
Average milling rate per day.....tons	423
Average value heads, ounces per ton	0.1697
Average value tails, ounces per ton	0.0168
Average recovery, ounces per ton	0.1529

Early in the year an effort was made to increase the capacity of the mill by decreasing the fineness of the grind from approximately 75 per cent. minus 200 mesh to between 60 per cent. and 65 per cent. minus 200 mesh. This resulted in increased tonnage but also increased the tailing loss. An agitator mechanism was purchased for a solution storage tank, which was already installed in the mill, and this tank was cut into the agitation circuit in July. Recovery was immediately increased to approximately the average of 1937. The present average tonnage of 425 to 450 tons per day seems to be the most economical operating point.

Production

The total metal recovery in 1938 was as follows: gold, 23,394.646 ounces; silver, 5,030.93 ounces.

A tabulation is given below of results obtained since production was started in November, 1934:—

Year	Gross production	Tonnage	Recovery per ton	Operating profit	Cost per ton	Ore reserve at year end
						tons
1938	$832,497.67	154,409	$5.393	$179,305.04	$4.151	248,520
1937	709,620.59	132,764	5.344	104,007.32	4.494	304,220
1936	425,216.22	54,764	7.765	59,795.06	6.563	290,940
1935 1934	380,391.86	53,314	7.140	76,597.23	5.700	125,965
Total	$2,347,726.34	395,251	$5.941	$419,704.65	$4.878	.....

An average of 172 men was employed, of whom 114 were in the mine and 16 in the mill. G. W. Mitchell is manager.

Matachewan Hub Pioneer Mines, Limited

Matachewan Hub Pioneer Mines, Limited, was incorporated in February, 1936, to succeed Matachewan Pioneer Syndicate. The authorized capitalization is 3,000,000 shares of $1 par value, of which 1,888,476 have been issued. The officers and directors are: G. W. Pinner, president; T. B. Williamson, vice-president; C. G. Knott, secretary-treasurer; H. A. Steven, F. L. M. Chaplin, Bruce Thompson, and W. A. Crich, directors. The head office is at 330 Bay Street, Toronto. The mine address is Box 30, Matachewan.

No underground work has been done on the property since 1935, when a shaft was sunk to a depth of 50 feet and 42 feet of crosscutting was done.

A deposit of iron pyrites has been found on the property, and during 1938 considerable research work was done on the ore. At the end of the year a ton of the crushed and ground ore was being treated in a small pilot plant in Toronto.

H. A. Steven is in charge of the work.

Matona Gold Mines, Limited

Matona Gold Mines, Limited, has an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,949,757 have been issued. The officers and directors are: A. H. Waite, president; W. B. McPherson, secretary-treasurer, Garnet Chaplin and George Tough, directors. The head office is at 171 Yonge Street, Toronto. The mine address is Shiningtree.

The property consists of 19 claims in Tyrrell township, Matachewan area, district of Timiskaming.

There is a 2-compartment shaft, 215 feet deep, on the property, with levels at 125 and 215 feet. Some 634 feet of drifting and 104 feet of crosscutting were done on the first level in 1936, and a small amount of drifting was done on the second level in 1937. No underground work was done in 1938. About 200 feet of surface trenching was accomplished and 4 diamond-drill holes, having a total length of 1,284 feet, were drilled from surface.

A. H. Smith was manager.

Melba Gold Mines, Limited

Melba Gold Mines, Limited, was incorporated in July, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value. In May, 1938, the capitalization was increased to 3,500,000 shares of $1 par value, of which 1,773,125 have been issued. The officers and directors are: A. P. Earle, president; C. L. Jerrom, vice-president and managing director; G. F. Racine, secretary-treasurer; T. J. Day and W. S. Edwards, directors. The executive office is at 388 St. James Street West, Montreal, Que. The head office and mine office are at Bourkes.

The property consists of 27 claims, 1,080 acres, in Melba township, in the Bourkes section of the Kirkland Lake area, district of Timiskaming.

During 1937 a 2-compartment, inclined shaft was sunk to a depth of 246 feet, and levels were established at 185 and 225 feet. A small amount of development work was done on the first level, and over 900 feet of drifting and crosscutting was completed on the second level before the suspension of operations in December, 1937. In 1938 operations were carried on from August 11 to September 30, about 170 feet of drifting and 40 feet of crosscutting being accomplished on the 225-foot level. Two diamond-drill holes, totalling 267 feet in length, were drilled from underground.

H. Brassaw was manager, employing 8 men.

Mesabi Gold Mines, Limited

Mesabi Gold Mines, Limited, was incorporated in October, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value. The offiers and directors are: Henry D. Tudor, president; B. R. Mackenzie, vice-president; D. A. Ampleford, secretary-treasurer; C. C. Calvin and S. A. Caldbick, directors.

The property consists of 142 acres, formerly held by Bourkes Syndicate, in Benoit township, Bourkes section of the Kirkland Lake area, district of Timiskaming.

There is a shaft 400 feet deep on the property, with levels at 80, 180, 280, and 380 feet, on which about 181 feet of crosscutting, 1,658 feet of drifting, and 1,506 feet of diamond-drilling had been done at the end of 1937. During 1938 operations were carried on from the beginning of the year to the middle of June. About 50 feet of drifting was done on the 380-foot level, and 1,485 tons of ore and waste were hoisted.

An office, crusher-house, and mill building were erected, and the 100-ton mill acquired from McMillan Gold Mines, Limited, was installed.

The mill operated from April 20 to May 13 and treated 1,193 tons of ore, an average of nearly 50 tons per day.

H. F. Knutson was manager until April 29, and was succeeded by W. A. White, who was in charge until the cessation of mining operations.

In September the company was declared bankrupt, and F. M. Moffatt, 199 Bay Street, Toronto, was appointed as trustee.

Miles-Martin Kirkland Mines, Limited

Miles-Martin Kirkland Mines, Limited, which was incorporated in March, 1937, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,175,333 have been issued. The officers and directors are: J. A. McCorquodale, president; A. Coutts, vice-president; J. W. C. Cornell, secretary-treasurer; Howard Robertson, director. The head office is at 112 Yonge Street, Toronto. The mine address is Kirkland Lake.

The property consists of 16 claims, in Morrisette and Bernhardt townships, Kirkland Lake area, district of Timiskaming, and includes the Goodfish mine.

The examination of the property, which had been begun from the Costello shaft in the latter part of 1937, was completed in February, 1938, and the workings were allowed to flood.

Minto Gold Mines, Limited

Minto Gold Mines, Limited, was incorporated in July, 1930, with an authorized capitalization of 8,000 shares of no par value, all of which have been issued. The officers and directors are: John Knox, Jr., president and managing director; John Knox, Sr., vice-president; M. E. Knox, secretary-treasurer; A. Dorfman and J. Ingram, directors. The head office and mine office are at Wawa.

The property consists of the Minto, Jubilee, and Cooper mines, located in township 29, range 23, Michipicoten area, district of Algoma.

Operations at the Jubilee mine were resumed on May 23, and continued for the rest of the year. On the fifth level, where a new ore shoot was discovered, 537 feet of drifting and crosscutting and 170 feet of raising were accomplished. Three diamond-drill holes, totalling 213 feet in length, were drilled from underground. Hoisting began on September 4, and the ore was taken by truck to the mill on the Minto property. A total of 2,962 tons of ore were hoisted and milled.

On the Cooper property there is an old shaft about 65 feet deep, inclined at an angle of 45 degrees, from which no lateral work had ever been done. On

August 2 the work of slashing this shaft out to make 2 compartments was begun. A level was established at a depth of 50 feet, and some 210 feet of drifting and 100 feet of raising were done. Open stoping was carried on, and 4,889 tons of ore were hoisted and treated at the Minto mill. Surface exploration work consisted of 200 feet of trenching, 5 feet deep. A new timber headframe and ore bins were built.

R. D. Caylor was manager, employing 25 men, of whom 6 were in the Jubilee mine, 7 in the Cooper mine, and 6 in the Minto mill.

Moneta Porcupine Mines, Limited

Moneta Porcupine Mines, Limited, which was incorporated in 1910, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,543,860 have been issued. The officers and directors are: W. E. Segsworth, president; R. S. Robertson, vice-president; H. B. Clearihue, secretary-treasurer; R. J. Jowsey, J. D. Conover, and A. M. Reaper, directors. The head office is at 67 Yonge Street, Toronto. The mine office is at Timmins.

The company owns 8 claims, 320 acres, situated west of and adjacent to the Hollinger mine, in the township of Tisdale, Porcupine area, district of Cochrane. The mine workings are on the northeast quarter of the south half of lot 12, concession II.

Development work previous to 1936 consisted of two shallow shafts, 85 and 125 feet deep, from which about 600 feet of lateral work was done. Present operations are all conducted through the 3-compartment, vertical, main shaft. The sinking of this shaft, which had been in progress at the end of 1937, was continued in the spring of 1938 to a total depth of 1,004 feet. The following table shows the amount of lateral development work done at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	965	39	1,004
150-FOOT LEVEL:			
Drifts	458	444	902
Crosscuts	263	34	297
Raises	71	81	152
275-FOOT LEVEL:			
Drifts	448	243	691
Crosscuts	282	.....	282
Raises	166	.....	166
400-FOOT LEVEL:			
Drifts	472	1,810	2,282
Crosscuts	232	47	279
Raises	133	.....	133
525-FOOT LEVEL:			
Drifts	456	941	1,397
Crosscuts	221	32	253
Raises	126	.....	126
675-FOOT LEVEL:			
Drifts	.....	944	944
Crosscuts	.....	203	203
Raises	.....	184	184
825-FOOT LEVEL:			
Drifts	.....	815	815
Crosscuts	.....	172	172
975-FOOT LEVEL:			
Drifts	.....	769	769
Crosscuts	.....	120	120

Ten diamond-drill holes, totalling 8,833 feet, were drilled from surface, and 124 holes, having a total length of 17,775 feet, were drilled from underground.

The tonnage hoisted during the year was as follows:—

	Ore	Waste
	tons	tons
From underground	59,030	18,953
From the stock pile	14,500	.....
Total	73,530	18,953

The new cyanide mill, which went into operation at the end of 1937, operated throughout 1938 at an average daily rate of 149.5 tons, and treated 54,576 tons of ore.

The old office building was turned into a residence, and a new office was erected. An addition to the assay office was built, and an electric furnace was installed. Other buildings erected included a lime-house, a waste bin, and an oil-house.

J. D. Barrington was manager, employing an average of 105 men throughout the year, of whom 58 were underground and 13 in the mill.

Morris Kirkland Gold Mines, Limited

Morris Kirkland Gold Mines, Limited, which was incorporated in January, 1935, has an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors are: W. B. Robb, president; Jas. E. Day and J. P. Arnott, vice-presidents; E. E. Meadows, secretary-treasurer; H. P. Armstrong, Dr. W. H. Bennett, L. Hurtubise, and G. W. Morris, directors. The head office is at 156 Yonge Street, Toronto. The mine address is King Kirkland.

The property consists of 5 claims, 296 acres, in Lebel township, Kirkland Lake area, district of Timiskaming.

In 1938 the mine operated from January 1 to August 10, during which time the 3-compartment shaft was sunk a further 15 feet to a total depth of 1,250 feet, and 615 feet of drifting, 277 feet of crosscutting, and 304 feet of raising were done. Underground diamond-drilling amounted to 13,413 feet. The pumps were kept working until October 23, then the workings were allowed to fill. At the end of November the mine was again dewatered and sinking operations were resumed the last week of December.

The mill operated until August 30 at an average rate of 100 tons per day. A total of 22,929 tons was treated. On November 1 the mill was leased to Upper Canada Mines, Limited, and was used by the latter company to treat ore from the Upper Canada mine during the rest of the year.

O. R. Wray was superintendent, employing an average of 41 men, 21 of whom were underground and 7 in the mill.

Naybob Gold Mines, Limited

Naybob Gold Mines, Limited, was incorporated in January, 1934, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 3,173,809 have been issued. The officers and directors are: Robert J. Naylor, president; Richard N. Clarke, vice-president; Jos. Sheedy, secretary; Harvey J. Haddleton, treasurer; G. E. Cutliffe, assistant secretary-treasurer; Jos. Montgomery, George E. Beggs, John G. Jones, and Sherman J. Le Pard, directors. The head office is at 85 Richmond Street West, Toronto. The mine address is Box 605, Timmins.

The property, formerly the Hayden mine, is situated 3½ miles due south of Timmins and consists of 16 claims, which lie on both sides of the Deloro-Ogden township line, Porcupine area, district of Cochrane.

Underground operations, which had ceased in November, 1937, were resumed in February, 1938, and continued to the end of the year. In the late summer the sinking of a 2-compartment winze in the carbonate ore zone was begun from the 700-foot level to an objective depth of 850 feet. At the end of the year 124 feet of sinking had been accomplished. The following table shows the amount of underground development work done at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	719	.....	719
WINZE	.....	124	124
100-FOOT LEVEL:			
Drifts	128	150	278
Crosscuts	330	.....	330
200-FOOT LEVEL:			
Drifts	85	92	177
Crosscuts	198	78	276
300-FOOT LEVEL:			
Drifts	3,109	142	3,251
Crosscuts	1,514	.....	1,514
Raises	291	88	379
400-FOOT LEVEL:			
Drifts	869	471	1,340
Crosscuts	1,103	13	1,116
Raises	302	111	413
550-FOOT LEVEL:			
Drifts	.....	649	649
Crosscuts	35	160	195
700-FOOT LEVEL:			
Drifts	3,025	847	3,872
Crosscuts	2,096	180	2,276
Raises	817	89	906

Diamond-drilling amounted to 10 holes, totalling 8,150 feet, drilled from surface, and 45 holes, totalling 4,548 feet, drilled from underground. Some 22,890 tons of ore and waste were hoisted, and 10,339 tons of ore were milled.

During the first eight months of the year plans were being made to increase the capacity of the mill to 150 tons a day, and milling operations consisted mainly of testing a number of flow-sheets in order to establish the most suitable process. The enlarged mill commenced operation in November and operated for the rest of the year.

The equipment added to the mill included the following: Traylor TY gyratory crusher, double-deck Niagara vibrating screen, 4 Dodge conveyers, Akins classifier, Denver jig, Denver simplex pump, 3 Denver agitators, 2 thickeners, Denver ball mill, Canadian Allis-Chalmers SRL sand pump, Merrill-Crowe clarifier and vacuum tank, Perrin precipitation press, Gardner Denver 250-cubic-foot compressor, Fairbanks-Morse centrifugal pump, Canadian Allis-Chalmers DOR-BM centrifugal pump, 2 Babcock-Wilcox and Goldie-McCulloch sand pumps, 3½ k.v.a. English Electric generator, and a Wabi Rockwell-type single-chamber bullion furnace.

The following new plant equipment was installed: Canadian Ingersoll-Rand double-drum hoist, Sullivan double-drum winze hoist, new heating plant, and pressure system for supplying water to residence buildings.

A crusher-house, conveyer-house, lime-house, storehouse, and boiler-house were built during the year. Three buildings formerly used as camps and cookery were remodelled for use as staff residences and an office.

R. V. Neily was manager during the early part of the year, and was succeeded by Charles Ordway. After Mr. Ordway's death, I. M. Marshall became manager. An average of 72 men was employed during the year.

New Golden Rose Mines, Limited

New Golden Rose Mines, Limited, was incorporated in April, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: J. Bradley Streit, president; W. M. Archibald, vice-president; J. E. Robinson, secretary; Jas. E. Riley, treasurer; J. J. Warren and M. D. Taylor, directors. The head office is at 302 Bay Street, Toronto.

The property is located in Afton township, Timagami Provincial Forest, district of Sudbury, and includes the Afton mine. Operations are carried on under the direction of the Consolidated Mining and Smelting Company of Canada, Limited. An account of the work done on the property during 1938 appears on page 99 of this report. The mine address is care of the superintendent, W. E. Aitchison, Glen Afton; or care of the manager, D. C. McKechnie, Sudbury

North Whitney Mines, Limited

North Whitney Mines, Limited, was incorporated in July, 1936, with an authorized capitalization of 3,500,000 shares of no par value, of which 1,823,590 have been issued. The officers and directors are: Wm. B. Gunton, president; F. G. Gardiner, vice-president; Wm. E. Smith, secretary-treasurer; Charles N. Gray, S. G. Underhill, H. F. Parkinson, and H. A. Willis, directors. The head office is at 330 Bay Street, Toronto. The mine address is Pamour.

The property consists of 7 claims, 285 acres, in concession VI, Whitney township, Porcupine area, district of Cochrane. It was operated some years ago by Keora Mines, Limited, and South Keora Mines, Limited.

The former operators sank three shafts on the property: No. 1, inclined at 60 degrees, is 55 feet deep; No. 2 is 110 feet deep; and No. 3 is 250 feet deep. A level was established from the bottom of each shaft, and considerable lateral work was done.

Between February 1 and June 1, 1938, the present operators dewatered No. 1 and No. 2 shafts and made a geophysical survey. Development work accomplished during this period amounted to about 40 feet of drifting on the 55-foot level, and 140 feet of drifting and 80 feet of crosscutting on the 110-foot. Some 7,174 feet of diamond-drilling was done from underground. Following the cessation of operations the mining plant was removed from the property.

A small office building and a 20-foot timber headframe at No. 2 shaft were erected.

A. O. Hall was manager, employing 9 men.

Northern Empire Mines Company, Limited

The Northern Empire Mines Company, Limited, was incorporated in July, 1932, with an authorized capitalization of 500,000 shares of $1 par value, of which 400,000 have been issued. The officers and directors are: Fred Searls, Jr., president; H. E. Dodge, secretary-treasurer; Gus Mrkvicka, assistant secretary-

treasurer; Geo. B. Agnew and A. Douglas, directors. The head office and mine office are at Empire. The executive office is at 14 Wall Street, New York, N.Y.

The property consists of 10 claims, 400 acres, on the Longlac–Port Arthur branch of the Canadian National Railways, in Summers township, Beardmore area, district of Thunder Bay.

Work at this property was continued throughout 1938. The shaft was sunk a further 441 feet, to a total depth of 1,920 feet, and new levels were established at 1,560, 1,725, and 1,900 feet. The sinking of a winze from the 750-foot level was begun in December, and about 18 feet of work was accomplished by the end of the year. The mining method used is resuing cut-and-fill. There were 59,688 tons of ore and waste hoisted, and the mill treated 59,332 tons of ore, an average of 180 tons per day.

The following table shows the development work accomplished at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
Shaft	1,479	441	1,920
Winze	.....	18	18
75-foot level:			
Ore-pass raise	63	.....	63
150-foot level:			
Drifts	3,476	.....	3,476
Crosscuts	208	.....	208
Raises	350	.....	350
300-foot level:			
Drifts	3,790	.....	3,790
Crosscuts	346	.....	346
Raises	437	192	629
450-foot level:			
Drifts	3,530	.....	3,530
Crosscuts	541	.....	541
Raises	224	166	390
600-foot level:			
Drifts	3,240	.....	3,240
Crosscuts	1,074	.....	1,074
Raises	414	105	519
700-foot sublevel:			
Drifts	.....	340	340
750-foot level:			
Drifts	.....	255	255
Crosscuts	1,000	.....	1,000
Raises	60	375	435
1,400-foot level:			
Drifts	368	1,738	2,106
Crosscuts	213	.....	213
Raises	.....	11	11
1,560-foot level:			
Drifts	.....	115	115
1,725-foot level:			
Drifts	.....	1,648	1,648
Raises	.....	122	122

Three diamond-drill holes, having a total length of 1,500 feet, were drilled from underground.

During 1938 a steel headframe 65 feet high was erected to accommodate a new Nordberg 300 h.p., double-drum electric hoist. A 25- by 45-foot addition to the hoist-room, a machine shop, new steel ore and waste bins, and an inclined waste conveyer, 150 feet long, were built. New equipment included 2 Westinghouse transformers, 2 skip and cage combinations, a 10- by 24-inch Dominion jaw-crusher, and miscellaneous shop equipment.

The following is taken from the report of the president for the year ending December 31, 1938:—

Tonnage milled during the year 1938 amounted to 59,332 tons, from which was produced $804,044.08, or $13.55 per ton. This compares with 65,026 tons at $10.90 recovered in 1937. In addition to this tonnage of ore, our cyanide plant treated on toll, 1,431 tons of flotation concentrate from the Tombill and Magnet Consolidated properties.

Development cost of $2.00 a ton is abnormal and still reflects the effect of the diabase sill in putting the mine behind schedule in its development. It is planned to continue rapid development during the current year. The shaft has reached the 1,900-foot level, and sinking is still in progress. It is also necessary to have an additional shaft or winze through the sill, as a second exit and for ventilation, and this opening is now in progress.

Production to date has substantially exhausted the ore remaining above the sill except for a few thousand tons remaining between the 600-foot level and the top of the sill in the easterly end of the mine. Incidentally, it is of interest to note that the diabase magma appears to have leached and altered the ore shoots for a vertical distance of 30 to 50 feet above its top so that they are unpayable in this interval, whereas underneath the sill the ore comes up to the diabase contact.

Beneath the sill, driving of the 1,400-foot level was followed by the 1,725-foot level, and now the intervening 1,560-foot level is being driven. Crosscutting from the shaft on the 1,900-foot level is also in progress.

An average of 182 men was employed, 125 of whom were in the mine, 12 in the mill, and 40 on construction work. Arthur Kendall is mine manager.

Omega Gold Mines, Limited

Omega Gold Mines, Limited, was incorporated in May, 1935, with an authorized capitalization of 5,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: J. P. Bickell, president; E. D. Fox, secretary-treasurer; Balmer Neilly, A. Dorfman, E. M. Thomson, and Dr. A. F. Demary, directors. R. J. Ennis is consulting engineer. The executive office is at 15 King Street West, Toronto. The head office and mine office are at Larder Lake.

The property consists of 25 claims, approximately 799 acres, in McVittie township, Larder Lake area, district of Timiskaming.

Operations continued throughout 1938. The following development work was accomplished: 5,286 feet of drifting, 253 feet of crosscutting, 1,698 feet of raising, and 46 feet of box-holing. Some 14,008 feet of diamond-drilling was done from underground. The mill treated 176,852 tons of ore during the calendar year, operating at an average of 484.5 tons a day.

A new 5- by 16-foot regrinding mill, manufactured by the Dominion Engineering Company, Limited, and a 150 h.p. Canadian Westinghouse motor were added to the milling equipment.

The following is taken from the report of the manager for the fiscal year ending March 31, 1939:—

Production

Ore treated.....tons	177,388	
Value per ton (0.1592 ounces).....	$5.572	
Gross value.....	$988,405.94	
Bullion recovered:		
Gold (24,550.430 ounces at $35.236).....		$865,053.84
Silver (3,494.900 ounces at $0.415).....		1,449.46
Total value.....		$866,503.30
Recovered per ton (0.139 ounces).....	$9.49	
Bullion melting, refining, and handling charges.....		10,618.64
		$855,884.66

PRODUCTION SINCE THE BEGINNING OF MILLING OPERATIONS IN 1936

Period	Months	Tons milled	Value per ton	Gross value	Recovery per ton	Total value
Feb. 1, 1936, to Mar. 31, 1936	2	17,352	$4.286	$74,369.00	$3.557	$61,726.28
Apr. 1, 1936, to Mar. 31, 1937	12	132,642	5.00	663,010.70	4.324	573,504.29
Apr. 1, 1937, to Mar. 31, 1938	12	167,051	5.36	895,393.36	4.668	779,766.65
Apr. 1, 1938, to Mar. 31, 1939	12	177,388	5.572	988,405.94	4.885	866,503.30
Total		494,433	$5.30	$2,621,179.00	$4.614	$2,281,500.52

While making the year's production, ore reserves were maintained from new development.

Mining

The ore milled during the year was obtained from the following sources:—

	Tons
Development	15,520
Stoping	161,868
Total	177,388

The ore hoisted from the various levels was:—

Level	Tons	Ounces per ton	Total ounces
300-foot	42,235	0.142	5,986
425-foot	34,695	.141	4,886
550-foot	30,818	.178	5,489
675-foot	30,233	.185	5,587
800-foot	18,216	.185	3,368
1,050-foot	9,047	.122	1,099
1,175-foot	12,215	.126	1,539
Total	177,459	0.1575	27,954

Development

Development done during the year was:—

	Feet
Drifting	5,449
Crosscutting	364
Raising	1,824
	7,637
Diamond-drilling	15,463
	cu. ft.
Stations, including slashing out of station crosscuts	1,130

Some further work of enlarging shaft stations and station crosscuts was completed during the year. The ore pass with its loading pocket below the 1,050-foot level was completed to all levels above. Some 75,220 tons of backfill were placed, of which 29,370 tons were gravel, 27,890 tons from surface dump rock, and the balance development rock. A gravel pit, 3½ miles from the mine and sufficient to take care of the mine's fill requirements for several years, was purchased. A truck and semi-trailer, handling 12 tons of fill per load, is now used to haul over 200 tons of fill per day to the mine.

The chief ore developments were:—

No. 1 Vein.—Stoping development on the western ends of the No. 1 vein stopes on the 675-foot and 800-foot levels gave added production and added reserves. New ore was also found by extendng the 675-foot level east.

No. 2 Vein.—The best block of ore developed during the year was on vein No. 2 on the 1,175-foot level, where 50,000 tons of a grade of 0.155 ounces to the ton were added to reserves.

No. 4 Vein.—Extensions in ore were made on the 425-, 550-, 675-, and 800-foot levels. The best grade was found on the 425-foot level east.

Nos. 6 and 7 Veins.—These veins, previously worked on the 1,050-foot level, were cut by a west crosscut on the 1,175-foot level. The ore found was of good grade but erratic. Further ore

will be mined at this point. The dacitic band of rocks, in which these veins and veins Nos. 2 and 4 occur, continues west of the present workings on the 1,175-foot level and will be further explored. Some ore is also indicated on upper levels in this band to the west of No. 2 shaft.

Nos. 12 and 14 Veins.—Two hundred feet of drifting on the 800-foot and 1,175-foot levels, 200 feet south of the main No. 1 vein, showed erratic gold assays in a band of quartz- and sulphide-impregnated Keewatin lava. Average values were below commercial grade but justify further exploration by diamond-drilling at other points.

Ore Reserves

Production during the year was up to the reserve estimate, allowing for a little dilution of development rock. The ore reserves are estimated at about the same as a year ago, being 520,000 tons, averaging 0.160 ounces ($5.60) per ton.

Operating Costs

Operating costs, which include all general and administration costs exclusive of depreciation, were somewhat higher than for the previous year, chiefly due to increased development expenditures, but were still low, as shown by the following table:—

	Total cost	Cost per ton milled
Development	$116,199.97	$0.655
Mining	380,691.05	2.146
	$496,891.02	$2.801
Milling	209,536.79	1.181
	$706,427.81	$3.982
Administration and taxes	7,386.45	.042
Total	$713,814.26	$4.024

Milling Operations

The mill tonnage for the year was 177,388 tons, an average of 486 tons per day, or 28 tons per day higher than for the previous year. Extraction was a little higher. A new 5- by 16-foot concentrate regrinding mill was put into operation towards the end of the year, increasing somewhat the gold extraction by cyanidation.

Milling costs were down somewhat, the saving being in the cost of crushing

	Total cost	Cost per ton milled
Crushing	$33,946.95	$0.191
Flotation	80,948.27	.456
Cyanidation	79,204.35	.447
Refining and assaying	11,728.82	.066
Mill alterations	3,708.40	.021
Total	$209,536.79	$1.181

Additions to Plant, Buildings, and Equipment

These were less than in the previous year, and no capital expenditures are now under way.

Underground equipment, including loading pocket of steel and 2 loading shovels	$9,166.02
Mine ventilation fan and drive	1,051.26
5- by 16-foot regrind tube mill and drive	11,986.78
Mill and surface equipment	676.00
Total	$22,880.06

General

The profits derived from the year's operation were larger than in the previous year and permitted of a substantial decrease in liabilities. Development throughout the mine replaced the ore mined, which graded 21 cents per ton higher than in the previous year. The best block of new ore developed was on the deepest or 1,175-foot level. The favourable band of dacite rocks, which lies under the main fault vein No. 1 and contains veins Nos. 2, 4, 6, and 7, is showing some fair ore indications west of No. 2 shaft.

A. D. Campbell was manager, employing an average of 198 men, 128 in the mine, 22 in the mill, and 48 on construction work.

Pamour Porcupine Mines, Limited

Pamour Porcupine Mines, Limited, which was incorporated in March, 1934, has an authorized capitalization of 5,000,000 shares of no par value, all of which have been issued. The officers and directors are: James Y. Murdoch, president; G. H. Rainville, vice-president; J. R. Bradfield, secretary; R. G. Rudolf, treasurer; Jules R. Timmins, Leo H. Timmins, M. Kendall, W. Meen, and J. E. Perrault, directors. The executive offices of the company are at 804 Royal Bank Building, Toronto. The head office and mine office are at Pamour.

The main property held by the company is located in concessions V and VI of Whitney township, Porcupine area, district of Cochrane, and contains 1,160 acres. The company owns three additional claims located at the south end of Three Nations lake.

Operations continued throughout 1938. The main shaft was sunk a further 867 feet, to a total depth of 1,958 feet. There are two other shafts on the property, sunk by former operators to depths of 110 and 220 feet.

The following is taken from the report of the general manager for the year ending December 31, 1938:—

Mine

Sinking of the main shaft was continued, and at the end of the year the bottom of this shaft was 34 feet above the 2,000-foot horizon. Stations were cut at the 1,200-, 1,400-, 1,600-, 1,700-, 1,800-, and 1,900-foot levels. This shaft has now reached its objective of depth for the present development project, but it will be continued to the 2,100-foot level to facilitate resumption of sinking operations at any future date.

An extensive programme of development has been projected, which includes main trunk-line drives east and west on the 800-, 1,200-, and 1,600-foot levels and following this up with crosscutting diamond-drill holes. The 400-, 600-, and 1,000-foot levels will also be extended east and west as required. This entails moving the underground crusher from its present location on the 500-foot level to a similar location on the 1,700-foot level, with a loading pocket at the 1,900-foot level, and carrying the ore and waste pass systems down to the new levels. The ore and waste pass raises are now completed to the 1,000-foot level, and raising has started from the 1,200- and 1,400-foot levels.

During the year 29,447.3 feet of development work has been done, including 6,033.3 feet of stope development. Following is the development record of the mine:—

	1938	Total to date
	feet	feet
Shafts	903.6	2,325.1
Winzes	27	126
Drifts	11,184.5	30,654.7
Crosscuts	2,794.7	10,723
Raises	6,816	16,981.5
Box-hole raises	1,718.2	5,514
Stope development	6,033.3	15,903.1
Total	29,477.3	82,227.4

Most of this development was done on the 200-, 400-, and 600-foot levels, but during the last part of the year trunk-line development was under way on the 800- and 1,000-foot levels. A start has also been made, getting away from the stations on the 1,200- and 1,600-foot levels. The lengths of the levels, east and west, are now as follows:—

Level	Total length	Extension during 1938
	feet	feet
200-foot	4,645	.....
400-foot	6,470	1,785
600-foot	3,475	880
800-foot	1,225	1,225
1,000-foot	1,647	1,647
1,200-foot	200	200
1,600-foot	261	261
Total	17,923	5,998

During the last half of February and the first half of March, the production was doubled, and with the crusher at the 500-foot level, the development objective during 1938 was still primarily to open up new ore on the 200- and 400-foot levels. This condition will obtain until the crusher can be moved to the 1,700-foot level, but in the meantime, stopes will be opened up on lower levels, and 5 stopes have already been made ready for production on the 600-foot level.

Mine production in 1938 was as follows:—

	Tons
200-foot level	182,723
400-foot level	310,957
600-foot level (development)	19,938
Lower levels (development)	1,575
Total	515,193

Diamond-drilling

No surface drilling was done during the year, but 4 drills were kept in continuous operation underground, where 402 holes were drilled, aggregating 73,578.1 feet. In this drilling a total of 6,980.5 feet, or 9.5 per cent. of the core showed mineralization. The record is as follows:—

	Surface	Underground	Total
	feet	feet	feet
Old drilling	6,569.8	.....	6,569.8
1934 (16 holes)	5,966.5	.....	5,966.5
1935 (55 holes)	29,105.5	.....	29,105.5
1936 (59 holes)	676	14,799.5	15,475.5
1937 (272 holes)	19,355.5	46,635.4	65,990.8
1938 (402 holes)	.....	73,578.1	73,578.1
Total	61,673.3	135,013	196,686.3

Ore Reserves

From information obtained in diamond-drilling, drifting, crosscutting, and raising, and from actual mining in the area above the 600-foot level, and including 303,000 tons of broken ore in stopes, ore in sight is estimated at 1,748,665 tons, averaging 0.159 ounces gold per ton. This is an increase over the previous year's estimate of 104,665 tons. In addition to this ore in sight, two large sections of good-grade ore have been located by diamond-drilling on the 1,000-foot level, one lying on each side of the great fault near the main shaft. To date these ore bodies have been drilled for a total length of 900 feet, and drilling is continuing; and also development of this section has begun, but there is not sufficient development work completed yet to allow of estimating tonnage and grade.

Mill

Average tonnage milled for the year was 1,411 tons per day. Beginning the year at about 800 tons per day, the tonnage was doubled in February and March to a 1,500-ton-per-day basis The average tonnage during the last three-quarters of the year was 1,514 tons per day. The record of production is as follows:—

Period	Tonnage milled	Heads assay, ounces per ton	Gold marketed	Recovery, per cent.
1st quarter	98,719	0.221	$714,176.97	93.29
2nd quarter	136,883	.208	929,225.42	92.48
3rd quarter	139,451	.194	882,672.62	92.70
4th quarter	140,140	.172	787,754.72	92.21
Total	515,193	0.197	$3,313,829.73	92.65

The mill operated 99.42 per cent. of total possible running time. In doubling the mill tonnage no fundamental changes were made in the process, but during the year certain refinements, particularly finer grinding of the flotation concentrates, has increased the efficiency to the extent that while there was a drop of over $1.00 in the heads, the percentage of recovery has remained constant.

Construction

During the year the following construction was completed: a 96- by 60-inch double-drum cage hoist, which was put into operation on January 22; a 9- by 10-foot Dominion ball mill, conveyers, etc., in February; also a new change-house, office building, oil-house, powder magazine, and 2 residences.

In addition to small equipment and standby units of crusher motor and duplicate pumps on surface and underground, the following installations were made: a 2,500-foot compressor, drill-sharpener, 300-gallon pump on the 1,000-foot level, two 5-ton locomotives, 60 ore cars, electric cap lamps.

The average number of men employed in 1938 was 507, divided as follows: underground, 349; mill, 32; surface, 93; construction, 31. R. M. Macaulay was general manager.

Paymaster Consolidated Mines, Limited

Paymaster Consolidated Mines, Limited, which was incorporated in February, 1930, has an authorized capitalization of 9,000,000 shares of $1 par value, of which 8,629,000 have been issued. The officers and directors are: E. H. Walker, president and managing director; A. S. Fuller, vice-president; E. L. O'Reilly, secretary-treasurer; Chas. E. Cook, Jos. Errington, C. J. O'Brien, and H. M. Pryale, directors. The head office and mine office are at South Porcupine. The executive office is at 19 Melinda Street, Toronto.

The main property, in Deloro and Tisdale townships, Porcupine area, district of Cochrane, contains approximately 748 acres and consists of the amalgamated holdings of several smaller former operating companies. The company also owns another 160 acres in Tisdale township, 920 acres in Cody township, and 80 acres in Whitney township, all in the district of Cochrane, and holds under lease 500 acres in Leonard and Tyrrell townships, Matachewan area, district of Timiskaming.

As a result of the activities of many former operators there are nine shafts on the main property. Four of these have been used by Paymaster Consolidated Mines, Limited, for hoisting purposes. The others are used for ventilation purposes, or not at all. During 1938, No. 5 shaft was sunk a further 879 feet, to a total depth of 2,685 feet, and new levels were established at 1,700, 1,825, 1,950, 2,075, 2,200, 2,325, 2,450, and 2,575 feet. No. 5-1,050 3 winze, which begins at the 1,050-foot level, was deepened a further 508 feet to the 2,075-foot level, where a connection was made with the workings from No. 5 shaft. Level workings from this winze were also established at 1,740 and 1,910 feet.

The depths of the various shafts and winzes are included in the table below, which is arranged to show the amount of development work done during 1938, the section of the mine in which it has been done, and the total:—

	1938				Total			
	Drifting	Cross-cutting	Raising	Sinking	Drifting	Cross-cutting	Raising	Sinking
	feet	feet	feet	feet	feet	feet	feet	feet
No. 1 SHAFT[1]								80
No. 2 SHAFT[1]								814
No. 3 SHAFT[1]								400
"Tunnel" level					144	130		
38-foot level					76	27		
100-foot level	48	95			872	1,156		
200-foot level	144				537	220		
300-foot level			145		4,248	2,278	145	
400-foot level	27	109			1,513	1,714		
600-foot level	191	436	146		1,361	784	146	
800-foot level					892	839		
475-foot level[2]						1,537		
No. 4 SHAFT[3]								253
100-foot level					450	312		
200-foot level					467	240		
No. 5 SHAFT[4]				879				2,685
No. 7 SHAFT[4]								75
No. 8 SHAFT[4]								185
No. 9 SHAFT[4]								185
No. 5-1050-1 WINZE[4]								162
No. 5-1050-2 WINZE[4]								582
No. 5-1050-3 WINZE[4]				508				1,065
60- and 75-foot levels					988	393		
120-foot level					1,171	303		
180-foot level	26		5		2,769	713	5	
300-foot level					2,543	887		
400-foot level					3,430	1,493	186	
500-foot level					1,406	927	67	
600-foot level	155				2,095	244	53	
750-foot level	243				1,591	131		
900-foot level			130		2,217	238	252	
1,050-foot level	351	387	28		5,453	3,994	720	
1,200-foot level	21				2,919	407	110	
1,325-foot level					1,933	202	175	
1,450-foot level			260		2,464	687	462	
1,575-foot level	594	136	431		4,274	1,678	431	
1,740-foot level	953	209			953	209		
1,910-foot level	171	166			171	166		
2,075-foot level	1,529	1,117	93		1,529	1,117	93	
2,575-foot level		27	99			27	99	
No. 6 SHAFT[5] (inclined)								457
No. 6-400-1 WINZE[5]								615
100-foot level					266	908		
200-foot level	122		15		2,804	317	138	
300-foot level	186				4,807	1,847	157	
400-foot level	459	226	71		2,882	649	266	
525-foot level	385	196			1,339	425	126	
675-foot level	935	96	94		2,091	223	338	
800-foot level	198	179			475	316	148	
1,000-foot level	106				210	173	163	

[1]On former Premier Paymaster property.
[2]Work done from the 475-foot level of the Ankerite mine.
[3]On former United Mineral Lands property.
[4]On former Dome Lake property.
[5]On former West Dome property.

Diamond-drilling in 1938 totalled 15,237 feet from surface and 41,535 feet from underground. A total of 193,117 tons of ore was hoisted during 1938, of

which 190,107 tons were milled, the mill operating throughout the year at an average rate of 521 tons per day.

During the year the 92-foot headframe of No. 5 shaft, which had been started in 1937, was completed. Additions were built to the crusher-house and mill, and an addition to the dry-house was begun.

An average of 363 men was employed during the year, of whom 240 were in the mine, 31 in the mill, and 79 on surface work. Chas. E. Cook is general manager.

The following is taken from the report of the general manager for the fiscal year ending June 30, 1939:—

Mining

The mine development programme consisted of the following:—

No. 5 Shaft.—The major part of the development work during the year was carried out on the new levels below the 1,575-foot level. Headings were driven both from No. 5 shaft and from No. 3 winze and consisted of: an exploration crosscut to the west on the 2,575-foot level; a line drive to the east on the 2,075-foot level to connect with No. 3 winze workings and also to provide an entry for the development of Nos. 3 and 14 veins; drifts and crosscuts from the new levels opened last year in No. 3 winze to develop No. 8 vein and auxiliary veins in the No. 8 vein ore zone; the cutting of ore and waste pockets, the installation of loading stations, and equipping of stations at the new levels at No. 5 shaft.

In addition to the above, considerable development work was carried out on the No. 3 vein between the 1,050- and 1,575-foot levels. Ore from stopes is now being drawn principally from those sections of the Nos. 3 and 8 veins developed between the 1,050- and 1,575-foot levels.

No. 6 Shaft.—New ore was developed on Nos. 10 and 21 veins and on westerly extensions of the No. 1 vein. Ore was drawn from these veins and also from No. 7 vein.

Nos. 2 and 3 Shafts.—A limited amount of development work was carried out during the past year, and the tonnage of ore delivered to the mill was increased from 100 to 150 tons per day.

Summary of Stoping, Development, and Diamond-drilling

Drifting	feet	7,464
Crosscutting	feet	5,783
Raising	feet	1,600
Sinking	feet	95
Station-cutting	cu. yds.	2,127
Diamond-drilling, surface	feet	10,292
Diamond-drilling, underground	feet	61,793
Ore stoped	tons	181,746
Ore from development work	tons	23,735
Waste hoisted	tons	60,823

Ore Reserves

Ore reserves have been increased 24.2 per cent. and the average grade well maintained. Details are as follows:—

	Tons	Ounces per ton
Probable ore	207,092	0.207
Positive ore (blocked out two or more sides)	387,896	.238
Broken ore	112,779	.235
Total	707,767	0.228

Milling

During the fiscal year there were milled 199,280 tons of ore, having an assay value of 0.222 ounces per ton. The average daily milling rate was 546 tons, as against 493.4 tons for the previous fiscal year, an increase of 10.65 per cent.

An intensive study of the ore and of the mill products was carried on in the company's ore dressing laboratory. This study indicated the advisability of treating the mill tailings by flotation,

with subsequent cyanidation of the concentrates. A 50-ton test plant was installed and operated, and confirmed the results obtained by study. Consequently a suitable retreatment plant is now being installed to handle the full tonnage of mill tailings.

Costs

The mining costs per ton broken were as follows: Nos. 2 and 3 shafts, $1.98; Nos. 5 and 6 shafts, $3.08. Following is an analysis of operating costs:—

	Total cost	Cost per ton milled
Diamond-drilling	$45,908.72	$0.23
Outside exploration	62.60	.....
Development Nos. 2 and 3 shafts	26,738.25	.14
Development Nos. 5 and 6 shafts	216,907.67	1.09
Mining Nos. 2 and 3 shafts	52,055.35	.26
Mining Nos. 5 and 6 shafts	484,949.42	2.43
Ore transportation	22,057.52	.11
Crushing and conveying	31,888.18	.16
Milling	132,332.15	.66
General expense	61,518.64	.31
Total	$1,074,418.50	$5.39

General

The total production for the fiscal year was $1,430,878.57.

Pickle Crow Gold Mines, Limited

Pickle Crow Gold Mines, Limited, was incorporated in January, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: J. E. Hammell, president; Robert Fennell, vice-president and secretary-treasurer; John Bland, assistant secretary-treasurer; Mrs. Eola Hammell and B. H. Budgeon, directors. The head office is at 25 King Street West, Toronto, and the mine address is Pickle Crow.

The property consists of 59 claims, totalling 2,537 acres, in the Pickle-Crow area, in the Patricia portion of Kenora district. It may be reached by airplane from Hudson or Sioux Lookout on the main western line of the Canadian National Railways, to Pickle lake, and from there over a 9-mile gravel road. Supplies are taken in by water from Hudson over Lac Seul, up the Root river, across a marine railway to Lake St. Joseph, and thence to Doghole Bay. A 30-mile truck road runs from Doghole Bay to the mine.

Production to the end of 1938 is as follows:—

	To Dec. 31, 1937	1938
Waste hoisted.....tons	34,919	23,400
Ore hoisted.....tons	214,506	135,808
Ore sorted.....tons	25,529	20,461
Ore ground.....tons	189,131	115,915
Gold recovered.....ounces	135,690	78,565

During 1938, the shaft was sunk a further 310 feet to a total depth of 1,995 feet, and stations were cut at 1,800 and 1,950 feet.

The following table shows the amount of underground development at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	1,685	310	1,995
125-FOOT LEVEL:			
Drifts	1,427	.....	1,427
Crosscuts	126	.....	126
Raises	134	.....	134
250-FOOT LEVEL:			
Drifts	1,135	.....	1,135
Crosscuts	222	.....	222
Raises	177	.....	177
375-FOOT LEVEL:			
Drifts	1,529	.....	1,529
Crosscuts	379	.....	379
Raises	114	.....	114
500-FOOT LEVEL:			
Drifts	1,561	.....	1,561
Crosscuts	291	.....	291
Raises	293	.....	293
625-FOOT LEVEL:			
Drifts	1,311	.....	1,311
Crosscuts	232	.....	232
Raises	277	.....	277
750-FOOT LEVEL:			
Drifts	1,875	.....	1,875
Crosscuts	461	735	1,196
Raises	168	.....	168
900-FOOT LEVEL:			
Drifts	1,417	.....	1,417
Crosscuts	217	.....	217
Raises	180	.....	180
1,050-FOOT LEVEL:			
Drifts	1,415	.....	1,415
Crosscuts	319	20	339
Raises	173	.....	173
1,200-FOOT LEVEL:			
Drifts	1,543	.....	1,543
Crosscuts	339	.....	339
Raises	183	147	330
1,350-FOOT LEVEL:			
Drifts	.....	648	648
Crosscuts	.....	465	465
Raises	.....	15	15
1,500-FOOT LEVEL:			
Drifts	.....	588	588
Crosscuts	.....	516	516
1,650-FOOT LEVEL:			
Drifts	.....	297	297
Crosscuts	15	581	596
1,800-FOOT LEVEL:			
Drifts	.....	182	182
Crosscuts	.....	676	676
1,950-FOOT LEVEL:			
Crosscuts	.....	583	583

The following table shows the amount of diamond-drilling completed to the end of 1938:—

	To Dec. 31, 1937		1938	
	Holes	Feet	Holes	Feet
Surface	104	37,427	32	18,208
Underground	220	19,063	5	1,041

During 1938 additions to the camp and plant buildings included a carpenter shop, chlorinating building, boiler-room, two bunk-houses, and extensions to the dry-house, shaft-house, dining-room, kitchen, and bakery. A Canadian Ingersoll-Rand centrifugal pump, capacity 125 gallons per minute, and a 125 h.p. Leonard boiler were added to the plant equipment.

During the year the average number of men employed daily was 289, distributed as follows: mine, 201; mill, 20; surface and general, 68. A. G. Hattie was manager.

The following is taken from the report of the manager for the 12 months ending December 31, 1939:—

Development

During 1938 no lateral development was done on the 125-, 250-, 375-, 500-, 625-, 900-, and 1,050-foot levels.

Diamond-drilling, Surface.—During 1938 thirty-two holes were drilled from the surface at different points on the property for a total footage of 18,208 feet. Seventeen of these holes were drilled along the strike of the shear zone reported last year, and towards which No. 738 north crosscut is now being driven. This drilling was done east and west of the area drilled last year and reported as 1,600 feet north, 30 degrees east of the shaft, which lies in claim No. 725, and proves the continuity of a strong shear zone extending over 2,000 feet. Of the 17 holes drilled on this break, 11 were drilled to the east, and a new area lying about 1,000 feet east of last year's drilling gave interesting and very encouraging intersections with ore possibilities. This area is in claim No. 744, approximately 3,500 feet north, 35 degrees east of the shaft.

The values were obtained in a definite quartz vein occurring in a schisted zone, near and at the contact of the porphyry and the greenstone.

Two holes drilled near the southeast corner of claim No. 738 and the northeast corner of claim No. 736 gave values which warrant further investigation. In this drilling the values occur in quartz stringers in the iron formation.

Diamond-drilling, Underground.—Five holes only were drilled underground during 1938, as follows: Two short holes were drilled from the walls of No. 660 east stope, No. 2 section, with negative results; three pilot holes were also drilled, one on the 1,350-foot level and two on the 1,800-foot level, all intersecting the vein on the respective levels. Results were checked by drifting.

Stoping.—During the year, stoping was carried out on levels to the 1,200-foot. The stopes have stood up to the grade and width expected from the development on the drifts. A total of 126,333 tons was produced from stopes during the year.

Hoisting.—During the year a total of 135,808 tons of ore were hoisted to the mill, of which 9,711 tons came from development. Some 23,400 tons of waste were hoisted to surface, the greater portion of this being dumped into No. 110 east waste pass, to be used for backfill underground.

Ore Reserves

During the year the broken ore reserve was increased from 3,165 tons at the beginning of the year to 6,928 tons at the end of the year, the increase being due to No. 760 east shrinkage stope, No. 1 section. At the year end there was sufficient ore left in place above the 1,200-foot level to operate the mill for two years at the present milling rate.

Below the 1,200-foot level sufficient ore had been developed to supply the mill for one year at the present milling rate. There was, therefore, at the year end sufficient developed ore to supply the mill for three years at the present milling rate. Drifting is still progressing on all levels below the 1,200-foot, with all faces still in ore at the year end.

Mill

The mill operated continuously throughout the year. A summary of milling operation for the year follows:—

Ore ground	tons	115,915
Waste picked	tons	20,461
Tons milled		136,376
Gold produced per ton milled	ounces	0.5900
Gold produced per ton ground	ounces	0.6929

RECOVERY OF GOLD AND SILVER

	Gold		Silver	
	Ounces	Per cent.	Ounces	Per cent.
By amalgamation	30,438.122	37.831	3,263.25	38.665
By cyanidation	48,126.865	59.817	5,176.56	61.335
Total recovery	78,564.987	97.648	8,439.81	100
Gold in tailings	1,892.347	2.352	.....	.....
Total gold	80,457.334	100	.....	.....

SUPPLIES USED IN MILLING

		Per ton milled
Balls	lbs.	2.03
Lime	lbs.	2.18
Cyanide	lbs.	.79
Zinc	lbs.	.1082
Litharge	lbs.	.1135
Lead nitrate	ounces	.1038

Costs

DEVELOPMENT

	Footage	Total cost	Cost per foot
Sinking	310	$32,745.69	$105.46
Crosscutting	4,061	65,307.80	16.08
Drifting	2,504	30,302.13	12.10
Raising	221	2,389.37	10.81
Stations	cu. ft. 19,144	16,674.51	.87

Cost of stations includes the reinforcing with steel and concrete of the stations on the 1,650-, 1,800-, and 1,950-foot levels.

A statement is attached showing total costs, as well as cost per ton and cost per ounce for each operation, and is self-explanatory.

SUMMARY OF COSTS, 1938

	Total cost	Cost per ton of ore milled	Cost per ounces of gold produced
Development	$182,703.32	$1.34	$2.33
Mining	481,334.41	3.53	6.13
Milling	147,330.59	1.08	1.87
Camp expense	12,493.57	.09	.16
Administrative expense	67,342.54	.49	.85
Total cost before depreciation	$891,204.43	$6.53	$11.34
Depreciation, etc.	125,645.23	.92	1.60
Total cost, including depreciation	$1,016,849.66	$7.45	$12.94

Supplies and Equipment Purchased during 1938

Power	$76,764.69
Explosives	93,530.71
Mill supplies	74,726.11
Construction	52,974.52
Fuels	10,153.15
Commissary supplies	97,635.70
General supplies	228,804.52
Total	$634,589.40

Labour

Wages paid during 1938 amounted to $544,121.84.

Pirate Gold Mines, Limited

Pirate Gold Mines, Limited, was incorporated in April, 1938, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 500,000 shares have been issued. The officers and directors are: Frank Hall, president; E. L. McKinnon, secretary-treasurer; L. P. Wood, vice-president; G. M. Grant Smith and H. T. Hooper, directors. The head office is at 347 Bay Street, Toronto. The mine address is Shiningtree.

The company holds 10 claims, 600 acres, in Macmurchy township, West Shiningtree area, district of Sudbury, including the former Shinintree and Kingston properties. It also has options to purchase several other claims.

There are shafts on both the Kingston and Shinintree claims, sunk by previous operators to depths of 114 and 100 feet, respectively, with a small amount of drifting on the 100-foot level on each property.

At the end of October, 1938, general repairs to the plant were begun. During the last week of December, 15 men were employed underground in the Kingston mine and had done 15 feet of drifting by the end of the month.

The work was done under the direction of Dan Dubriy, foreman.

Planet Gold Mines, Limited

Planet Gold Mines, Limited, was incorporated in January, 1937, with an authorized capitalization of 2,000,000 shares of $1 par value, which was increased to 3,000,000 shares in May, 1937. At the end of 1938 the number of shares issued was 1,872,042. No president has been appointed as yet. The other officers and directors are: D. S. Baird, vice-president; M. C. van der Voort, secretary; Mark Emery, treasurer; Peter Tagliamonti and Oscar R. Smith, directors. The head office is at 350 Bay Street, Toronto. The mine address is Boston Creek.

The company's holdings consist of 2 claims, and an option on a third claim, in Boston township, in the Boston Creek section of the Kirkland Lake area, district of Timiskaming, and 6 claims in the Michipicoten area, district of Algoma.

Work on the Boston Creek property was carried on from January to September, 1939. The 2-compartment shaft was sunk a further 28 feet, to a total depth of 48 feet. Some 300 feet of surface-trenching and 1,000 feet of diamond-drilling from surface were accomplished.

Construction during 1938 included a boiler-house, hoist-house, dry-house, carpenter and blacksmith shop, office, compressor-house, powder-house, fuse- and cap-house, and mill building.

New plant equipment installed included the following: 310-cubic-foot Ingersoll-Rand compressor, 8- by 10-inch steam-driven hoist, 60 h.p. locomotive-type boiler, crusher, steam-driven upright engine, and a Nutt ball mill. A few tons of shaft rock were run through the mill for test purposes.

D. S. Baird was in charge of the work, employing an average of 8 men.

Porcupine Lake Gold Mining Company, Limited

The Porcupine Lake Gold Mining Company, Limited, has a Dominion charter and is capitalized at 3,000,000 shares of no par value, of which 2,543,275 shares have been issued. The officers and directors are: C. E. Calvert, president; H. H. Sutherland, vice-president; Geo. McKeown, secretary-treasurer; J. R. L. Starr and N. E. Forgie, directors. The head office is at 112 Yonge Street, Toronto. The mine address is Porcupine.

The property consists of 6 claims, approximately 240 acres, in Whitney township, Porcupine area, district of Cochrane. It is situated less than a mile

from Porcupine station on the branch line of the Temiskaming and Northern Ontario Railway serving the Porcupine area.

The mine was operated throughout 1938. The 3-compartment, inclined shaft, which dips under Porcupine lake at an angle of 56 degrees, was sunk an additional 107 feet to a total depth of 855 feet, and a new level was established at 850 feet. The other levels are at 280, 362, 482, 603, and 723 feet. The following development work was accomplished during 1938: drifting, 880 feet; crosscutting, 287 feet; raising, 140 feet.

Some 4,856 tons of ore and waste was hoisted during the year. A 20-ton test mill was installed in the spring and operated from April 16 to the end of the year, treating 4,714 tons of ore. A wood stave pipe tailings line, 1,650 feet long, was built.

J. G. Sipprell was manager, employing an average of 26 men.

Preston East Dome Mines, Limited

Preston East Dome Mines, Limited, was incorporated in 1911, with an authorized capitalization of 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: E. Ward Wright, president; W. H. Bouck, vice-president; L. I. Hall, secretary-treasurer; D. G. H. Wright, managing director; H. Preston Coursen, S. A. Hayden, A. P. Herbert, and Stuart Playfair, directors. The head office is at 100 Adelaide Street West, Toronto. The mine address is South Porcupine.

The property consists of 6 claims, 240 acres, in Tisdale township, Porcupine area, district of Cochrane.

No. 1 shaft at this property was sunk several years ago to an inclined depth of 90 feet, and a level was established at this depth, on which a considerable amount of drifting and crosscutting has been done. The vertical, 5-compartment shaft, begun during 1937, was sunk a further 322 feet during 1938 to a total depth of 668 feet, and new levels were established at 425 and 550 feet.

The following table shows the amount of development work done on the various levels to December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT NO. 1	90	.....	90
SHAFT NO. 2	346	322	668
90-FOOT LEVEL:			
Drifting	787	198	985
Crosscutting	453	40	493
200-FOOT LEVEL:			
Drifting	1,824	142	1,966
Crosscutting	1,458	18	1,476
Raising	157	.....	[1]157
300-FOOT LEVEL:			
Drifting	910	389	1,299
Crosscutting	976	233	1,209
Raising	130	25	[2]155
425-FOOT LEVEL:			
Drifting	.....	82	82
Crosscutting	.....	633	633
Raising	.....	100	100
550-FOOT LEVEL:			
Drifting	.....	538	538
Crosscutting	.....	725	725
Raising	.....	20	20

[1]In addition, 173 feet of box-holes were cut during 1938.
[2]In addition, 285 feet of box-holes were cut during 1938.

The following diamond-drilling was accomplished during 1938:—

	Holes	Feet
Surface	11	1,862
Underground	82	14,461

A total of 22,160 tons of ore and waste was hoisted during the year.

In October the erection of a building to house a 300-ton cyanide mill was begun. At the end of the year the building had been completed and the equipment was partly installed. A crusher-house, a dry-house, and an extension to the hoist-house were also built.

V. A. James was manager, employing an average of 65 men throughout the year.

Raven River Mines, Limited

Raven River Mines, Limited, was incorporated in November, 1934, with an authorized capital of 2,500,000 shares of $1 par value, of which 1,666,859 have been issued. The officers and directors are: Paul A. Fisher, president; R. W. Farrar, vice-president; C. D. McGregor, secretary-treasurer; Wm. Weller and W. W. Snider, directors. E. M. Thomson is general manager. The head office is at 67 Yonge Street, Toronto. The mine office is at Larder Lake.

The property consists of 11 claims in Hearst and McVittie townships, Larder Lake area, district of Timiskaming. Seven of these claims comprise the former Harris-Maxwell mine.

The 2-compartment, vertical shaft is 438 feet deep, with level workings at 53, 100, 249, 325, and 420 feet, on which considerable lateral work has been done. During 1938 a 2-compartment vertical winze was sunk from the 420-foot level for a distance of 296 feet, and two new levels were established at 125-foot intervals. The following table shows the amount of development work accomplished during the year:—

Level	Drifts	Crosscuts	Raises
	feet	feet	feet
2nd	90	137	175
3rd	85	366	97
4th	119	120	383
5th	22	136	150
6th	269	216	.....
7th	292	286	12

Diamond-drilling amounted to 54 holes, totalling 5,906 feet, drilled from underground.

There were 35,828 tons of ore and waste hoisted. The mill operated throughout the year and treated 23,964 tons of ore, an average of 65.7 tons per day.

A new 7- by 6-inch, single-drum air hoist and a 20- by 20-inch Blake-type Allis Chalmers crusher were added to the plant equipment.

An average of 63 men was employed during the year, of whom 37 were in the mine and 9 in the mill. J. E. Jerome was mine superintendent.

Rebair Gold Mines, Limited

Rebair Gold Mines, Limited, was incorporated in March, 1938, with an authorized capitalization of 3,000,000 shares of $1 par value, 995,500 of which have been issued. The officers and directors are: H. J. Mollenberg, president;

R. E. Smith, vice-president; J. M. Baird, secretary-treasurer; E. J. Hart and F. J. Smith, directors. The head office is at 9 Adelaide Street East, Toronto. The mine address is Atikokan.

The company acquired the property of Rebair Gold Syndicate, consisting of 15 claims, situated 5 miles north of Atikokan, in Freeborn township, district of Rainy River.

Considerable surface exploration work had been done by Rebair Gold Syndicate when the present owners acquired the property. During the spring and summer of 1938 some 500 feet of surface-trenching was done, and 7 diamond-drill holes, totalling 790 feet, were drilled. A vertical, 2-compartment shaft was begun and had reached a depth of 42 feet when operations were suspended.

Buildings erected during 1938 included a headframe 42 feet high, a powder-house, a small building for storing fuse and caps, and an addition to the black-smith shop.

The plant used to sink the shaft consisted of a 250-cubic-foot Ingersoll-Rand portable gas compressor and a hand windlass.

L. W. Reed was manager, employing 5 men.

Red Crest Gold Mines, Limited

Red Crest Gold Mines, Limited, was incorporated in May, 1934, with an authorized capitalization of 3,000,000 shares of no par value, of which 2,326,500 have been issued. The officers and directors are: A. A. McKelvie, president; Horace G. Young, vice-president; F. L. Hutchinson, secretary-treasurer; W. C. Nicholson, R. W. Wallace, W. A. Taylor, and H. M. Porteous, directors. The head office is at 1178 Phillips Place, Montreal, Que. The secretary's office is at New Liskeard. The mine address is Golden Arm.

The property consists of 7 patented claims, totalling 181 acres, in Todd township, Pipestone Bay section of the Red Lake area, in the Patricia portion of Kenora district, and was formerly known as the Rowan Discovery.

Operations in 1938 were carried on until March 2. The following table shows the development work as at the end of 1937, during the 1938 period of operation, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	600	.....	600
150-FOOT LEVEL:			
Drifts	659	56	714
Crosscuts	254	60	314
275-FOOT LEVEL:			
Drifts	648	.....	648
Crosscuts	371	.....	371
425-FOOT LEVEL:			
Drifts	399	101	500
Crosscuts	272	55	327
575-FOOT LEVEL:			
Drifts	209	116	325
Crosscuts	160	80	240

The company reports that a series of flat diamond-drill holes, totalling 1,258 feet in length, was drilled from underground in 1938.

An average of 24 men, 12 of whom were in the mine, was employed for two months. T. L. Lynch was superintendent.

Red Lake Gold Shore Mines, Limited

Red Lake Gold Shore Mines, Limited, was incorporated in December, 1927, with an authorized capitalization of 5,000,000 shares of no par value. The officers and directors are: Chas. E. St. Paul, president; Henry A. Newman, vice-president; Ira E. Hough, secretary-treasurer; Gerald E. Welsh and Chas. V. Gallagher, directors. The president's address is 100 Front Street West, Toronto.

Operations at the company's property, consisting of 23 claims in Heyson and Dome townships, Red Lake area, Patricia portion of Kenora district, were continued until the end of August, 1938. Owing to the company's inability to secure the necessary funds for further exploration work, operations were then suspended and the workings were allowed to flood. In October the property was sold to Hasaga Gold Mines, Limited, for 250,000 shares of Hasaga stock. The shareholders received 1 share of Hasaga stock, subject to pool, for each 18 shares of Red Lake Gold Shore stock. A report on Hasaga Gold Mines, Limited, appears on page 120 of this report.

During the period from January 1 to August 28, the 2-compartment winze, which is collared at the 550-foot level, was deepened from 864 feet to 1,005 feet and levels were established at 910 and 1,000 feet.

The following table shows the development work completed at the end of 1937, during 1938, and the total at the time Red Lake Gold Shore Mines, Limited, ceased operations:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	706	.....	706
WINZE	314	175	489
182-FOOT LEVEL:			
Drifts	332	.....	332
Crosscuts	50	.....	50
Raises	160	.....	160
300-FOOT LEVEL:			
Drifts	1,201	.....	1,201
Crosscuts	336	.....	336
Raises	132	.....	132
425-FOOT LEVEL:			
Drifts	844	.....	844
Crosscuts	352	.....	352
Raises	241	46	287
550-FOOT LEVEL:			
Drifts	511	14	525
Crosscuts	472	.....	472
Raises	19	.....	19
700-FOOT LEVEL:			
Drifts	564	164	728
Crosscuts	194	.....	194
Raises	176	.....	176
830-FOOT LEVEL:			
Drifts	411	.....	411
Crosscuts	35	.....	35
910-FOOT LEVEL:			
Drifts	.....	260	260
Crosscuts	.....	25	25
Raises	.....	118	118
1,000-FOOT LEVEL:			
Drifts	.....	386	386
Raises	.....	170	170

Diamond-drilling during 1938 amounted to 14 holes, totalling 800 feet, from surface and 24 holes, totalling 3,555 feet, from underground. About 300 feet of surface-trenching, averaging 4 feet in depth, was accomplished.

Some 29,655 tons were hoisted, of which 23,858 tons were milled. W. P. Mackle and E. P. Sawyer were successively in charge of operations.

No underground work has been done by Hasaga Gold Mines, Limited. The mill is being used to treat ore from the Hasaga mine.

Walter Regnery and Partners

Walter Regnery, Joseph Kenny, and Henry Regnery are the owners of 37 claims in township 28, range 24, Michipicoten area, district of Algoma. The property is about 13 miles west of Hawk Junction. The address is Hawk Junction.

Underground operations were continued from January 1 to August 1, 1938. The 2-compartment, 45-degree shaft is 105 feet deep on the incline, with a level at 92 feet. The following table shows the amount of lateral development work at December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
Drifts	160	1,792	1,952
Crosscuts	105	307	412

A crosscut was driven out of the side of a hill, providing an adit entrance to the 92-foot level. Diamond-drilling consisted of 9 holes, 2,400 feet, from surface, and 4 holes, 800 feet, from underground. Some 400 feet of surface trenching, 2½ feet deep, was done. An assay office, 20 by 23 feet, was added to the camp buildings during the year.

Walter Regnery was manager, employing 9 men underground for the first 8 months of the year, and an average of 10 men on surface for the rest of the year.

Ronda Gold Mines, Limited

Ronda Gold Mines, Limited, was incorporated in March, 1936, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 3,356,671 have been issued. The officers and directors are: E. H. Dickenson, president; James E. Day, vice-president; T. J. Day, secretary-treasurer; E. C. Wainwright and Garbett C. Edwards, directors, and Jenkin Evans, alternate director for Garbett C. Edwards. The head office is at 85 Richmond Street West, Toronto. The mine address is Shiningtree.

The property consists of 13 claims, approximately 315 acres, held under leases and licenses of occupation, in Churchill and Macmurchy townships, West Shiningtree area, district of Sudbury.

Operations continued throughout 1938. The following buildings were erected: mill, 78 by 54 feet, crusher-house, conveyer between the mill and crusher-house, machine shop, blacksmith shop, office, change-house, bunk-house, 60-foot headframe, shaft-house, refinery and assay office, and power-house.

A new Canadian Ingersoll-Rand PE1 double-drum hoist and a 1,500-cubic-foot XVHE-2 electric compressor were installed. The new mill building was equipped with a complete cyanide mill with a rated capacity of 150 tons per day. The main items of the equipment are: 24- by 10-inch Allis-Chalmers crusher; 6- by 9-foot Allis-Chalmers ball mill; 54-inch Akins classifier; 8- by 8-foot Northern filter; 8- by 7-inch Canadian Ingersoll-Rand compressor and 15- by 5-inch vacuum pump; 28- by 16-foot, 3-compartment Dorr thickener; two 16-

by 24-foot Dorr agitators; and a Merrill-Crowe precipitation system. The mill was ready to commence operations at the end of the year.

A substation containing two 300 k.v.a. Bepco transformers was erected, and a 14-mile power line was built to connect with the Ontario Hydro-Electric Power Commission's Abitibi Canyon line.

The vertical, 2-compartment, No. 1 shaft at this property is 325 feet deep, with levels at 100, 200, and 300 feet. During 1938 the 3-compartment, vertical winze, which was collared at the 300-foot level, was sunk a further 144 feet to a total depth of 700 feet from surface. It was also raised to surface and is being used as a main shaft. The levels from this shaft are at 300, 425, 550, and 675 feet. The following table shows the lateral development work accomplished during 1938:—

Level	Drifts	Crosscuts
	feet	feet
200-foot	48	150
425-foot	430	.....
550-foot	720	180
675-foot	.....	40

The following diamond-drilling was done during the year:—

	No. of holes	Feet
Surface	3	535
Underground	5	1,124

Shrinkage stoping was begun on the 200-, 300-, and 425-foot levels.

An average of 55 men was employed throughout the year, 17 in the mine and 38 on surface and construction work. J. M. Thompson succeeded J. R. Hughes as superintendent.

Sachigo River Exploration Company, Limited

The Sachigo River Exploration Company, Limited, was incorporated on March 20, 1936, with an authorized capitalization of 100,000 shares of no par value, of which 98,990 have been issued. The officers and directors are: C. D. Kaeding, president; E. L. Brown, vice-president; Miss E. I. Jenking, secretary; W. S. Morlock, director. The head office is at 25 King Street West, Toronto, and the mine address is Sachigo River.

The main property consists of 59 claims, 2,225 acres, in the Sachigo River area, Patricia portion of Kenora district. It is 350 miles due north of Sioux Lookout and 110 miles due east of Gods Lake, Man. The company also holds 16 claims at Matthews lake, 16 miles south of the main group, and 39 claims at Kistigan lake, Manitoba.

The mine may be reached by airplane from Red Lake or from Lac Du Bonnet, Man. Supplies and freight are hauled by tractor during the winter months from Ilford on the Hudson Bay railroad, a distance of 250 miles.

During the first four months of 1938 activity was centred on the construction of a 35-ton mill. Underground work was resumed on May 1, and continued for the rest of the year.

The 2-compartment, vertical shaft was deepened from 405 to 535 feet, and a fourth level was established at 500 feet.

The following table shows the underground development at December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	405	130	535
125-FOOT LEVEL:			
Drifts	292	.....	292
Crosscuts	120	11	131
Raises	.....	50	50
250-FOOT LEVEL:			
Drifts	452	.....	452
Crosscuts	193	.....	193
Raises	155	50	205
375-FOOT LEVEL:			
Drifts	.....	372	372
Crosscuts	.....	140	140
Raises	.....	132	132
500-FOOT LEVEL:			
Drifts	.....	262	262
Crosscuts	.....	170	170

The following is taken from the annual report of the superintendent for the 12 months ending December 31, 1938:—

During the first three months of the year a total of approximately 1,250 tons of construction material and operating supplies were freighted in over the 250-mile winter road from Ilford, at a cost of $65.00 per ton. Construction work on the mill and crushing plant was started as soon as freight began to arrive on the property and was pushed along as rapidly as possible, with the result that the mill was ready for operation by the 17th of May. The mill has been in continuous operation since that date.

During the period of production a total of 8,837 tons of ore was mined and hoisted. Of this, 2,660 tons of rock were sorted out in the crushing plant and the balance of 6,084 tons were treated in the mill. From this total of 6,084 tons were produced a total of 10,683 fine ounces of gold and 1,324 fine ounces of silver.

Mine Development

For the first four months of the year all underground work was suspended while the whole crew was employed on the construction job. With the resumption of underground work on May 1, the first consideration was keeping the mill supplied with feed, and development work was of distinctly secondary importance. The mine plant was of limited capacity, so that the amount of development work it was possible to do was limited to the excess of air supply over and above the stoping requirements. In spite of these limitations the 3rd level was opened up, the shaft deepened to the 4th level, the 4th level crosscut driven out to the vein, and a limited amount of drifting done on the 4th level. A raise was also driven from the 3rd level to within a short distance of the 2nd level, to prove the continuity of the ore in this block.

As an aid to development work, a contract for underground diamond-drilling was let to Boyles Brothers Drilling (E), Limited, and during the year a total of 40 short holes were drilled into the walls of development headings to give a maximum of information on the entire ore zone as the drifts advanced. One hole was also drilled to a point some 260 feet south of the west drift on the 2nd level for exploration purposes. This, however, was stopped by the intersection of a highly fractured zone which delivered large quantities of water and made further work impossible. In all, a total of 1,432 feet of diamond-drilling was done underground during the year.

Ore Reserves

Drifting on the 3rd level opened up a continuous ore length of 300 feet, which, due to its mode of occurrence, has been divided into ore shoots as follows:—

Shoot No.	Length	Width	Grade
	feet	feet	ounces
3-1	162.1	1.4	2.00
3-1A	151.1	1.4	1.09

On the 4th level a narrow width of ore was encountered where the crosscut intersected the general ore zone; this was found to have a total length of 24 feet. Further development work on

this level was, of necessity, quite limited in nature; but from the work to date it is evident that geological conditions which prevail on the new level are identical with those that exist on the upper levels. In the summary of calculated ore reserves which follows no allowance has been made for any ore below 3rd level, nor for any extension of ore to the west of our present workings. The block above 1st level has been calculated on the basis of mining 75 feet above the present drift. The reserve as shown below represents the actual tonnage that will be fed to the mill, due allowance having been made for sorting, both on surface and underground.

Block	Tonnage	Grade	Total
		ounces	ounces
Above 1st level	3,130	1.53	6,300
Between 1st and 2nd levels	1,141	1.92	2,198
Between 2nd and 3rd levels	3,000	1.06	3,184
Broken reserve	2,300	1.82	4,185
Total	10,571	1.50	15,867

Mining

Early in February, when a considerable supply of cement had been received by tractor freight, an attempt was made to seal off some of the water in those sections of the workings in which it was intended to mine during the year. Some 350 bags of cement were pumped into the face of the west drift on 1st level, which had been stopped in high-grade ore due to intersection of a water channel, and a slight reduction in the quantity of water was effected. On the 2nd level a similar quantity of cement was pumped as grout into seams in the crosscut and the east drift. The flows in these places were entirely sealed off, but as a result of the grouting operations channels in No. 2-1 stope and raise began to deliver about an equal volume of water. At this point work had to be discontinued due to lack of cement.

Mill feed during the first few weeks of operation was supplied almost entirely from the surface stock pile, which allowed adequate time for the preparation of No. 2-1 ore shoot for stoping during May. Thus by the time the surface supply was exhausted the mine was in condition to provide an uninterrupted feed to the mill.

During the operating period No. 2-1 stope was carried up to the 1st level and, due to several local bulges in the ore zone which gave stope widths up to 12 feet, produced almost twice the tonnage estimated for this block. More than 50 per cent. of the ore hoisted has come from this source. A start was made at opening up the No. 2-3 ore shoot, but this work was discontinued when a serious flow of water was encountered. Backs have been taken down for almost the entire ore lengths on the upper three levels, and we are at present mining the No. 3-1A section of the ore on the 3rd level.

Standard shrinkage stoping with timbered backs has, to date, been the only mining method tried. This is proving very satisfactory, for although it is necessary to break considerable waste with the ore to maintain mining width, the rock can be easily distinguished and removed in the surface sorting plant.

Milling

Since going into operation on May 17, the mill has been found highly satisfactory both mechanically and metallurgically. No serious difficulty has been encountered in the treatment of the ore. Operation to date has confirmed the original research findings in connection with the ore dressing, and we have been fortunately able to maintain a very high recovery. The details of mill operation are shown herewith:—

Dry tons treated		6,084
Per cent. operating time		97.3
Tons treated per mill day		27.3
Average value of heads	ounces	1.78
Average value of heads		$62.83
Average value of tails	ounces	0.0247
Average value of tails		$0.87
Per cent. recovery		99.28

General

Sufficient cordwood and mine timber for the coming year's operations have been cut in the vicinity of the mine, and will be hauled to the yard during the winter months. A gravel pit of sufficient size to provide several years' supply for underground fill and construction purposes has been located close at hand, and opened up ready for use.

No further exploration work or geological surveying was carried out during the past year; but all work was concentrated on the all-important task of getting the mine into productive condition.

In addition to the mill, the following buildings were erected: steel shop, crusher-house, conveyer-house, lime shed, daily powder magazine, refrigerating plant, and superintendent's residence. The headframe was raised to 55 feet and closed in. New plant equipment included a 156 k.v.a. General Electric generator, direct-connected to a No. 6 VCR Ruston and Hornsby 180 h.p. Diesel engine.

B. G. Edward was superintendent, employing an average of 62 men throughout the year.

St. Anthony Gold Mines, Limited

St. Anthony Gold Mines, Limited, was incorporated in September, 1921. The authorized capitalization is 5,000,000 shares of $1 par value, of which 3,418,510 shares have been issued. The officers and directors are: H. P. Bellingham, president and general manager; R. F. Taylor, vice-president; D. M. Bellingham, secretary-treasurer; R. Robertson and J. T. Horner, directors. The head office is at 159 Bay Street, Toronto. The mine address is Savant Lake.

The property consists of 16 claims, 698 acres, 12 miles south of Savant Lake station on the main line of the Canadian National Railways, in Thunder Bay district. The 3½-mile wagon road from Savant Lake station leads to the north end of the North arm of Sturgeon lake. From this point, transportation to the mine is by water. Scows and power boats are used to transport supplies over the water route.

The mine and mill continued to operate throughout 1938. The following table shows the underground development accomplished on the various levels during the year:—

Level	Drifts	Crosscuts	Raises
	feet	feet	feet
350-foot	.....	32	.....
500-foot	.....	5	.....
625-foot	315	.....	284
750-foot	552	75	67

The following is an extract from the report of the mine manager for the twelve months ending December 31, 1938:—

Summary of Underground Work Accomplished to Date

	Feet
New inclined shaft	1,017
Old shaft	150
Winzes and raises	1,996
Drifts	6,766
Crosscuts	2,300
Total	12,229

Lateral development work was carried on the 625- and 750-foot levels, advancing the drifts in a northerly direction in the granodiorite formation, where the ore zone has an average strike of N. 20° E. and dip of 72° W. The vein material consists of white quartz, which is fractured and usually banded with some galena and sphalerite, with visible gold associated with the sulphide bands. Stoping operations were carried on the 350-, 500-, 625-, and 750-foot levels. A crosscut was driven west on the 750-foot level to the location of No. 3 winze.

No. 3 Winze.—No. 3 winze is located approximately 220 feet west of the 750-foot level station. Commencing November 1, 1938, a crosscut was driven west in granodiorite from the No. 750-2 north drift for 45 feet with slashing for winze and hoisting stations completed by the end of the year.

The winze will be sunk for 170 feet with stations established at the 875- and 1,000-foot horizons. It is anticipated that the winze will intersect the downward extension of the vein developed on the No. 750-2 north drift, at the 875-foot horizon.

Due to the extensive development work on the 625- and 750-foot levels, the grading of ore for mill feed was uncontrollable, since a large percentage of ore came from lateral development work during the entire year.

Ore Hoisted

	Tons
350-foot level	6,466
500-foot level	1,396
625-foot level	10,258
750-foot level	15,263
Total ore hoisted	33,383
Waste sorted on surface	4,879
Total ore	28,504

Some 2,321 tons of waste rock was hoisted from the mine.

Mill

Per cent. operated of possible running time	85.4
Ore treated.....tons	28,945
Average tons milled per day of 24 hours running time	80.2
Total gold bullion of fine gold recovered and shipped...ounces	6,225.538
Total silver bullion recovered and shipped.....ounces	1,815.12
Per cent. of average recovery	97
Average cost of milling per ton	$1.74

Hydro-Electric Power Plant

Operations were continuous throughout the year, but with the efficiency greatly impaired during the winter season because of the greater than normal decrease in the level of Sturgeon lake, which supplies water to the power plant. Partial excavation of the west channel leading into the forebay resulted in temporary relief. Further excavation of this channel is contemplated as soon as conditions permit, thus insuring improved operating efficiency and increased power output.

Plant and Mine Improvement

A Diesel and compressor were installed in February, which greatly improved the power situation, and permitted increased mining and milling operations for the remainder of the year.

Developed Ore

The past year's development work has proven definite ore reserves and disclosed very favourable conditions, which together with previous diamond-drilling results strongly indicate a large tonnage of commercial-grade ore, both above and below the 750-foot or present bottom level.

Development work has now proven and blocked out ore sufficient to supply the mill at the rate of 125 tons per day and better, for a period of two years, while partly blocked out and indicated ore insures a substantial increase in ore reserves operating at the rate of 125 to 150 tons per day for a much longer period.

B. D. Elderkin was mine manager, employing an average of 80 men throughout the year.

Sand River Gold Mining Company, Limited

The Sand River Gold Mining Company, Limited, which was incorporated in February, 1935, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,520,005 shares have been issued. The officers and directors are: R. J. Jowsey, president; A. Jackson, secretary-treasurer; T. A. Gass, C. H. Hitchcock, and G. C. Armstrong, directors. The head office is at 302 Bay Street, Toronto. The mine address is Beardmore.

The property consists of 22 claims, adjoining the property of Leitch Gold Mines, Limited, on the west in Eva and Summers townships, Beardmore area, district of Thunder Bay. It is about 6 miles by motor road from Beardmore, on the Longlac–Port Arthur branch of the Canadian National Railways.

The mine and mill continued to operate throughout 1938. In October an 18- by 24-inch, single-drum Canadian Ingersoll-Rand hoist, driven by a 40 h.p. English Electric induction motor, was installed at the 650-foot level, and the deepening of the 3-compartment, vertical shaft was resumed. At the end of the

year a depth of 902 feet had been reached, and a new level had been established at 900 feet.

The following table shows the development work at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	684	218	902
150-FOOT LEVEL:			
Drifts	1,400	.....	1,400
Stope drifts	.....	65	65
Crosscuts	85	.....	85
Raises	145	87	232
275-FOOT LEVEL:			
Drifts	1,575	.....	1,575
Stope drifts	.....	17	17
Crosscuts	28	.....	28
Raises	17	471	488
400-FOOT LEVEL:			
Drifts	1,940	.....	1,940
Crosscuts	152	.....	152
Raises	.....	211	211
525-FOOT LEVEL:			
Drifts	360	1,187	1,547
Stope drifts	.....	161	161
Crosscuts	90	.....	90
Raises	.....	276	276
650-FOOT LEVEL:			
Drifts	150	1,556	1,706
Stope drifts	.....	46	46
Crosscuts	160	.....	160
Raises	45	326	371
900-FOOT LEVEL:			
Station	.....	20	20

The following diamond-drilling was done during the year:—

	No. of holes	Feet
Surface	6	1,764
Underground	9	517

Stopes were operated on all levels except the 900-foot. The method used is resuing cut-and-fill. There were hoisted 45,230 tons of ore and waste, and the mill treated 35,670 tons of ore, an average of 97.7 tons per day.

A 6- by 18-foot Oliver drum-type filter was added to the mill equipment. New buildings erected included a bunk-house and a residence.

G. B. Tribble was manager, employing an average of 118 men, 81 of whom were in the mine and 10 in the mill.

Selby Lake Mines, Limited

Selby Lake Mines, Limited, was incorporated in October, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value. C. A. Billings is the managing director, and W. M. Gordon is secretary. The head office is at 10 Adelaide Street East, Toronto, and the mine address is Goldrock, via Wabigoon.

The property consists of 136 acres, on the north shore of Trafalgar bay, Upper Manitou lake, in Kenora district. It is about a mile from Goldrock and adjoins the Elora and Big Master mines. The mine may be reached by airplane from Dryden, or by boat and motor car, a 30-mile route, from Wabigoon on the main western line of the Canadian Pacific Railway.

The shaft on this property is 265 feet deep, with levels at 125 and 250 feet. About 200 feet of drifting had been done on the 250-foot level when operations were suspended in December, 1937. Work was resumed in January, 1938, and continued until March 20, when the mine was allowed to fill. It was dewatered shortly afterward, and a diamond-drilling campaign was carried on until May 24. The workings filled with water, but were again pumped out in August when an examination was made. The property was idle for the rest of the year.

The following table shows the total amount of underground development work on the property:—

Level	Drifts	Crosscuts
	feet	feet
125-foot	80	560
250-foot	75	400

The total amount of diamond-drilling accomplished is as follows:—

	Feet
Surface	3,000
Underground	3,000
Total	6,000

New buildings erected in 1938 include an office and staff quarters, an assay office, and a directors' lodge.

C. A. Billings was in charge of the work, employing 10 men.

The company took an option on the Big Master mine, had an examination made, and did some diamond-drilling. An account of these operations appears on page 84 of this report.

Shenango Gold Mines, Limited

Shenango Gold Mines, Limited, was incorporated in March, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,804,429 have been issued. The officers and directors are: Louis Normandin, president; Bruce Cameron, vice-president; James Hutchison, secretary-treasurer; William Cromar, director. The head office is at 67 Yonge Street, Toronto. The mine address is Oba.

The property consists of a group of 9 claims in Hawkins township, and one of 12 claims in Walls township, district of Algoma.

During 1938 work on the Hawkins township claims was confined to surface-trenching and diamond-drilling. Some 1,500 feet of trenching was accomplished, and 5 diamond-drill holes, totalling 1,400 feet in length, were drilled from surface.

At the end of the year preparations were being made to sink a new shaft on claim S.S.M. 7,490, about half a mile west of the original workings.

An average of 11 men was employed under the direction of Thos. L. de Rome.

Slate River Mining Syndicate, Limited

Slate River Mining Syndicate, Limited, was incorporated in March, 1938, with an authorized capitalization of 35,000 shares of $1 par value, of which 17,500 shares were issued to the vendors for the property. The officers and directors are: R. K. Piper, president; D. E. Schoales, secretary; L. C. Irwin, treasurer. F. Stewardson, 536 South Marks Street, Fort William, is manager. The head office address is 252 West Francis Street, Fort William.

The syndicate owns claims T. 151 and 152, Paipoonge township, and has a lease on claims T.B. 25,983, 25,984, and 25,985. Scoble township, district of Thunder Bay.

There is a shallow shaft and some surface-trenching on each group of claims, the work having been done by former operators.

The present syndicate installed a 10-ton mill and treated about 10 tons of test ore from the dumps. Some 800 pounds of concentrates were shipped to Trail, B.C. The property is now idle.

South Vermillion Gold Mines, Limited

South Vermillion Gold Mines, Limited, was incorporated in April, 1934, with an authorized capitalization of 1,500,000 shares of $1 par value. The officers and directors are: A. Pacitto, president and manager; A. E. Broadley, vice-president; M. F. Burrows, secretary-treasurer; C. McLaughlin and F. J. McFarlane, directors. The head office is at 21 King Street East, Toronto. The mine address is Mine Centre.

The property owned by this company consists of a group of 3 claims, located on Bad Vermilion lake, about 3 miles southwest of Mine Centre, Rainy River district.

There is a 2-compartment, vertical shaft 115 feet deep on the property, with a station at 115 feet.

No underground work was done during 1938. On July 27 the manager, with the aid of one other man, commenced diamond-drilling with a small X-ray drill in the vicinity of the shaft, and completed 7 holes, totalling about 1,200 feet.

Split Lake Gold Mines, Limited

Split Lake Gold Mines, Limited, was incorporated in November, 1935, with an authorized capitalization of 4,000,000 shares of no par value, all of which have been issued. The officers and directors are: Hugh C. McRae, president; Glen A. Rea, secretary-treasurer; D. I. Jarvis, F. B. Anderson, and H. L. Donaldson, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Kenora.

The company has two properties in the Kenora district. The Split Lake property, consisting of 54 claims, 2,200 acres, is about 14 miles southeast of Sioux Lookout and 6 miles from Alcona station on the Port Arthur–Sioux Lookout branch of the Canadian National Railways. It has been idle since April, 1937. The second group, known as the Oliver-Severn claims, in Indian Reserve No. 38b, some 6 miles east of Kenora, contains 240 acres.

Operations on the Oliver-Severn property, which had been suspended on November 1, 1937, were resumed on February 16, 1938, and continued until the end of May. The mine was dewatered, and a headframe was erected. The following new plant equipment was installed: a 60 h.p. Scotch marine type boiler, a 240-cubic-foot Ingersoll-Rand portable gasoline compressor, and a 310-cubic-foot Sullivan portable gasoline compressor.

About 40 feet of drifting was done on the 100-foot level, following which shaft-sinking was resumed. The 2-compartment, 75-degree shaft was sunk a further 106 feet to a depth of 206 feet, and a second level was established at 200 feet. Some 50 feet of drifting and 200 feet of crosscutting were done on this level.

H. L. Donaldson was in charge for the company, but the work was done on contract by Hilding Johnston. An average of 12 men was employed.

Spooner Gold Mines, Limited

Spooner Gold Mines, Limited, was incorporated in January, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,032,103 have been issued. The officers and directors are: H. T. Leslie, president; J. H. Colville, vice-president; J. A. Doupe, secretary-treasurer; E. M. Thomson, C. D. McGregor, and Fred Spooner, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Empire.

The property consists of a group of 15 claims, about 650 acres, adjoining that of the Northern Empire Mines Company on the east, in Summers township, Beardmore area, Thunder Bay district.

The 2-compartment, vertical shaft on this property is 303 feet deep, with a level at 150 feet, on which 1,025 feet of drifting and 10 feet of crosscutting have been done.

No underground development work was done in 1938, operations being confined to diamond-drilling from surface. Seven holes, totalling 1,879 feet, were drilled.

Straw Lake Beach Gold Mines, Limited

Straw Lake Beach Gold Mines, Limited, was incorporated in August, 1934, with an authorized capitalization of 3,000,000 shares of no par value, of which 2,854,999 have been issued. The officers and directors are: M. C. Mosher, president; W. M. Sixt, vice-president and managing director; W. R. Salter, secretary-treasurer; W. G. Chipp, assistant secretary-treasurer; W. R. Baker, director. The head office is at 36 Toronto Street, Toronto. The mine address is Emo.

The property consists of a group of 24 claims, totalling 985 acres, at Straw lake in the district of Kenora. It may be reached over a 70-mile road and water route from Emo, which is 20 miles west of Fort Frances on the Canadian National railway.

The mine was operated continuously throughout 1938. The following table shows the underground development work as at December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	441	.....	441
100-FOOT LEVEL:			
Drifting	585	.....	585
Crosscutting	68	.....	68
Raising	87	.....	87
300-FOOT LEVEL:			
Drifting	822	5	827
Crosscutting	142	.....	142
Raising	13	.....	13
425-FOOT LEVEL:			
Drifting	366	450	816
Crosscutting	66	89	155

Stopes were begun on the 300-foot level, and preparations for stoping were made on the 100- and 425-foot levels.

In anticipation of the commencement of milling operations, all the dumps were sampled by driving 3-inch pipe and sampling the cores. These dumps furnished a large part of the first ore milled on the property.

The construction of the 60-ton flotation-amalgamation mill started in July. Milling operations commenced on November 16 and continued for the rest of

the year. Some 2,395 tons of ore and 2,022 tons of waste were hoisted, and 2,475 tons of ore were milled, including 1,153 tons from the surface dumps. The average daily rate of operation was 53.88 tons. The total value of the gold sponge produced was $18,471.11.

Additional construction work during the year included a crusher-house, conveyer-house, two ore bins, a cookery, and an ice-house.

An average of 9 men was employed in the mine throughout the year, and there were 8 men in the mill during its period of operation. J. D. Tolman is manager.

Sturgeon River Gold Mines, Limited

Sturgeon River Gold Mines, Limited, was incorporated in August, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,749,759 shares have been issued. The officers and directors are: A. L. Bishop, president; J. M. Wood, vice-president; C. S. Kennedy, secretary-treasurer; Alex. Longwell, W. T. Brown, and Fraser Raney, directors. The head office is at 320 Bay Street, Toronto. The mine address is Nezah.

The property consists of 8 claims, 350 acres, in Irwin, Pifher, and Walters townships, in the Sturgeon River area, district of Thunder Bay, about 8 miles northwest of Nezah station on the Longlac–Port Arthur branch of the Canadian National Railways.

Operations at the property continued throughout 1938. Shaft-sinking was resumed in November, the present objective depth being 1,250 feet. At the end of December a depth of 966 feet had been reached and a station cut at 875 feet.

The following table shows the amount of development work accomplished at December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT	774	192	966
125-FOOT LEVEL:			
Drifts	609	.....	609
Crosscuts	96	.....	96
Raises	174	.....	174
250-FOOT LEVEL:			
Drifts	1,322	.....	1,322
Crosscuts	145	15	160
Raises	322	.....	322
375-FOOT LEVEL:			
Drifts	1,219	69	1,288
Crosscuts	173	57	230
Raises	530	.....	530
500-FOOT LEVEL:			
Drifts	1,201	321	1,522
Crosscuts	362	.....	362
Raises	107	[1]205	312
625-FOOT LEVEL:			
Drifts	436	457	893
Crosscuts	69	21	90
Raises	.....	[2]131	131
750-FOOT LEVEL:			
Drifts	993	684	1,677
Crosscuts	118	178	296
Raises	.....	[3]875	875

[1]Does not include 45 feet of box-holes.
[2]Does not include 10 feet of box-holes.
[3]Does not include 185 feet of box-holes.

Diamond-drilling during the year amounted to 4 holes, having a total depth of 537 feet, from surface, and 37 holes, totalling 4,357 feet, from underground.

The following new buildings were erected during the year: bunk-house, dry-house, saw-mill, and club-house. Additions to the compressor-house, machine shop, and office were built. An 850-cubic-foot Babcock-Wilcox and Goldie-McCulloch compressor and a 400-cubic-foot, 2-cylinder Broom and Wade compressor were added to the plant equipment.

The following is taken from the report of the manager for the year ending December 31, 1938:—

Mining

Underground operations were confined to the Main or No. 3 vein. As in 1937, the ore was found in high-grade lenses separated by sections of low-grade or barren material. For the most part the various mining horizons were opened up along their full length to eliminate the possibility of ore being missed. The differential mining method employed allows the rejection of most of the lean sections.

Exploration and Development

A geological survey showed that favourable conditions existed to the south end of the present workings. Six hundred feet of drifting to the south on the bottom level (750 feet) disclosed a very interesting new ore section, 80 feet long, 450 feet south of the main ore zone. A raise to the 625-foot horizon showed ore all the way. This section is now being developed. To the north on the 500-foot level the vein and shearing persisted but did not make ore.

Diamond-drilling below the 750-foot level indicated that conditions were similar at depth. The vein was in the shaft to the 875-foot level, in which section channel samples averaged $12.00 over 30 inches.

Milling

During the year, 45,700 tons of ore were hoisted, of which 17,540 tons, or 38 per cent., was sorted. Operating 98.3 per cent. of possible running time, the mill handled an average of 77 tons daily for a total of 28,160 tons. A recovery of 97.1 per cent. of the gold value yielded 14,432 ounces, which realized $509,000.00, or $18.07 per ton. Value of ore per ton hoisted was $11.47, including tails. The width of the ore mined was 37.2 inches, giving the value of the ore mined over 30 inches as $14.22.

Ore Reserves

Based on a stoping width of 30 inches, ore reserves above the 750-foot level are estimated at 33,500 tons, with an average of $12.00 per ton. This is in addition to the 3,000-ton stock-pile, on surface, of development ore.

Under company supervision a townsite has been rapidly built up. Twenty-five employees with their families are resident on the property, the community now numbering over 200. A recreation club has been organized and with the assistance of the company, a community hall built and equipped with canteen, card room, dance floor, and a 16 m.m. talking picture machine.

The Government roads department has greatly improved our road to Nezah. The road, 9 miles, has been well drained and most of it graded, allowing truck-freighting at all seasons except mid-winter.

T. D. Anderson was manager, employing an average of 107 men throughout the year.

Sylvanite Gold Mines, Limited

Sylvanite Gold Mines, Limited, was incorporated in June, 1913, with an authorized capitalization of 3,300,000 shares of $1 par value, of which 3,299,500 have been issued. The officers and directors are: Edward L. Koons, president; William L. Marcy, vice-president; Clark L. Ingham, treasurer; William S. Walton, secretary; Welles V. Moot, managing director; Alfred H. Sharpe and Harry Yates, directors. K. C. Gray is manager and W. S. Maguire is superintendent. The executive office is at 300 Erie County Bank Building, Buffalo, N.Y. The secretary's office is at 603 Royal Bank Building, Toronto. The head office and mine office are at Kirkland Lake.

The property consists of 5 claims and a fraction, approximately 230 acres, in Teck township, Kirkland Lake area, district of Timiskaming.

An average of 334 men was employed throughout 1938.

The following is taken from the manager's report for the fiscal year ending March 31, 1939:—

Production

During the year, 193,044 tons were milled, producing 68,256.42 troy ounces of gold and 12,238.63 troy ounces of silver, with a value of $2,409,670.98. The mill averaged approximately 40 tons more per day than in the previous year. Extraction, calculated on the same basis as

last year, was slightly better, averaging 95.90 per cent. The following is a summary of production for the last five years:—

Fiscal year ending March 31	Tons milled	Fine ounces gold produced	Average price per ounce	Production total	Average recovery, troy ounces per ton
1935	124,956	51,445.27	$30.81	[1]$1,584,817.39	0.41
1936	153,942	55,798.66	34.62	[2]1,931,891.87	.36
1937	166,131	61,208.92	35.08	[3]2,147,237.26	.37
1938	178,462	64,299.41	35.08	[3]2,255,381.11	.36
1939	193,044	68,256.42	35.30	[3]2,409,670.98	.35

[1]Including exchange on bullion after bullion tax is deducted.

[2]Including exchange on bullion, after deducting bullion tax effective for period April 1, 1935, to May 31, 1935, but before deducting Mint handling charge of 35 cents per fine ounce gold, effective for period June 1, 1935, to March 31, 1936. [3]Including exchange on bullion.

Mining

The ore pass system was enlarged, and one additional loading pocket is being put in on the 2,000-foot level. This work will be completed early in the new year. A change-over has been made to detachable bits. The following is a summary of ore and waste broken and hoisted:—

Year	Ore broken			Waste			Total ore and waste broken
	In stopes	From development and backs	Total	Hoisted to surface	Used for backfill	Total	
	tons	tons	tons	tons	tons	tons	tons
1935	93,883	37,161	131,044	11,812	10,623	22,435	153,479
1936	111,091	42,183	153,274	12,576	7,607	20,183	173,457
1937	121,778	47,017	168,795	19,499	15,247	34,746	203,541
1938	120,433	55,703	176,136	20,873	24,526	45,399	221,535
1939	130,279	63,806	194,085	14,950	27,335	42,285	236,370

Broken Ore Reserves

Broken ore reserves were 83,757 tons at the year end. No attempt was made or will be made to increase the broken ore reserves. This tonnage has proven ample for operating requirements.

Development

Development work was slightly higher for the year:—

Class of work	Year ending March 31, 1937	Year ending March 31, 1938	Year ending March 31, 1939	Total from beginning of operations to March 31, 1939
	feet	feet	feet	feet
Drifting	14,855	15,950.5	17,731	105,764
Crosscutting	7,221	5,255	4,593.5	44,770.5
Raising	1,531.5	2,802	3,079.5	22,544
Sublevel drifting	392.5	821	977	11,830.5
Box-hole raising	57	357	823	8,182.5
Winzing	.....	.....	.....	97.5
Shaft-sinking	.....	.....	.....	5,654
Total	24,057	25,185.5	27,204	198,843
Per cent. of crosscutting to total of crosscutting and drifting	32.7	24.8	20.6	29.7
	cu. ft.	cu. ft.		cu. ft.
Shaft stations and sump excavations	3,438	912	.....	211,628
	feet	feet	feet	feet
Diamond-drilling	14,285	14,787	18,223	143,680

Drifting and subdrifting through ore amounted to 5,964 feet. The more important results of the development work done during the year were:—

1. A substantial ore body was developed from the 700- to the 1,125-foot level on the No. 80 vein, a subsidiary vein 300 feet north of the main north vein, in the western section of the property.
2. An additional 300-foot length of medium-grade ore was opened up on the 2,375-foot level on a vein 500 feet north of the main north vein in the central section of the property.
3. A 250-foot length of ore was developed in a new area on the 2,500-foot level on a vein 700 feet north of the main north vein in the eastern section of the mine.
4. Ore of a grade above mine average was developed in the continued exploration of the inclined vein on the 1,500- and 1,875-foot levels, west of the Major fault and on the 1,250-foot level, east of the Major fault.
5. Ore was developed on the 2,375- and 2,500-foot levels on a minor inclined vein lying between the north and south vein, 600 feet below the main inclined vein.
6. Development of the main north and south veins and of their numerous parallel branches continued to yield an important part of the new ore developed.

Operating Costs

Operating costs were slightly lower at $5.870. The operating costs of the two previous years are given for comparison:—

	Total cost	Cost per ton ore milled	Cost per fine ounce gold produced
1937:			
Development and exploration	$300,751.11	$1.810	$4.914
Mining	338,917.71	2.040	5.537
Milling	169,774.56	1.022	2.774
General charges	54,812.88	.330	.896
Administrative charges	60,112.18	.361	.982
Tailings disposal expense (new dam)	3,640.69	.022	.059
Bullion selling expense:			
Insurance, shipping, and Mint refining charges	5,782.15	.035	.094
Mint handling charge	21,349.53	.129	.349
Total	$955,140.81	$5.749	$15.605
1938:			
Development and exploration	$335,110.43	$1.878	$5.212
Mining	384,749.70	2.156	5.984
Milling	191,501.05	1.073	2.978
General charges, including employees' group life, accident and sickness insurance and pension plan expense	69,514.59	.389	1.081
Administrative charges	60,722.25	.340	.944
Tailings disposal expense (extension of area, etc.)	10,920.34	.061	.170
Bullion selling expense:			
Insurance, shipping, and Mint refining charges	5,861.59	.033	.091
Mint handling charge	22,703.56	.127	.353
Total	$1,081,083.51	$6.057	$16.813
1939:			
Development and exploration	$357,825.31	$1.854	$5.242
Mining	403,933.23	2.092	5.918
Milling (including tailings disposal expense)	210,306.98	1.090	3.081
General charges, including employees' group life, accident and sickness insurance and pension plan expense	65,529.03	.339	.960
Administrative charges	66,034.70	.342	.968
Bullion selling expense:			
Insurance, shipping, and Mint refining charges	5,415.58	.028	.079
Mint handling charge	24,111.81	.125	.353
Total	$1,133,156.64	$5.870	$16.601

Additional Buildings and Equipment

A modern dry was built during the year. Two new houses were built for members of the staff and a recreation hall erected for the Sylvanite Sports Association.

Teck-Hughes Gold Mines, Limited

Teck-Hughes Gold Mines, Limited, was incorporated in March, 1923, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 4,807,144 have been 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; H. C. McCloskey, secretary; K. P. Emmons, treasurer; John F. Lash and John F. Thompson, directors. The executive office is at 25 King Street West, Toronto. The mine office and head office are at Kirkland Lake.

The property in Teck township, Kirkland Lake area, district of Timiskaming, operated throughout 1938 with an average force of 564 men. J. G. McMillan is general superintendent; G. Gill, mine superintendent; and E. H. Whitman, mill superintendent.

During the calendar year 1938 the following development work was done: 8,976 feet of drifting, 3,388 feet of crosscutting, and 3,725 feet of raising. Some 20,437 feet of diamond-drilling was done from underground. An average of 1,041.7 tons of ore per day was hoisted and milled.

The following is taken from the report of the general superintendent for the fiscal year ending August 31, 1938:—

During this period 376,465 tons of ore from the mine and 15,671 tons of old tailings were milled. The total recovery of bullion and precipitate was the equivalent of 112,167.2 troy ounces of fine gold, of which 1,937.1 troy ounces was recovered from the re-treatment of old tailings. The realized value of bullion production was $3,930,534.88; and after addition of $72,521.68, being the interest earned on investments, the gross revenue was $4,003,056.56, or $10.21 per ton.

The total operating cost amounted to $2,130,050.00, or $5.43 per ton milled. After provision of $268,111.58 for taxes, net surplus for the fiscal year was $1,604,894.98.

An analysis of operating costs follows:—

	Total cost	Cost per ton of ore treated	Cost per ounce of gold produced
Mining and development	$1,448,078.01	$3.69	$12.91
Milling	396,046.29	1.01	3.53
General expense	271,481.70	.69	2.42
Examination and exploration of new properties	14,444.00	.04	.13
Total	$2,130,050.00	$5.43	$18.99

Development footage for the fiscal year was as follows:—

	Feet
Drifting	6,793.5
Crosscutting	3,264
Subdrifts and Subcrosscuts	3,804
Raising	4,238
Total development	18,099.5

Diamond-drill exploration amounted to 21,264.9 feet. Ore production from drifting and crosscutting totalled 15,908 tons.

New ore found totalled 1,377 feet, or 20.3 per cent. of all drifting. Of this, 415 feet was found in the main break and 962 feet in hanging-wall ore bodies. While 16 per cent. of all drifting on the main break was in ore, the proportion in the hanging wall was 22.9 per cent. Hanging-wall ore bodies were found on levels Nos. 4, 5 and 6, 30 and 31, 25 and 26.

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	202,076	57,812.1	5.72
Blocked ore	408,819	153,345.9	7.50
Total	610,895	211,158	6.91

In all 111 properties were submitted to the Exploration Department during the year. Sixty-four resulted in office examination only. Of these 25 came from Ontario, 34 from Quebec, and 5 from farther afield. Personal examinations were made of 30 properties in Ontario and of 17 in Quebec province. Options were taken on two properties in Western Quebec, on which diamond-drilling failed to extend previous indications, and the options were allowed to lapse.

Theresa Gold Mines, Limited

Theresa Gold Mines, Limited, was incorporated in April, 1938, with an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,057,642 have been issued. The officers and directors are: A. Caouette, president and manager; A. Gagnon, vice-president; Gaston Vincent, secretary-treasurer; M. Halle and M. Caouette, directors. The head office address is Kapuskasing, and the mine address is Longlac.

The company acquired from A. Caouette a group of 15 claims, approximately 600 acres, formerly optioned by the N. A. Timmins Corporation. The property is situated on the west side of the Making Ground river, about 7½ miles south and slightly east of Longlac, and is contiguous to the south boundary line of the Martin Falls Indian Reserve. It is accessible by water, via the river, in the summer, and in winter may be reached by road through the reserve from the siding at mileage 96.7 on the Caramat subdivision of the Canadian National Railways.

The following underground development work was done by the former operators:—

	Feet
No. 1 SHAFT	135
No. 2 SHAFT	217
125-FOOT LEVEL:	
Drifting	36
Crosscutting	145
200-FOOT LEVEL:	
Drifting	110
Crosscutting	420

A total of 7,868 feet of diamond-drilling from surface has also been done on the property.

The present company began operations on April 1, 1938. The following new plant and camp buildings were erected: mill, bunk-house, cookery, 4 houses, dry-house, and an addition to the headframe. A 6- by 10-inch reversible steam hoist, a Chicago Pneumatic 310-cubic-foot compressor, and a small test mill consisting of a 12-ton Gibson ball mill and a 25-ton amalgamation unit were installed. The mill commenced operation on June 1 and continued until September 30, treating ore from the dump and from the first level, where 15 feet of raising was done.

At the end of the year a new mining plant was installed, and preparations were made to sink a shaft on the east shore of the Making Ground river, about half a mile west of No. 2 shaft.

An average of 15 men was employed.

Tionaga Gold Mines, Limited

Tionaga Gold Mines, Limited, was incorporated in November, 1937, with an authorized capitalization of 300,000 shares of $1 par value, of which 200,003 have been issued. The officers are: H. C. Dudley, president; W. E. Smith, vice-president; W. F. Ferris, secretary-treasurer. The head office and mine office are at Tionaga. The executive office is at 704 Lonsdale Building, Duluth, Minn.

The company acquired the Smith-Thorne property, formerly worked under option by Hollinger Consolidated Gold Mines, Limited, in Horwood township, district of Sudbury. It is 17 miles southwest of Tionaga on the Canadian National railway.

During the period of operation by Hollinger a 2-compartment, 45-degree shaft had been sunk to a depth of 599 feet on the incline, with levels at 200, 325, and 570 feet, on which considerable lateral work had been done.

The present company commenced operations in February, 1938. The shaft was dewatered, and in April sinking was begun. The shaft was sunk a further 132 feet to a total inclined depth of 731 feet, and new levels were established at 450 and 700 feet.

The following table shows the amount of development work done by Hollinger, the work done during 1938, and the total:—

	Work done by Hollinger	Work done during 1938	Total
	feet	feet	feet
200-FOOT LEVEL:			
Drifting	539	37	576
Crosscutting	46	44	90
325-FOOT LEVEL:			
Drifting	136	.....	136
Crosscutting	75	.....	75
450-FOOT LEVEL:			
Drifting	.....	284	284
Crosscutting	.....	40	40
570-FOOT LEVEL:			
Drifting	713	66	779
Crosscutting	360	.....	360
Raising	.....	15	15
700-FOOT LEVEL:			
Drifting	.....	272	272
Crosscutting	.....	169	169
Raising	.....	40	40

During the summer and fall a 50-ton amalgamation mill was installed. It operated from November 10 to the end of the year at an average daily rate of 43.3 tons. Some 2,454 tons of ore and waste were hoisted, of which 2,122 tons were milled.

The following new buildings, in addition to the mill, were erected: shaft-house, crusher-house, refinery, assay office, powder-house, ice-house, superintendent's residence, and seven log cabins.

R. A. Findlay was superintendent, employing an average of 33 men.

Toburn Gold Mines, Limited

Toburn Gold Mines, Limited, was incorporated in January, 1931, with a capitalization of 2,000,000 shares of no par value, of which 1,850,000 have been issued. The officers and directors are: H. A. Guess, president; R. F. Goodwin,

vice-president; J. C. Emison, treasurer; G. A. Brockington, secretary; A. W. Holmested and S. C. Guess, directors. M. W. Hotchkin is manager. The head office is at 1809 Royal Bank Building, Toronto. The mine office is at Kirkland Lake.

The property, formerly called the Tough-Oakes Burnside, consists of 10 claims, 343 acres, in Teck and Lebel townships, Kirkland Lake area, district of Timiskaming. An average of 198 men was employed during 1938.

The following is taken from the annual report of the president for the year ending December 31, 1938:—

The report of your manager, Mr. M. W. Hotchkin, upon the development and operation of your company's property during the year ending December 31, 1938, follows:—

"A total of 8,146 lineal feet of underground development was done in 1938, compared with 10,048 feet in 1937. This development consisted of 4,609 feet of drifting, 435 feet of sublevel drifting, 1,293 feet of raising, 1,399 feet of crosscutting, and 410 feet of slashing. Of the total development 2,748 feet were in ore, breaking 8,853 tons, averaging 0.58 ounces gold per ton.

"Approximately 74 per cent. of the total development was confined to the 542-, 667-, 792-, and 1,090-foot levels. During the year 1938, 50 diamond-drill holes were completed, aggregating 9,135 feet, compared with 54 holes, aggregating 7,857.5 feet in 1937.

"The salient results of the 1938 development were: (1) locating and developing the downward extension of the 425-drift vein in the 608-drift at the 667-foot level; (2) locating the downward continuation of the 419-drift vein on the 542-foot level and development thereof by the 574 and 575-drifts; (3) locating and developing the upward continuation of the 696-697-drift vein, in the 569 drift, on the 542-foot level, and the downward continuation, which was located at the 800-foot level on a branch of the 820-drift vein.

"The centralization of work in other parts of the mine during 1938 made it inconvenient to completely explore by diamond-drilling the area mentioned in last year's report on the A-400-foot level, along the 419-drift, east, in the vicinity of the high-grade surface showing. It is contemplated to complete this work during the coming year.

"Plans were formulated in the latter part of 1938 to rehabilitate the internal shaft from the 1,090-foot level to the 1,850-foot level, and to install adequate equipment for sinking and developing deeper horizons.

"Production figures for 1938, compared with those of the year 1937, are:—

Year	Tons milled	Average ounces gold per ton	Ounces fine gold produced	Percentage mill recovery
1937	37,465	0.729	26,243	96.10
1938	52,434	.625	31,553	96.25

"The estimated ore reserves, broken and unbroken at December 31, 1938, were 149,050 tons, averaging 0.58 ounces gold per ton, compared with 151,850 tons, averaging 0.57 ounces gold per ton, at December 31, 1937. Due to some dilution in actual mining, this tonnage may be somewhat increased, with a corresponding decrease in grade. It is apparent, therefore, that 49,634 tons of new ore were found and opened up by the 1938 development."

Earnings for the year 1938, after deducting administration and taxes, but before deduction of $54,172.19 depreciation and depletion, were $483,845.35.

Continental Kirkland Mines, Limited[1]

During 1938 exploration and development work was continued upon the above property under the option arrangement whereby treasury shares at 20 cents per share were acquired for expenditures made, this option being held to the extent of one-third each by your company, Premier Gold Mining Company, Limited, and American Smelting and Refining Company, and toward the end of 1938 the option was extended for a further 2-year period, namely, until December 5, 1940.

A total of 2,418 feet of underground development was done upon the strong quartz zone opened up in 1937 both upon the 800-foot level in its northwestern area and also upon the 925-foot sublevel opened up by winze therefrom. The results continued to be merely tantalizing in that while an abundance of good-looking quartz was opened up, it was entirely of non-commercial value, the assays being from 60 cents or so to about $2.50, other than for a few high assays occasionally encountered.

Also a total of 6,778 feet of underground diamond-drilling was done. One of these holes was put down vertically from the 800-foot level near the winze to see whether better values occurred in the quartz at a depth of 500 feet below the level and 375 feet below the winze level,

[1]A further report on Continental Kirkland Mines, Limited, appears on p. 100 of this volume.

but although a large amount of quartz was cut, the same low assays were obtained. Another hole has been started vertically to cut this zone at a depth of 1,700 feet, or 900 feet below the 800-foot level. It is contemplated having a geophysical survey made early in 1939 to more clearly define this quartz zone and possibly other zones upon the property that might be worth investigation by diamond-drilling.

It is also possible that at some later date, should operations in your company's property be carried on at a depth of 2,000 feet or more with workings toward the east, that a drift therefrom into Continental Kirkland ground might be advisable for exploratory purposes in the hope of finding upon such deeper horizon commercial ore bodies.

As of December 31, 1938, your company's share of the expenditures upon the above property was $81,673.23, for which it received 408,333 shares of Continental Kirkland Mines, Limited.

Beaverhouse Lake Gold Mines, Limited (Former Argonaut Mine)[1]

In February, 1938, your company took from Premier Gold Mining Company, Limited, an assignment of a 30 per cent. interest in the agreement that Premier entered into on January 1, 1938, with respect to the above company. Under this agreement Premier and your company acquired for expenditures upon the property, treasury shares of the above company at 20 cents per share and if they continued with the agreement to its completion, they would have thus acquired 1,500,000 shares, or one-half the then total issued shares.

Unwatering of the old mine was begun in the spring of 1938 and the 200-foot and 350-foot levels were opened up and sampled, and various drifting, crosscutting, and diamond-drilling done thereon under the direction of your company's manager. This work showed, as per your manager's summary, on the 200-foot level an aggregate length of 260 feet for four shoots of ore of approximately 4 feet width and approximately 0.35 ounces gold per ton, and on the 350-foot level an aggregate length of 438 feet for six shoots of ore of approximately 4 feet width and approximately 0.52 ounces gold per ton. But at the close of 1938 the management of your company and of Premier decided that the mine would at best be likely to support a production of too small a tonnage to be particularly attractive, and the agreement upon the property was relinquished, the actual relinquishment taking effect as of January 19, 1939. Your company and Premier retain the shares acquired for work done. Up until December 31, 1938, your company's share of the expenditures was $18,480.00, representing 92,400 shares.

Minesta Mines, Limited

Under date of September 16, 1938, your company executed an agreement with Minesta Mines, Limited, whereunder it took over by working contract of fifty years duration the above property [31 claims in Godfrey township, district of Cochrane]. Briefly the salient terms are that if and when the property is upon a producing and profitable basis, Toburn applies all the first profits to the reimbursement of all of its outlays with interest thereon at 6 per cent. per annum, and thereafter profits are divided: 85 per cent. to Toburn; 15 per cent. to Minesta.

The ground had been previously geophysically surveyed, outlining porphyry areas and sediments, and some diamond-drilling is now in progress upon the chance that in this structure, which is somewhat similar to that of the Porcupine camp to the northeast, an ore body may be found. Nothing has as yet been found by drilling above an assay, for a narrow streak or two, of 0.06 ounces gold per ton. Toburn can drop the agreement at any time.

Mineral Estates, Limited

Under date of November 24, 1938, Toburn executed an agreement with the above company upon the above properties [41 claims in Bristol township and 14 claims in Ogden township, district of Cochrane], similar in its terms to those of Minesta, given above, and is at present having a geophysical survey made thereon, to see whether favourable shear zones may be thus disclosed, which would justify investigation by diamond-drilling and otherwise.

Federal Kirkland Mining Company, Limited;[2] Kirkland Combined Mines, Limited

Under date of December 29, 1938, Toburn executed a tri-party agreement with the above companies, whereunder it took over under a fifty-year operating contract the thirteen claims and a fraction owned by the two above companies, which form a fringe along the northern boundary of the Sylvanite, Toburn, and Continental Kirkland properties at Kirkland Lake. The payment consideration for the fifty-year contract was $28,000.00 for Federal Kirkland's nine claims and a fraction, and $9,000.00 for Kirkland Combined's four claims.

Toburn then started a crosscut north from its 1,100-foot level toward its north boundary and will continue it into the Federal Kirkland claims and if a north break is found, which seems a fair possibility, will drift thereon and otherwise develop it, and will spend in these and related matters a minimum of $7,500.00 over each three months' period. A geophysical survey is also started to trace the contacts of the porphyry and to disclose any breaks, shear zones, etc., as a guide in connection with the above-mentioned work.

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[1] A further report on Beaverhouse Lake Gold Gold Mines, Limited, appears on p. 80 of this volume.

[2] A further report on Federal Kirkland Mining Company, Limited, appears on p. 111 of this volume.

If and when the properties are upon a producing and profitable basis, all profits are to be applied to the reimbursement of Toburn for all of its outlays and expenditures, except the $37,000.00 payment consideration, together with interest thereon at 5 per cent. per annum and after Toburn has been thus fully reimbursed, including that of working capital, profits shall be divided 70 per cent. to Toburn; 22½ per cent. to Federal Kirkland; 7½ per cent. to Kirkland Combined. Toburn can relinquish the agreement at any time.

Tombill Gold Mines, Limited

Tombill Gold Mines, Limited, was incorporated in October, 1935, with an authorized capitalization of 1,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: Percy E. Hopkins, president; Fred Searls, Jr., first vice-president; Carroll Searls, second vice-president; A. W. Burt, secretary; Henry E. Dodge, treasurer; Gus Mrkvicka, assistant secretary and assistant treasurer; T. A. Johnson, W. R. G. Johnson, and C. H. Ellis, directors. The head office is at Empire and the Toronto office is at 908 Royal Bank Building. The mine office is at Geraldton.

The property consists of 6 claims, 240 acres, located immediately west of the property of Bankfield Gold Mines, Limited, in Lindsley and Errington townships, Little Long Lac area, district of Thunder Bay.

Mining continued throughout 1938. The 100-ton mill began operation on February 1. In August the mill capacity was increased to 150 tons by the addition of a cyanide unit. The following is the main equipment now used in the mill: a 7- by 4-foot Hardinge ball mill in closed circuit with a unit Sub-A flotation cell; a 2-compartment Denver jig; a 48-inch Dorr duplex classifier; twelve Denver Sub-A flotation cells; two Sub-A cells used as cleaners; a 12- by 5-foot Dorr thickener; a 4- by 4-foot concentrate regrind ball mill in closed circuit with a 16-inch Akins classifier, with corduroy blanket tables between the ball mill and classifier. The overflow from the Akins classifier goes to a cyanide circuit consisting of two Pachuca tanks, a 6- by 16-foot Dorr thickener, two 10- by 8-foot Denver Wallis-type agitators; a 6- by 16-foot Dorr thickener, and an Oliver drum filter from which the pulp is repulped and sent to the tailings. The tails from the main flotation plant flow over corduroy blankets in parallel with those following the regrind ball mill, and the concentrate from the blankets goes to the amalgam barrel.

A total of 26,486 tons of ore was hoisted and milled, the average daily milling rate for the year being 87.5 tons.

The following table shows the underground development work done at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
SHAFT (3-compartment, vertical)	611	.....	611
220-FOOT LEVEL:			
Drifts and crosscuts	1,423	76	1,499
Raises	40	285	325
400-FOOT LEVEL:			
Drifts	1,847	236	2,083
Raises	.....	209	209
600-FOOT LEVEL:			
Drifts	286	129	415
Crosscuts	226	.....	226

One diamond-drill hole, 450 feet in length, was drilled from underground during 1938.

Arthur Kendall is mine manager, and J. A. Pike is mine superintendent. An average of 65 men was employed during the year, of whom 30 were in the mine and 10 in the mill.

Trout Creek Gold Mining Company, Limited

The Trout Creek Gold Mining Company, Limited, was incorporated in November, 1927, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,613,672 have been issued. The officers and directors are: Albert Cox, president; C. M. A. Strathy, vice-president; John Price, secretary-treasurer; G. A. Robertson and Walter Carlson, directors. The head office address is Bank of Commerce Building, St. Catharines. The mine address is c/o E. H. Orser, Suite 2, David Building, Kirkland Lake.

The property consists of 4 claims in Teck township, Kirkland Lake area, district of Timiskaming. Several years ago a vertical, 2-compartment shaft was sunk to a depth of 76 feet, where a level was established and some 90 feet of drifting and 98 feet of crosscutting were done.

In July, 1938, the workings were dewatered and examined, but no development work was done. One diamond-drill hole, 1,000 feet in length, was drilled from surface. The new equipment which was purchased, consisting of an air receiver, two hoists, a cage, and various smaller items, was not put into service. Operations ceased in September.

E. H. Orser was manager, employing an average of 3 men during the period of operation.

Tyranite Mines, Limited

Tyranite Mines, Limited, was incorporated in April, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,511,419 have been issued. The officers and directors are: E. L. Koons, president; William L. Marcy, vice-president; W. S. Walton, secretary; C. L. Ingham, treasurer; Harry Yates and A. H. Sharpe, directors. The head office is at Kirkland Lake. The executive office is at 319 Erie County Bank Building, Buffalo, N.Y., and the secretary's office is at 603 Royal Bank Building, Toronto. The mine address is Gowganda.

The property consists of 9 claims, 356 acres, in Knight and Tyrrell townships, Matachewan area, district of Timiskaming.

Operations continued throughout 1938. An inclined, 2-compartment winze was sunk from the 525-foot level for a distance of 350 feet, and new levels were established at 675 and 825 feet. The following development work was accomplished: drifting, 684 feet; crosscutting, 20 feet; raising, 50 feet. Eleven diamond-drill holes, totalling 764 feet in length, were drilled from surface, and 66 holes, totalling 4,978 feet, were drilled from underground. Some 7,826 tons of development rock was hoisted. At the end of the year plans were made to erect a mill early in 1939.

W. J. Trestrail was superintendent, employing an average of 26 men throughout the year.

Uchi Gold Mines, Limited

Uchi Gold Mines, Limited, was incorporated in January, 1937, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,500,000 have been issued. The officers and directors are: J. E. Hammell, president; Robt Fennell, vice-president and secretary-treasurer; John Bland, assistant secretary; Mrs. Eola Hammell, B. H. Budgeon, and A. G. Hattie, directors.

The head office is at 25 King Street West, Toronto. The mine address is Uchi Lake.

The property, consisting of 29 claims, 1,200 acres, is located half way between Lost bay of Confederation lake and Uchi lake in Earngey township, Patricia portion of the district of Kenora. It may be reached by airplane from Sioux Lookout or Hudson on the main western line of the Canadian National Railways. These claims were originally known as the MacAulay group.

Operations continued throughout 1938. New buildings constructed included the following: a temporary wooden headframe; an electrical shop; a switching station; a 120- by 26-foot cookery, with a 40- by 48-foot kitchen attached; three 2-storey bunk-houses, 26 by 90 feet; and a staff-house. A power-line from the hydro plant at Ear Falls, 43 miles away, was built.

In July a new vertical, 4-compartment shaft was collared, 800 feet south of the original shaft. Sinking under power began on October 18, and at the end of the year a depth of 226 feet had been reached and a connection made with the old workings at 100 feet. The present objective depth of the shaft is 1,000 feet. Levels to connect with the older workings will also be cut at 300, 450, and 600 feet.

The following table shows the underground development work done at the end of 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
No. 1 SHAFT (2-compartment, vertical)	623	.....	623
No. 2 SHAFT (4-compartment, vertical)	.....	226	226
100-FOOT LEVEL:			
Drifts	993	687	1,680
Crosscuts	169	652	821
Raises	.....	111	111
300-FOOT LEVEL:			
Drifts	864	486	1,350
Crosscuts	94	559	653
Raises	.....	922	922
450-FOOT LEVEL:			
Drifts	237	1,043	1,280
Crosscuts	90	418	508
Raises	.....	398	398
600-FOOT LEVEL:			
Drifts	743	499	1,242
Crosscuts	107	575	682
Raises	.....	193	193

The following diamond-drilling was done during the year:—

	Holes	Feet
Surface	55	6,921
Underground	130	9,822

The site for a 500-ton mill was chosen, just west of the new shaft, and plans for its erection were complete at the end of the year.

An average of 122 men was employed, 40 of whom were in the mine. R. H. Sturgess is manager.

Upper Canada Mines, Limited

Upper Canada Mines, Limited, was incorporated in 1936 with an authorized capitalization of 2,500,000 shares of $1 par value. In April, 1938, the capitalization was increased to 3,500,000 shares of $1 par value, of which 2,849,009 had

been issued at December 31, 1938. The officers and directors are: R. R. Brown, president; T. J. Day, vice-president; Wm. Magladery, secretary-treasurer; H. S. Crabtree and H. E. Martin, directors. The head office is at 80 Richmond Street West, Toronto. The mine office is at Kirkland Lake.

The property consists of 19 claims in Gauthier township, Kirkland Lake area, district of Timiskaming.

Mining operations continued throughout 1938. No. 1 shaft was slashed to make a third compartment from surface to the 500-foot level. Underground development work consisted of 2,567 feet of drifting, 638 feet of crosscutting, and 275 feet of raising. Forty-two diamond-drill holes, totalling 2,915 feet in length, were drilled from underground. Some 6,424 tons of ore and 8,188 tons of waste were hoisted during the year.

A six-month lease of the 125-ton mill at the Morris Kirkland mine was obtained, and the mill was operated from November 1 to December 31. A total of 6,270 tons of ore was treated. The ore is taken by truck from the Upper Canada mine to the mill, a distance of 5 miles. Plans for the erection of a 125-ton mill on the company's own property were under way at the end of the year.

New buildings constructed during 1938 included switch-house, hoist- and compressor-house, combination office, storehouse, and dry-house, shaft-house, headframe, boiler-room, pump-house, core-house, and garage. The assay office was rebuilt.

A 1,500-cubic-foot Alley and MacLellan compressor, with a 300 h.p. motor, and a 36- by 42-inch Ingersoll-Rand hoist were added to the plant equipment. The mining plant was completely electrified. Power is delivered to three 300 k.v.a., 25-cycle transformers.

An average of 66 men was employed during the year. C. W. Tully and J. A. W. Brown were successively in charge of operations.

Upper Seine Gold Mines, Limited

Upper Seine Gold Mines, Limited, was incorporated in April, 1937, to succeed the Upper Seine Gold Syndicate. The authorized capitalization is 3,000,000 shares of $1 par value, of which 1,358,955 have been issued. The officers and directors are: Wm. L. Doyle, president and general manager; W. L. Anderson, vice-president; C. A. Mills, secretary-treasurer; Dr. E. A. Dolson, director. The head office is at 156 Yonge Street, Toronto. The mine address is Atikokan.

The property consists of 11 claims, 560 acres, located on Sawbill lake in the Upper Seine area, district of Rainy River. It may be reached by water in the summer, and in the winter by a 27-mile road north of Atikokan on the Port Arthur–Fort Frances branch of the Canadian National Railways. It includes the old Sawbill mine, which produced gold in the nineties. The underground work accomplished by the operators at that time includes a vertical shaft to a depth of 240 feet, with a total of 935 feet of lateral work. About 200 feet south of No. 1 shaft is a second vertical shaft, which is connected to the lateral workings from No. 1 shaft on the 50-foot level. On the 240-foot level, north of No. 1 shaft, a winze was sunk to a further depth of 50 feet. Stoping was carried on north and south of No. 1 shaft on the 50- and 100-foot levels.

In 1936 and 1937 the present operators carried on surface exploration work and did some diamond-drilling from surface. In September, 1937, dewatering of the old workings was begun.

During the first six months of 1938 some 320 feet of drifting was done on the third level, and 500 feet of surface-trenching, 4 feet deep, was accomplished. Mining operations were suspended in June.

The 50-ton amalgamation mill, formerly in use at the property of Hudson-Patricia Gold Mines, Limited, was purchased and was installed during the second half of the year. The equipment includes a Blake 15- by 9-inch jaw crusher, Allis-Chalmers 5- by 5-foot ball mill, Denver 12- by 18-inch jig, and Dorr 3- by 18-foot rake classifier, corduroy blankets, and amalgam plates.

Additional equipment bought during 1938 included a Ruston and Hornsby Diesel engine, and a 30 h.p. Allis-Chalmers caterpillar tractor.

The following buildings were erected: mill, blacksmith shop, magazine, cap-house, cook-house, ice-house, office, and an addition to the boiler-house.

W. N. McClintock was superintendent, employing an average of 13 men.

Virita Porcupine Gold Mines, Limited

Virita Porcupine Gold Mines, Limited, was incorporated in July, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,720,505 have been issued. The officers and directors are: G. E. Buchanan, president; V. R. MacMillan, secretary-treasurer; R. M. Elliot, Geo. A. MacMillan, and G. W. Lee, directors. The head office is at 1705 Royal Bank Building, Toronto. The mine address is South Porcupine.

The property consists of 11 claims, approximately 440 acres, in Whitney township, Porcupine area, district of Cochrane.

Operations were carried on during part of 1938. The company reports that a shaft was sunk to a depth of 55 feet, and that 60 feet of drifting was done. Fifteen diamond-drill holes, totalling 307 feet in length, are also reported to have been drilled from surface. Operations were suspended before the end of the year.

G. A. MacMillan was manager, employing an average of 5 men during the period of operation.

L. A. Voges

Orelia Mines, Limited, was incorporated in October, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, to succeed Golden Star Consolidated, Limited, and Golden Star Mining Syndicate. Shareholders of the former received one new share for each old share and unit-holders of the latter received thirteen new shares per unit. The officers and directors are: W. P. Ryan, president; R. H. Wilson, vice-president; Samuel Ciglen, secretary-treasurer; Wilfred Leeson and C. O'Loughlin, directors. The head office is at 427 Spadina Avenue, Toronto. The mine address is Mine Centre.

The property consists of 8 claims, 397 acres, on the south shore of the north-east arm of Bad Vermilion lake, about 2 miles south of Mine Centre on the Fort Frances branch of the Canadian National Railways. It includes the old Golden Star mine and 5 adjoining claims purchased from Seine River Mines, Limited.

On the Golden Star claims there is a shaft 480 feet deep, with considerable lateral development on six levels, accomplished by former operators prior to the year 1900. In 1934, the mine was dewatered and sampled and some ore from surface dumps was milled. No underground work has been done by the present owners. In 1937, the old buildings and the mill were repaired and some 200 tons of tailings were treated. No recovery was obtained, owing to the inadequacy of the mill.

On June 1, 1938, the property was leased to L. A. Voges, who made changes in the mill circuit and treated 250 tons of mill tailings between June 1 and July 22. A ton of concentrates shipped to Flin Flon yielded 2.95 ounces of gold and 1.17 ounces of silver. Later in the summer 280 tons of tailings and 80 tons of ore

from an open cut near the old Golden Star shaft were treated. From this operation 3.357 ounces of gold and 2.34 ounces of silver were obtained.

Three men were employed between June 1 and September 30. The property was idle at the end of the year.

Wascanna Mines, Limited

Wascanna Mines, Limited, which was incorporated in March, 1936, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,922,656 have been issued. The officers and directors are: J. H. Colville, president; E. M. Thomson, vice-president; J. A. Doupe, secretary-treasurer; H. T. Leslie, C. D. McGregor, and L. W. Nachman, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Tashota.

The property consists of 13 claims in the Kowkash area, district of Thunder Bay, immediately east of Tashota station on the main line of the Canadian National Railways, and includes the old Tash-Orn mine.

The vertical, 2-compartment shaft on this property is 322 feet deep, with levels at 100, 200, and 300 feet. Some 400 feet of lateral work was done on the 100-foot level by former operators about 1916. The present company did 1,421 feet of drifting and crosscutting on the 200- and 300-foot levels in 1937.

No underground work was done during 1938. Operations were confined to the drilling of 9 diamond-drill holes, having a total length of 3,116 feet, from surface.

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 capitalization was increased to 3,000,000 shares in July, 1935, and was again increased in June, 1936, to 4,000,000 shares. The number of shares issued at December 31, 1938, was 3,498,890.

The officers and directors are: H. G. Young, president and manager; H. D. Tudor, vice-president; H. R. Tudhope, secretary-treasurer; W. G. Cameron and A. C. Snively, directors. The head office is at 80 King Street West, Toronto, and the mine address is Box 990, Kenora.

The property consists of 30 claims, 1,194 acres, at Witch bay, on the Lake of the Woods, district of Kenora, and includes the old Wendigo mine. The mine is about 22 miles southeast of Kenora and may be reached by boat in summer and by road in winter.

Operations continued throughout 1938. No. 1 shaft was deepened from 512 to 833 feet, and new levels were established at 575, 650, 725, and 800 feet.

The following table shows the underground development at December 31, 1937, during 1938, and the total:—

UNDERGROUND DEVELOPMENT

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
No. 1 SHAFT	512	321	833
No. 2 SHAFT	100	.....	100
50-FOOT LEVEL:			
Drifts	183	.....	183
100-FOOT LEVEL:			
Drifts	306	55	361
Crosscuts	56	.....	56

UNDERGROUND DEVELOPMENT—*Continued*

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
200-FOOT LEVEL:			
Drifts	863	97	960
Crosscuts	188	.....	188
Raises	14	.....	14
350-FOOT LEVEL:			
Drifts	597	111	708
Crosscuts	51	.....	51
Raises	136	.....	136
500-FOOT LEVEL:			
Drifts	912	.....	912
Crosscuts	182	.....	182
Raises	211	.....	211
575-FOOT LEVEL:			
Drifts	.....	390	390
Crosscuts	.....	11	11
650-FOOT LEVEL:			
Drifts	.....	695	695
Crosscuts	.....	75	75
Raises	.....	368	368
725-FOOT LEVEL:			
Drifts	.....	320	320
Raises	.....	106	106
800-FOOT LEVEL:			
Drifts	.....	556	556
Crosscuts	.....	68	68
Raises	.....	53	53

Exploration work included 41 diamond-drill holes, totalling 1,811 feet, drilled from surface, and 2,364 feet of surface-trenching, 3 feet deep. The new flotation unit for producing copper-gold concentrates commenced operation in January.

A total of 35,141 tons of ore was hoisted during the year, of which 30,041 tons were milled after sorting. The mill operated at an average daily rate of 87.5 tons. A 20- by 30-foot frame bunk-house was added to the camp buildings.

G. G. Campbell was manager until February 10, and was succeeded by H. G. Young, who was in charge for the rest of the year. An average of 114 men was employed, of whom 53 were in the mine.

Wright-Hargreaves Mines, Limited

Wright-Hargreaves Mines, Limited, was incorporated in June, 1916, with an authorized capitalization of 5,500,000 shares of no par value, all of which have been issued. The officers and directors are: E. L. Miller, president; W. H. Wright, vice-president; P. H. Gerhard, secretary; Gerard F. Miller, treasurer; M. W. Summerhayes, managing director and general manager; Oliver G. Donaldson and J. Y. Murdoch, directors. R. L. Healy is assistant to the general manager. The head office is at Fort Erie North. The executive office is at the Liberty Bank Building, Buffalo, N.Y. The mine address is Kirkland Lake.

The main property consists of 4 claims, 155 acres, in Teck township, Kirkland Lake area, district of Timiskaming. The company also has four claims, totalling 203 acres, in Morrisette township, from which sand for backfilling is obtained. Two claims in Teck township and 8 claims in Lebel township are used for slimes disposal.

The mine and mill continued to operate throughout 1938, the mill running at an average rate of 1,191 tons per day. An average of 1,055 men was employed, 755 of whom were in the mine. The No. 5 winze was sunk a further 784 feet to a

total depth of 6,404 feet, and new levels were established at 5,850 and 6,150 feet. Stations were also cut at 5,700, 6,000, and 6,300 feet. Lateral development work amounted to 16,689 feet of drifting and 6,176 feet of crosscutting. Some 3,946 feet of raises and 2,417 feet of box-holes were driven. Diamond-drilling amounted to 216 holes, totalling 24,520 feet in length, from underground.

The following is taken from the report of the general manager for the fiscal year ending August 31, 1938:—

During the period 437,130 tons of dry ore were treated in the mill, from which we recovered 225,496 ounces fine gold, and 38,457 ounces fine silver. There was realized from marketing this bullion, $7,933,103.92. The average grade of the ore going to the mill was 0.539 ounce or $18.900 per ton, with a recovery of 0.518 ounce or $18.148 per ton, and extraction of 96.02 per cent.

ANALYSIS OF OPERATING COSTS

	Total cost	Cost per ton milled
Development, exploration, and pumping	$622,375.21	$1.424
Stoping	1,129,172.06	2.583
	$1,751,547.27	$4.007
Less mine development—undistributed	158,000.00	.362
	$1,593,547.27	$3.645
Transporting ore (hoisting, etc.)	394,877.46	.903
Milling charges	545,385.21	1.248
General surface and miscellaneous mine buildings charges	133,140.50	.305
Stock transfer, dividend and annual report expense	27,875.08	.064
Employees' group insurance, silicosis, workmen's compensation, property taxes, and insurance	97,919.30	.224
General and miscellaneous undistributed charges	162,558.57	.372
Marketing bullion	18,054.30	.041
	$2,973,357.69	$6.802
Provision for taxes	670,000.00	
Royal Mint special bullion handling tax	78,800.90	2.096
Depreciation buildings and equipment	167,377.03	
Total	$3,889,535.62	$8.898

MILLING STATISTICS

September 1, 1937 to August 31, 1938

Ore milled	tons	437,130
Average value per ton		$18.900
Gross value	$8,261,852.10	
Loss in tailings	328,748.18	
Net value recovered		$7,933,103.92
Average tons milled per day		1,197.62
Per cent. of possible running time		99.80
Tons 100 per cent. running time		1,200
Solution precipitated	tons	1,428,020
Solution precipitated per ton of ore	tons	3.27
Value per ton in tailings		$0.752
Yield per ton of ore		$18.148
Per cent. extraction		96.02
Cyanide consumed per ton of ore (K.C.N.)	pounds	0.576
Zinc consumed per ton of ore	ounces	1.680
Zinc consumed per ton of solution	ounces	0.514
Lime consumed per ton of ore	pounds	4.088
Steel consumed per ton of ore, ball mills	pounds	2.598
Steel consumed per ton of ore, tube mills	pounds	2.810
Grinding, average per cent.,—325 mesh		86.3
Cost of flotation reagents consumed per ton of ore		$0.040
Average value of pregnant solution per ton		$5.548
Average h.p. consumed per day		2,628
Average h.p. consumed per ton milled		2.19
Power cost per h.p. consumed		$47.11

SUMMARY OF DEVELOPMENT AND EXPLORATION
August 31, 1938

	Drifting	Shaft-sinking	Cross-cutting	Raising	Total footage	Diamond-drilling	Excavation
	feet	feet	feet	feet		feet	cu. ft.
Aug. 31, 1937....	205,076	12,471	61,882	15,055	294,484	161,370	654,138
Fiscal year.....	18,222	1,004	4,750	3,865	27,841	24,995	89,964
Aug. 31, 1938....	223,298	13,475	66,632	18,920	322,325	186,365	744,102

PRODUCTION RECORD, 1921–1938

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[1].....	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	12.20	3,248,496	11.37	3,027,848	[2]825,000
1932.....	295,525	14.52	4,292,194	13.57	4,011,554	1,100,000
1933 (8 mos.)[3].....	193,441	17.85	3,452,207	16.62	3,215,730	[4]550,000
1934[5].....	330,741	22.44	7,423,229	21.44	7,089,884	2,750,000
1935.....	350,196	21.76	7,619,834	21.06	7,374,158	3,300,000
1936.....	387,464	20.30	7,866,397	19.60	7,595,231	3,300,000
1937.....	429,120	18.70	8,022,580	17.98	7,714,486	3,850,000
1938.....	437,130	18.90	8,261,852	18.15	7,933,104	3,850,000
Total.....	4,131,454	$16.29	$67,317,938	$15.31	$63,272,967	$24,131,250

[1]Period 1921 to 1932, inclusive, calendar years.
[2]Years 1931 to 1938 reflect increase in value of gold.
[3]Fiscal year closing changed to August 31.
[4]April and July dividends only.
[5]12 months fiscal year ending August 31, 1934.

ORE RESERVES ESTIMATE

	Tons	Ounces	Grade	Value at $35 per ounce
On hand August 31, 1937.....	1,455,609	0.53	$18.68	$27,197,275
Developed in fiscal year.....	452,293	.53	18.55	8,392,099
	1,907,902	0.53	$18.65	$35,589,374
Milled in fiscal year.....	437,130	.54	18.90	8,261,852
Ore reserves, August 31, 1938.....	1,470,772	0.53	$18.58	$27,327,522

ADDITIONS TO PLANT, BUILDINGS, AND EQUIPMENT
September 1, 1937, to August 31, 1938

Mill.....	$13,625.61
Coarse crusher house.....	2,686.90
Shops.....	5,194.47
Power-house.....	15,407.44
Substation.....	171.50
Assay office.....	256.90
General surface and buildings.....	9,995,78
Underground equipment.....	7,425.12
New buildings and additions.....	9,560.10
Sprinkler system.....	1,213.84
Tailings disposal.....	1,155.60
Offices.....	6,173,42
Total.....	$72,866.68

Development

During the year just closed, we can report major progress on our depth developments. The No. 5 winze was deepened 1,004 feet, bottoming at 6,404 feet; stations were cut at a number of the new levels, together with a pumping station and sump at the 6,150-foot level.

Drifting on several levels between the 4,000- and 5,000-foot levels, has resulted in very satisfactory ore disclosures, especially so on the 4,800-foot, developing major lengths of high-grade ore without any change of structure or formation to that of the upper levels. In addition a new vein, known as No. 8, north of our present main workings, has been developed to some extent on the three deep levels commencing at the 4,350-foot, which at present indicate major possibilities.

Milling

It will be noted the average daily tonnage was raised to 1,197 tons, an increase of 22 tons per day over the previous year. The extraction was only slightly lower, 96.02 per cent., as against 96.16 per cent. last year. Research is being continued to further improve the extraction. This work is indicating an improvement to be possible.

General

A 60,000-cubic-feet-per-minute fan was installed at the No. 5 winze on the 3,900-foot level to assure an adequate supply of fresh air for the lower levels. The general ventilation throughout the mine has been greatly improved during the year.

Yama Gold Mines, Limited

Yama Gold Mines, Limited, was incorporated in January, 1937, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 1,999,558 have been issued. The officers and directors are: R. R. Murdock, president; A. C. Smith, vice-president; G. G. Findlay, secretary-treasurer; Stanley Harpham and Angus Miller, directors. The head office is at 171 Yonge Street, Toronto. The mine address is Boston Creek.

The company holds 11 claims on the border between Catharine and McElroy townships, 6 claims in Catharine township, and 17 claims in Hearst township, Larder Lake area, district of Timiskaming.

Operations were carried on during 1938 on the group of claims on the border of Catharine and McElroy townships. Some 5,400 feet of surface-trenching, 3 feet deep, was accomplished, and 36 diamond-drill holes, totalling 21,700 feet, were drilled from surface. In the fall the sinking of a 3-compartment shaft to an objective depth of 570 feet was commenced. The shaft was 32 feet deep at the end of the year.

The following buildings were erected: residence, bunk-house and cookery, core shack, and root-house.

R. A. Coutts was superintendent, employing an average of 10 men.

Young-Davidson Mines, Limited

Young-Davidson Mines, Limited, was incorporated in April, 1926, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,584,108 have been issued. The officers and directors are: Gideon Grant, president; C. G. Knott, vice-president; Frank M. McKay, secretary-treasurer; W. C. Young, managing director; A. C. Ross, Jacob A. Davidson, R. J. Driscoll, and G. W. Adams, directors. The head office and mine office are at Matachewan.

The property consists of 5 claims, 161.9 acres, in Powell township, Matachewan area, district of Timiskaming, which is being operated under agreement by Hollinger Consolidated Gold Mines, Limited. A reference to the property appears on page 124 of this report.

During 1938 No. 2 internal shaft was sunk a further 384 feet, to a depth of 430 feet below the collar, which is at 463 feet. New levels were established at 663 and 863 feet below surface. A total of 1,326 feet of drifting and 1,204 feet of crosscutting was done, and 570 feet of exit raises and 2,060 feet of pillar and

manway raises were driven. Six diamond-drill holes, having a total length of 2,095 feet, were drilled from underground.

Construction during the year included a building to house a 500-ton ore-bin and a 60-ton waste-bin, a crusher-house, a hoist-house, a conveyer-way 290 feet long between the shaft and crusher-house, a duplex dwelling-house, and an extension to the boiler-house.

A 7- by 5-foot double-drum Nordberg electric hoist, a 36- by 48-inch Buchanan jaw crusher, and a 24-inch belt conveyer, 290 feet long, were added to the plant equipment.

H. North was manager, employing an average of 242 men throughout the year.

GRAPHITE

Black Donald Graphite Company, Limited

The Black Donald Graphite Company, Limited, was incorporated in 1906, with an authorized capitalization of 3,000 shares of $100 par value, all of which have been issued. The officers are: R. F. Bunting, president; W. B. Bunting, vice-president; R. A. Telfer, secretary-treasurer. The head office and mine office are at Calabogie.

The property consists of 300 acres in Brougham township, Renfrew county. The mine operated from January 1 to June 30, and the mill operated intermittently throughout the year. A room, 100 by 60 feet, and 7 feet high, was cut from the old incline at the 175-foot level. Graphite to the value of $41,590 was mined and milled.

An average of 11 men was employed in the mine and 27 in the mill.

GYPSUM

Canadian Gypsum Company, Limited

The Canadian Gypsum Company, Limited, has a capitalization of 3,000 shares of $100 par value, of which 2,710 have been issued. The officers and directors are: O. M. Knode, president; W. L. Keady, vice-president; C. H. Shaver, secretary-treasurer; F. B. Gibbs, director of sales; S. L. Avery, J. E. MacLeish, and Otis Wack, directors. W. F. Anderson is production manager and B. S. Barns, agent and comptroller. The head office is at Windsor, N.S., and the business office is at 1221 Bay Street, Toronto. 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 and wall board and block manufacturing buildings. During 1938 some 35,277 tons of gypsum were mined, of which 32,121 tons were milled and 3,156 tons were crushed only. An average of 15 men was employed in the mine and crushing plant. W. E. Allen is superintendent. The mine address is Hagersville.

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.

Through a wholly owned subsidiary, Toronto Asphalt Roofing Manufacturing Company, Limited, the company owns and operates an asphalt roofing plant at Mount Dennis, Ont.

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 500,000 shares of no par value, having been changed from the former capitalization of 2,000,000 shares of no par value. The officers are: Col. Henry Cockshutt, chairman; George A. Dobbie, president; J. E. McConnell and C. G. Cockshutt, vice-presidents; S. H. J. Reid, secretary; F. Andrews, comptroller and treasurer; P. P. Tyler, managing director; J. R. Inksater and S. G. Dixon, directors. The head office is at Paris, Ont.

The mine and mill at Caledonia, Seneca township, Haldimand county, was operated throughout 1938. L. V. Robinson was superintendent, employing an average of 26 men in the mine and crushing plant.

A total of 34,700 tons of rock was hoisted. Of this, 2,436 tons were crushed and ground and sold. Some 27,032 tons were manufactured into land-plaster, stucco, Paristone, Gyproc, dry Insulex, Gyproc wool, gypsum lath, and other building products.

In addition to the Caledonia mine, the company operated 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.

IRON

Algoma Ore Properties, Limited

Algoma Ore Properties, Limited, was incorporated in February, 1936, with an authorized capitalization of 50,000 shares of no par value, all of which have been issued. The officers and directors are: Sir James Dunn, president; T. F. Rahilly and E. Ward Wright, vice-presidents; William Jeffrey, secretary; E. W. Shell, treasurer; W. C. Franz, J. A. McPhail, E. G. McMillan, and H. E. Langford, directors. The head office is at Sault Ste. Marie, Ont. The mine address is Helen Mine.

This company is a wholly owned subsidiary of the Algoma Steel Corporation, Limited, from which various iron properties in Algoma district were acquired, including the Helen mine in township 29, range 24. This property consists of 42 claims, containing approximately 1,376 acres.

Operations in 1938 were carried on from January 1 to May 31, and from December 5 to the end of the year. The siderite deposit outcropping is at the top of the tallest hill in the vicinity, having a peak elevation of 1,720 feet above sea-level. A tunnel 977 feet long was driven into it at an elevation of 1,450 feet. At the inside end of the tunnel a raise to the surface of the deposit was begun. About 200 feet of this raise was completed during 1938. Some 1,200 feet of box-holes were cut. A total of 7,920 feet of surface-trenching, 3 feet deep, was accomplished.

A. A. Richardson was superintendent, employing an average of 36 men.

MICA

Kingston Mica Mining Company, Limited

The property known as the Thirty Island Lake mica mine was operated intermittently during the early part of 1938 by S. H. Orser. In March it was acquired by Charles Keller, representing interests in the United States. A new company, with a capitalization of 15,000 shares of $1 par value, known as the Kingston Mica Mining Company, Limited, was formed, and an application for a charter was made. This was not obtained until April, 1939. The officers of the new company are: Charles Keller, president; Stuart H. Richardson, vice-president; Wm. C. Richardson, secretary; Alfred Keller, treasurer. The head office and mine office are at Godfrey.

The property consists of the south half of lot 5, concession II, Bedford township, Frontenac county, and contains 100 acres.

The shaft is 130 feet deep. During 1938 operations under the direction of Charles Keller were carried on from May 1 to December 31. Some 40 feet of drifting was done.

An average of 7 men was employed.

MOLYBDENITE

McCoy Molybdenite, Limited

McCoy Molybdenite, Limited, was incorporated in March, 1937, with an authorized capitalization of 2,000,000 shares of $1 par value, of which 721,905 have been issued. The officers and directors are: Geo. A. MacMillan, president; V. R. MacMillan, secretary-treasurer; T. H. Baker, W. J. Dreany, G. E. Buchanan, and Adolph St. Pierre, directors. The head office is at 1705 Royal Bank Building, Toronto. The mine address is Denbigh.

The property consists of 9 claims in the townships of Lyndoch and Raglan, Renfrew county.

Operations were carried on during February, March, and April, 1938. A 2-compartment shaft was sunk to a depth of 50 feet, and some 260 feet of surface-trenching was done.

Geo. A. MacMillan was in charge of the work, employing 5 men.

Zenith Molybdenite Corporation, Limited

The Zenith Molybdenite Corporation, Limited, was incorporated in February, 1937, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,227,010 have been issued. The officers and directors are: W. H. Hamblin, president; F. L. Stinson, secretary-treasurer; T. R. Godfrey, John Thomson, and W. C. Jackson, directors. The head office is at 85 Richmond Street West, Toronto. The mine address is Ashdad.

In March, 1938, the company acquired the assets of the Phoenix Molybdenite Corporation, Limited, on a share for share basis. The mining property consists of the west half of lots 27 and 28, concession IV, Bagot township, Renfrew county, and contains 200 acres.

Under the former operators a shaft had been sunk to a depth of 200 feet, with levels at 95 and 175 feet, and a considerable amount of lateral work had been done. Operations during 1938, which were carried on from June 13 to October 22, were confined to 4,800 feet of surface-trenching.

John Clayton was in charge of the work, employing 10 men.

NICKEL AND COPPER

Denison Nickel Mines, Limited

Denison Nickel Mines, Limited, was incorporated in November, 1936, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 2,816,580 have been issued. The officers and directors are: J. R. Rea, president; J. H. Greenberg, vice-president; M. Campbell, secretary-treasurer; H. L. Sheppard and L. B. Sheppard, directors. The head office is at 217 Bay Street, Toronto. The mine address is Worthington. The property, on lot 12, concession II, Denison township, district of Sudbury, contains 227 acres.

Operations were continued throughout 1938. Underground work was carried on from January 1 to April 16, and from July 15 to December 24. During the period from the middle of April to the middle of July only plant construction work was done. A power-house, a substation, and a powder magazine were erected. A transmission line, 6¾ miles long, was built to connect with the hydro-electric plant at High Falls.

New plant equipment included the following: a 1,030-cubic-foot air compressor, direct-connected to a 200 h.p. Canadian Westinghouse motor; a 42- by 30-inch, double-drum Canadian Ingersoll-Rand PE-1 electric hoist, driven by a 100 h.p. Canadian Westinghouse motor.

The vertical, 3-compartment shaft was sunk a further 358 feet, to a total depth of 880 feet, and new levels were established at 650 and 800 feet.

The following table shows the lateral development work at December 31, 1937, during 1938, and the total:—

	To Dec. 31, 1937	1938	Total
	feet	feet	feet
200-FOOT level:			
Drifts	468	.....	468
Crosscuts	637	.....	637
350-FOOT LEVEL:			
Drifts	30	321	351
Crosscuts	105	.....	105
500-FOOT LEVEL:			
Drifts	348	377	725
Crosscuts	397	.....	397
650-FOOT LEVEL:			
Drifts	.....	76	76
800-FOOT LEVEL:			
Drifts	.....	92	92

The following diamond-drilling was accomplished during the year:—

	Holes	Feet
Surface	2	328
Underground	30	2,446

Carl R. Boehm was superintendent, employing an average of 20 men.

Falconbridge Nickel Mines, Limited

Falconbridge Nickel Mines, Limited, was incorporated in August, 1928, with an authorized capitalization of 5,000,000 shares of no par value. The officers and directors are: J. Gordon Hardy, president; Thayer Lindsley and

H. S. Munroe, vice-presidents; N. F. Parkinson, secretary-treasurer; W. S. Morlock, Halstead Lindsley, and H. Whittingham, directors. The head office is at 25 King Street West, Toronto.

The company operates a nickel-copper mine, concentrator, and smelter in Sudbury district, and a refinery at Kristiansand, Norway. Ernest Craig is manager of the Sudbury district operations; J. R. Gill, assistant manager; John Metz, mine superintendent; R. C. Mott, concentrator superintendent; and M. J. Tamplin, smelter superintendent. During 1937 an average of 743 men was employed, of whom 293 were underground. The mine address is Falconbridge.

The following is an extract from the annual report of the company for the year ending December 31, 1938:—

Mine Development

Combined development footages on all levels during the year were as follows:—

	Feet
Drifting and crosscutting (including slashing)	8,014
Raising (including slashing)	2,274
Fill passes (including slashing)	422
Diamond-drilling	3,083
Shaft-sinking	643
	cu. ft.
Station-cutting	51,428

Of the total 8,014 feet of drifting and crosscutting, 5,877 feet were along the ore zone, with some 2,821 feet driven on levels hitherto unexplored, except by previous diamond-drill holes. The 2,100-foot level was opened up for 1,786 feet westerly from No. 5 shaft, disclosing ore of about average grade but with continuity and width hardly measuring up to the zone at the 1,750-foot horizon. The 1,400-foot level was driven easterly and westerly from No. 1 shaft for a total distance of 794 feet, and showed an average width of 14.5 feet at better than average grade. Some 241 feet on the 1,750-foot level in the same area indicated the continuation of grade and width to this horizon.

Practically all the balance of drifting on the ore zone was carried out in connection with extensions of stoping areas. This work included the westerly advance of the 1,200-foot level drift to a point 887 feet west of No. 1 shaft. In No. 5 shaft area, advances were made westerly on the 200-foot level and both easterly and westerly on the 325-foot level for stoping purposes—easterly to connect with the fill pass system on the 625-foot level, and westerly on both the 825-foot and 1,000-foot levels for stope extension. Where these drifts extended beyond the limits of ore reserve blocks, the ore disclosed was at least equal in grade and width to that developed in contiguous blocks.

Stoping operations were extended by opening some 1,674 lineal feet of new stopes. With the exception of 400 feet on the 1,200-foot level west of No. 1 shaft, these were all in the No. 5 shaft area. Accordingly, the ore hoisted from this area was substantially increased for the year under review.

No. 5 shaft was deepened 643 feet to 2,457 feet, and stations were established at intervals of 175 feet. Diamond-drilling from the shaft bottom obtained a good ore intersection easterly from the shaft. The fill pass system at No. 5 shaft is now complete from surface to 825 feet.

It is proposed, during 1939, to complete the connections between No. 1 and No. 5 shafts on the 1,750- and 2,100-foot levels, and to open up new ground between the two shafts at various horizons above the 1,200-foot level. In addition, it is proposed to drive westerly from No. 1 shaft on the 700-foot level to explore an ore indication which is now being checked by diamond-drilling from surface.

Ore Production

Mining activities for ore production are summarized below:—

	Tons
Broken ore reserves December 31, 1937	252,579
Ore broken in stopes during 1938	360,436
Total	613,015
Less: trammed from stopes, 1938	437,885
Broken ore balance December 31, 1938	175,130

When development ore is included, tonnage of ore hoisted tabulates as follows:—

	Tons
Ore trammed from stopes, 1938	437,885
Ore from development, 1938	59,620
Total ore hoisted	497,505

Ore Reserves

As indicated by the report for the quarter ending September 30, the second half of 1938 witnessed a lessening of special impetus to mine development, in view of straitening business conditions. This brought about the abandonment—at least for 1938—of our programme to develop enough new ore each year, sufficient to replace the ore extracted during that year and in addition add one million tons to the ore reserves.

You will note accordingly that while over one million tons of new ore were indicated by our work of 1938, yet the ore extracted in that year was not also replaced. In other words, we only increased the net ore reserves by some 548,000 tons instead of a million. Attention should be drawn to the results from careful systematic development by diamond-drilling—now suspended—of the new Levack prospect, listed under "New ore from outside holdings." This covers an investigation as yet only taken to 600 feet from surface, with the ore shoot continuing on down strongly.

Our ore reserve figures then are:—

	Tons
Ore reserves as of December 31, 1937:	
Falconbridge mine	6,083,601
Outside holdings	249,000
Total as of December 31, 1937	6,332,601
Less: drawn during 1938	497,505
	5,835,096
New ore added during 1938:	
From Falconbridge mine	276,904
From outside holdings	769,000
Total added during 1938	1,045,904
Total (averaging 1.80 per cent. nickel and 0.97 per cent. copper) as of December 31, 1938	6,881,000

Ore Treatment

The ore dressing and reduction plants record satisfactory operation, the latter showing a loss of only 1.3 per cent. of full possible operating time. Only 5,421 tons of waste was picked and discarded from the hoisted ore. After deducting this amount and adjusting for difference in above-ground storage, the reduction plant performance develops as follows:—

	Tons
Total ore treated (made up of milling ore, 252,866 tons, 51.5 per cent.; smelting ore, 238,072 tons, 48.5 per cent.)	490,938
	Short tons
Matte produced	14,779.1
Nickel in matte	8,012.7
Copper in matte	4,108.5
NICKEL:	pounds
Metals recovered per ton of ore treated	32.64
Metallurgical losses per ton treated	3.49
	36.13
	per cent.
Indicated grade of ore treated (after waste rejection)	1.81
Indicated grade of ore hoisted (before waste rejection)	1.80
COPPER:	pounds
Metals recovered per ton of ore treated	16.74
Metallurgical losses per ton treated	3.49
	19.01
	per cent.
Indicated grade of ore treated (after waste rejection), 0.95 per cent.	0.95
Indicated grade of ore hoisted (before waste rejection)	0.94

Construction

The completion of that "rounding out" programme in mill and sintering plant, referred to in our 1937 report, was accomplished during the year, with considerable benefit to the operation resulting.

Failure of the timbered section of No. 1 shaft through overburden brought on the necessity of enlarging the excavation and carrying a reinforced concrete lining from bed rock to surface, some 55 feet. At the same time, the existing headframe had to be demolished and a new one erected. Though this shaft was out of service for seven weeks as a result, production was not affected.

General

Nine dwellings, including two staff residences, were erected in the townsite during the year. This brings the total to 154, of which 16 are for staff members. These dwellings are all occupied by Falconbridge employees.

The following is an extract from the report of the consulting metallurgist:—

Refinery

The refinery operated steadily and normally throughout the year. The year started with an excess of matte accumulated during the strike of the previous year, but this excess was worked off during the first few months and the production later maintained to balance the matte production. The normal amount of custom matte was received regularly.

The plant for recovery of liquid SO_2 from roaster gases was started up in September and delivery of the product has been maintained since that time to the satisfaction of our, as yet, only customer. The starting up troubles to be expected with a new plant for a new process are gradually being overcome.

For the year 1938, the amount of metals in matte received from the smelter, the refinery production, the metals in process, and metals in matte on hand at the end of the year is set out in the following table:—

	Nickel	Copper
	lbs.	lbs.
Metals in matte received, less refining losses	15,803,958	7,840,033
Produced in marketable form during year	16,425,735	8,250,642
Metals in process of refining at end of year	3,486,806	803,320
Metals in matte on hand at end of year	882,180	449,412
Total of Falconbridge and custom refined metals produced	18,665,630	9,785,630

International Nickel Company of Canada, Limited

The authorized capital of the International Nickel Company of Canada, Limited, 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 officers are: Robert C. Stanley, chairman of the board and president; John F. Thompson, executive vice-president; Paul D. Merica, Donald MacAskill, and D. Owen Evans, vice-presidents; John C. Nicholls, assistant to the president; James L. Ashley, secretary-treasurer.

The directors whose term expires in 1939 are: James L. Ashley, John F. Dulles, Reg. Halladay, Donald MacAskill, 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 1940 are: J. P. Bickell, Hon. H. Cockshutt, Wm. N. Cromwell, D. Owen Evans, Rt. Hon. Lord McGowan, R. H. McMaster, Wm. W. Mein, Rt. Hon. Lord Melchett, Paul D. Merica, Thomas Morrison, Seward Prosser, and Grant B. Shipley.

The executive office is at 67 Wall Street, New York, N.Y., and the general offices are at Copper Cliff, Ont.

This company and subsidiary companies operate hydro-electric plants at High Falls, Big Eddy, Wabageshik, and Nairn Falls, Ont.; nickel-copper mines in the Sudbury district, Ont.; smelters at Copper Cliff and Coniston, Ont.; refineries at Copper Cliff and 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 following information is extracted from the annual report of the company covering the year ending December 31, 1938:—

During the year under review your company's sales followed the downward trend of world trade, and for the first time since 1932 net profit failed to show an increase over the preceding year. It is significant, however, that the rate of increase of nickel sales during these years was greater than for industry as a whole, and that sales in 1938, while 21 per cent. less than in 1937, were still 31 per cent. in excess of the volume reported for 1929.

The company's various mines and plants were operated throughout the year at a slightly reduced scale, and from the viewpoint of costs, quality of products, and labour relations, results were highly satisfactory.

Capital expenditures made over recent years for plant, process economies, improved metallurgy and research facilities, are definitely the most important factor in maintaining the various activities at maximum efficiency. Funds thus expended in 1938 amounted to $10,750,707.10, comparable with $7,924,204.19 in 1937. Estimated disbursements for 1939 for all such purposes total approximately $10,600,000, of which the largest single item, $4,300,000, is allocated to the company's project in Finland.

Net profit of $32,399,470.23 was realized after all charges including provision for taxes, depreciation, ore depletion, and other purposes. After payment of preferred dividends of $1,933,898.75, there remained $30,465,571.48, equivalent to $2.09 per share of common stock, and dividends aggregating $29,156,338.00 were disbursed on this stock.

Sales

	1938	1937
	pounds	pounds
Nickel in refinery and smelter products (Copper Cliff, Port Colborne, Clydach)	142,501,701	173,386,406
Nickel in rolling mill and foundry products (Birmingham, Glasgow, Huntington, Bayonne)	18,913,204	29,881,744
Nickel in salts and chemicals (Copper Cliff, Clydach, Birmingham)	2,963,340	4,432,793
Total sales of nickel in all forms	164,378,245	207,700,943
Monel[1]	15,091,998	19,494,912
Rolled nickel[1]	5,952,224	12,066,459
Inconel[1]	886,408	1,115,367
Copper	292,129,727	291,880,403
Selenium	62,398	81,334
Tellurium	3,036	4,423
	ounces	ounces
Gold (including recoveries from purchased materials)	82,086	75,840
Silver (including recoveries from purchased materials)	2,470,509	2,356,170
Platinum metals	193,195	188,756

[1]Nickel contents of these products are included in the item "Nickel in rolling mill and foundry products" above.

Mines

Ore requirements were extracted from four mines, which were operated continuously throughout the year, as follows:—

	Short tons
Frood	3,497,846
Creighton	1,092,155
Levack	814,513
Garson	380,780
Total	5,785,294

The new shaft at the Levack mine was completed, and the surface plant to serve this shaft has been erected. Mine development is advancing rapidly, and this completely new unit is scheduled for ore production by July, 1939.

The open pit mining development at the Frood mine, referred to in last year's report, was started in June, 1938, and the project is well advanced. At the year end a million tons of ore had been developed and ore shipments started in January.

New work projected by the mining department includes an underground shaft in the Creighton mine, necessary for economic extraction of ore from the lower ore bodies, and a shaft and surface plant at the Garson mine to increase extraction and to lower costs of mining at this property.

Ordinary underground development was continued in all mines at a rate compatible with ore production requirements. The following table shows the development advance of shafts, drifts and crosscuts, raises, winzes, and box-holes in all operating mines:—

	1938	Total to date
	feet	feet
Frood	16,337	303,274
Creighton	10,702	274,930
Levack	13,122	62,548
Garson	3,514	79,562
Total	43,675	720,314

Smelters

The concentrator was operated at approximately the same rate as in the previous year, and a total of 4,519,652 tons of ore was milled. Continued experimental and research work in this important department has resulted in improved metallurgy, increased tonnage per unit of equipment, and the lowering of metal losses. The percentage of metal lost in tailings has decreased each year since 1933.

The smelter at Copper Cliff was operated at a slightly lower rate than in 1937 and produced 182,904 tons of bessemer matte and 158,912 tons of converter copper. Due in large measure to assistance rendered by the new central research laboratory a substantial advance in smelter metallurgy was made. Important improvements have been the reduction of metal losses in slags and the use of molten bessemer matte in the Orford separation process, which resulted in substantially lower operating costs.

The Coniston smelter was operated continuously, processing 823,906 tons of ore and producing 48,608 tons of bessemer matte. Many plant improvements were made to prevent accidents and to minimize fire hazards.

Hydro-Electric Power Plants

The plants at High Falls, Big Eddy, Wabageshik, and Nairn Falls ran at capacity, and no major repairs were necessary. The dams, power-houses, generating equipment, and transmission lines are maintained at all times in first-class condition. Power requirements at Copper Cliff have increased in recent years to such an extent that, to supplement the company's own supply in periods of low water, additional large blocks of power have been secured from the Hydro-Electric Power Commission of Ontario.

Horseshoe Lake Mining Company, Limited

As mentioned in last year's report, upon acquiring complete ownership of this company at the end of 1936 the rehabilitation of its sodium sulphate plant at Ormiston, Saskatchewan, was undertaken. This work has now been completed. The steam drying system for dehydrating was replaced by coal-fired rotary driers. Diesel electric power was installed throughout in place of steam electric power. Equipment was provided for stock-piling, making possible continuous operations during periods when the soda lake is flooded. A combined office and warehouse was erected and living quarters for employees provided. The new plant is now operating very satisfactorily and an adequate supply of sodium sulphate, an important flux for use in the Copper Cliff smelter, is assured at lower cost of production.

Refineries

Port Colborne Nickel Refinery.—This refinery produced 124,233,682 pounds of refined nickel (of which 115,482,436 pounds were electrolytically refined) a reduction of 16 per cent. from the figures reported for 1937.

Improvements were made in roasting furnace practice which resulted in a 3½ per cent. increase of production and a 10 per cent. decrease in fuel consumption. At the same time dust losses were substantially reduced.

Anode smelting practice was greatly improved by the installation of pre-heaters and dust collectors on the furnaces, which decreased oil consumption and effected a saving of approximately 80 per cent. of the dust losses. Due to enlarging the size of the anode furnaces, and applying the appurtenances mentioned, the smelting capacity has been doubled during the past four years. Casting wheels are being installed in the refinery, which will result in a substantial saving of arduous labour.

The works research department, co-operating with the central research laboratory in Copper Cliff, has carried on many experiments directed toward improvement in process or quality of product.

Ontario Refining Company, Limited.—This refinery received 158,793 tons of converter copper, transferred in a molten state from the Copper Cliff smelter, and produced 145,141 tons of refined copper.

Among the principal accomplishments of 1938 were the continuous operation of the electric refining furnace and the doubling of the production and deliveries of the new "ORC" vertically cast wire bars, pointed at both ends.

The works research department, in co-operation with the central research laboratory at Copper Cliff, carried on active experimentation, as a result of which many mechanical and metallurgical improvements were made.

Ore Reserves

Proven ore reserves at December 31, 1938, excluding Petsamon Nikkeli O/Y, were 212,368,000 short tons, an increase of 5,971,000 tons over the figures reported a year ago. The nickel-copper contents of the ore reserves are calculated to be 6,806,000 tons, an increase of 67,000 tons.

Throughout the year the geological department continued the campaign of exploratory diamond-drilling referred to in last year's report.

Employees

The total number of employees at the year end was 17,282, distributed as follows: Canada, 10,147; Great Britain, 3,490; United States, 2,121; Finland, 1,457; other countries, 67. Employees on December 31, 1937, including Finland, numbered 17,968.

The retirement system for the benefit of employees, which is financed entirely by the company, completed its eleventh year of operation, and 345 pensions and 68 death benefits were paid during 1938. At the year end the amount of the retirement system liability, as determined by actuarial calculation, was $14,108,724.27. Against this liability, government bonds in an amount of $14,106,323.30 were held under control of your board of directors as at that date.

The contributory non-occupational accident and sickness insurance plan, which was inaugurated in 1937 for all of the company's employees in Canada and the United States whose remuneration is on an hourly basis, completed its first year of operation and demonstrated its value as a welfare measure. In those countries, 3,630 employees received the stipulated benefits during their periods of incapacitation on account of sickness and accident. During the year a similar plan was inaugurated for the company's employees in Great Britain.

During 1938 an average of 2,668 men was employed at Copper Cliff, 466 at Coniston, 2,581 at Frood, 882 at Creighton, 621 at Levack, and 263 at Garson.

Donald MacAskill is general manager; E. A. Collins, assistant to the general manager; R. D. Parker, general superintendent; I. J. Simcox, assistant to the general superintendent; H. J. Mutz, superintendent of mines; P. F. MacDonald, superintendent of smelters; F. J. Eager, superintendent of the Frood mine; A. F. Brock, superintendent of the Frood open pit; B. F. Crandall, superintendent of the Creighton mine; C. H. Stewart, superintendent of the Levack mine; J. B. Fyfe, superintendent of the Garson mine; R. M. Coleman, superintendent of the Copper Cliff smelter; E. Herbert Rose, superintendent of the Copper Cliff concentrator; E. T. Austin, superintendent of the Coniston smelter.

PEAT

Wm. Leasa

Wm. Leasa, Milverton, operated the peat property in lot 11, concession X, Ellice township, Perth county, some 7 miles north of Stratford, during the summer of 1938.

About 450 tons of peat fuel were produced.

Geo. Runke and Sons

During the summer of 1938 Geo. Runke and Sons, 115 Cameron Street North, Kitchener, produced and sold about 120 tons of peat fuel from a small bog, 20 acres in extent, situated in the upper part of the German tract, lot 55, Waterloo township, Waterloo county.

Walter J. Stewart

Walter J. Stewart, Box 186, Morewood, operated a peat bog near Morewood, in Winchester township, Dundas county, during the summer of 1938. Some 50

tons of peat fuel were produced, of which 20 tons were sold. The peat is cut into small blocks and allowed to dry in the sun and wind.

SILVER AND COBALT

E. Bateman and Partners

E. Bateman and two partners, Messrs. Palmi and McAllister, operated No. 18 vein of the Coniagas mine in Coleman township, Cobalt area, district of Timiskaming, under a lease from Ambrose Murphy and A. P. Landry, from July to November, 1938.

Some work was done on the 225-foot level, the ore being hoisted through an open stope to surface.

The work was done by the three partners and two employees.

P. E. Cain and Jos. McDonough

P. E. Cain and Jos. McDonough, the owners of the Wettlaufer mine in South Lorrain township, district of Timiskaming, operated the property from January 2 to December 13, 1938. Operations were confined to picking dumps, working a vein on surface, and selective mining of exposed veins on the first level.

Herman Laitenen was in charge of the work, and 5 men were employed.

F. L. M. Chaplin

F. L. M. Chaplin operated the Cobnor mine, in Bucke township, district of Timiskaming, under lease from the York Bousquet Gold Mines, Limited, from July 5 to October 31.

An average of 15 men was employed under the direction of S. S. W. Cole. The mine address is Cobalt.

Cobalt Products, Limited

Cobalt Products, Limited, has an authorized capitalization of 40,000 shares of no par value, of which 38,003 have been issued. The officers are A. Kelso Roberts, president; Jos. McDonough, vice-president; and W. G. Hughson, secretary-treasurer. The head office is at 67 Yonge Street, Toronto.

The company operated the Beaver mine in Coleman township, district of Timiskaming, under lease from the P. E. Cain Estate from August 1 to December 31, 1938. From January 1 to June 15 the property was worked under lease by A. G. Morgenthaler. An account of this operation appears on page 233 of this report.

Cobalt Products, Limited, built a new dry-house and boiler-house, made repairs to the shaft-house, and installed a 10- by 12-inch Jenckes air-hoist.

Underground development work consisted of 50 feet of drifting and 15 feet of crosscutting.

An addition to the company's own mill was built, the mill was reconditioned, and the following equipment was added: a 100-ton Canadian Allis-Chalmers rolls crusher, a 100-ton Richard Pulsator jig, a Denver No. 250 flotation cell, a 4-foot by 6-inch Dorr classifier, two hydraulic classifiers, a 22-inch Dorr thickener, and a 4-inch Wabi diaphragm pump. Milling operations were carried on from November 1 to the end of the year. Some 3,175 tons of ore were treated. This included ore from the Beaver and Dotsee mines and from independent leases.

J. E. McDonough was manager. An average of 9 men was employed in the mine during the period of operation, and an average of 26 men on construction work and in the mill. The mine address is Cobalt.

Cobalt Properties, Limited

Cobalt Properties, Limited, was incorporated in August, 1931, with an authorized capitalization of 25,000 shares of $1 par value, all of which have been issued. The officers and directors are: W. Mavor, president; E. L. Tomney, secretary; E. A. McDonald, treasurer; J. D. Henry and A. Brocklebank, directors.

The company owns and operates several properties in Bucke and Coleman townships, Cobalt area, district of Timiskaming.

Operations were carried on intermittently from January 1 to December 31, 1938. No underground development work was done. Ore was obtained from remnants of pillars and old stopes at the different mines held by the company. Some 190 tons of mill rock were shipped to the O'Brien mill for treatment, and small shipments of high-grade cobalt, silver, and niccolite ores were made.

Arthur Brocklebank was manager, employing an average of 6 men.

Comet Leasing Company

The Comet Leasing Company is composed of James H. Price, Cobalt; Bruce Williams, Kirkland Lake; and J. A. Price, Cobalt. The company has a lease on the Kerr Lake mine, in Coleman township, Cobalt area, district of Timiskaming. The head office is at 1 Government Road East, Kirkland Lake, and the mine address is Cobalt.

Operations were carried on throughout 1938. A 2-compartment shaft was sunk to a depth of 90 feet, and a level was established at 35 feet, where about 100 feet of drifting and 20 feet of raising were done. A small hoist-room was built.

About 2,000 tons of high-grade silver and cobalt ores were shipped. James H. Price was manager, employing an average of 9 men.

J. C. Dean

The Silver Bar mine, owned by J. C. Dean, consists of 25 acres in Coleman township, Cobalt area, district of Timiskaming. The mine address is Cobalt.

Some 3,000 pounds of high-grade ores were shipped to the Temiskaming Testing Laboratories for treatment during 1938.

J. C. Dean was in charge.

Dotsee Cobalt Mines, Limited

Dotsee Cobalt Mines, Limited, was incorporated in June, 1938, with an authorized capitalization of 100,000 shares of $1 par value, of which 50,003 have been issued. The officers are: A. Kelso Roberts, president; Jos. McDonough, vice-president; and W. G. Hughson, secretary-treasurer. The head office is at 67 Yonge Street, Toronto.

The company operated the Yorkshire Cobalt mine, on the northwest quarter of the south half of lot 1, concession II, Bucke township, Cobalt area, district of Timiskaming, under lease throughout 1938.

New buildings erected during the year included the following: power-house, hoist-house, headframe, shaft- and rock-house, magazine, and cap-house. A 120 h.p. Fairbanks-Morse Diesel engine and a 750-cubic-foot Sullivan angle compound air compressor were added to the plant equipment.

Underground development work consisted of 1,230 feet of drifting, 22 feet of crosscutting, 218 feet of raising, and 136 feet of box-holes.

Silver and cobalt ores were shipped to the mill of Cobalt Products, Limited, for treatment.

An average of 16 men was employed under the direction of O. L. Dixon. The mine address is Cobalt.

R. Fauteaux

The Silver Cliff mine, in Coleman township, Cobalt area, district of Timiskaming, was operated under lease by R. Fauteaux in 1938.

Shipments of high-grade silver and cobalt ores were made to Deloro.

The mine address is Cobalt.

Fountain Falls Mining Syndicate, Limited

The Fountain Falls Mining Syndicate, Limited, was incorporated in August, 1937, with an authorized capitalization of 35,000 shares of $1 par value, of which 19,620 have been issued. Of these, 11,666 were allotted to the vendors for the property. L. H. Sutherland is president, and H. M. Peterson is secretary-treasurer. The head office is at Haileybury. The mine office is at Cobalt.

The property consists of 4 claims in Gillies limit, Cobalt area, district of Timiskaming.

Operations were carried on from January to June, 1938. A vertical, 2-compartment shaft was sunk to a depth of 55 feet, and some crosscutting was done on a level at 50 feet.

An average of 5 men was employed, under the direction of Peter Anderson.

W. C. Inch

Curry Mine

W. C. Inch, of Haileybury, obtained a lease on the Curry mine, in South Lorrain township, district of Timiskaming. During the summer the workings were dewatered and examined, and test shipments of silver and cobalt ores were sent to Deloro.

University Mine

W. C. Inch operated the University mine, in Coleman township, Cobalt area, district of Timiskaming, during the summer of 1938. A small shaft was sunk on the vein in the open pit, to a depth of 30 feet. Three men were employed.

Shipments of high-grade silver and cobalt ores were made to Deloro.

J. V. Legris and Associates

The Lorrain Consolidated mine, in South Lorrain township, district of Timiskaming, was leased to J. V. Legris, of Cobalt, and two associates, in 1938.

The old shaft was dewatered and a small amount of cobalt ore was mined in the winter. In the summer four men were employed in picking ore from the dumps. In the fall an ore-sorting jig and a slime table were installed to treat the ore. Some 73 tons of ore and concentrates were shipped to Deloro.

J. V. Legris was in charge of the work, employing an average of 8 men.

J. A. MacArthur

J. A. MacArthur, of Haileybury, obtained an option on the Rochester mine, on lot 2, concession III, Coleman township, Cobalt area, district of Timiskaming, from W. D. Taylor, and carried on operations from January to July, 1938.

About two tons of silver-cobalt ore were shipped to Deloro.

W. E. McCready and Partner

W. E. McCready, of Cobalt, and a partner obtained a lease on the Red Jacket mine, in Coleman township, Cobalt area, district of Timiskaming, and carried on operations from July to October, employing 4 men.

A small shipment of silver-cobalt ore was sent to Deloro.

An account of work done in the early part of the year by Thomas Wainwright and a partner appears on page 236 of this report.

Hugh MacDonald

Hugh MacDonald, of Cobalt, operated the Temiskaming mine, in Coleman township, Cobalt area, district of Timiskaming, under lease throughout 1938, employing 3 men.

Thirty tons of high-grade silver, cobalt, and nickel ores were shipped to Deloro.

George Martin

Crown Reserve Mine

George Martin, of Cobalt, operated the Crown Reserve mine in Coleman township, Cobalt area, district of Timiskaming, under lease from May to November, 1938, employing 5 men.

About 9 tons of cobalt-silver ore were shipped for treatment.

Provincial Mine

George Martin operated the Provincial mine, in the Gillies limit, Cobalt area, district of Timiskaming, under lease throughout 1938.

The headframe was increased to a height of 32 feet, and a hoist-house and small mill building were erected. An 8- by 10-inch Jenckes air hoist was installed. The milling equipment consisted of a bumping-table, a double set of jigs, and two James concentrating tables. The milling capacity is 50 tons per day.

Some 20 feet of drifting and 25 feet of raising were done underground, and 30 feet of surface-trenching was completed.

About 31 tons of ore and concentrates were shipped. An average of 7 men was employed.

Raoul Mercier

Raoul Mercier, of Cobalt, obtained a lease on the Trethewey mine, in Coleman township, Cobalt area, district of Timiskaming, from Ambrose Murphy and A. P. Landry, and carried on operations from June to December, employing 4 men.

The ore was obtained from an open cut. About 15 tons of cobalt ore were shipped for treatment.

Miller-Elliott Mines

The Canadian Lorrain property, in South Lorrain township, Cobalt area, district of Timiskaming, was acquired by H. G. Miller, of Cobalt, who operated it throughout 1938 under the name of Miller-Elliott Mines.

A 550-cubic-foot Canadian Ingersoll-Rand compressor, driven by a 120 h.p. Diesel engine, and a 7- by 10-inch Jenckes air hoist were installed.

No underground development work was done. About 500 tons of the broken mill ore which had remained in the stopes were hoisted and shipped for treatment. An average of 7 men was employed.

In December, a new company known as Millwights Mines, Limited, with an authorized capitalization of 3,000,000 shares of $1 par value, was formed to carry on the operation of the property.

M. J. O'Brien, Limited

O'Brien Mine

The O'Brien (Cross Lake) mine, in Coleman township, Cobalt area, district of Timiskaming, is owned and operated by M. J. O'Brien, Limited. The officers of the company are: M. J. O'Brien, president; J. A. O'Brien, vice-president; H. A. Green, secretary-treasurer. J. G. Dickenson is general mines manager, and H. G. Kennedy is mine manager. The head office is at 140 Wellington Street, Ottawa. The mine address is Cobalt.

The mine and mill continued to operate throughout 1938. The vertical, 3-compartment, No. 2 winze was sunk a further 139 feet, to a total depth of 824 feet from surface, and new levels were established at 750 and 800 feet. A total of 4,474 feet of drifting, 784 feet of crosscutting, 50 feet of raising, and 180 feet of box-holing was done during the year. Diamond-drilling consisted of 17 holes, totalling 5,391 feet, from underground.

Some 26,518 tons of ore were hoisted, of which 26,268 tons were milled.

An addition to the assay office was built, and a new 9- by 8-inch Canadian Ingersoll-Rand PSR air hoist was installed at No. 2 winze.

An average of 115 men was employed.

Miller Lake O'Brien Mine

The Miller Lake O'Brien mine, in Nicol and Haultain townships, Gowganda area, district of Timiskaming, is owned and operated by M. J. O'Brien, Limited. H. G. Kennedy is manager, and H. D. Palser is assistant manager.

The vertical No. 9 winze, which is collared at the 730-foot level, was deepened a further 50 feet, to the 900-foot level. A total of 1,685 feet of drifting, 125 feet of crosscutting, and 119 feet of raising was done during the year. One diamond-drill hole, 264 feet in length, was drilled from surface, and 10 holes, having a total length of 4,634 feet, were drilled from underground.

Some 25,664 tons of ore were hoisted and treated. A new 36-inch picking-belt and rotary grizzly, with a capacity of about 90 tons per shift, were installed to replace the old sorting-table equipment.

An average of 63 men was employed. The mine address is O'Brien.

A. G. Morgenthaler

Adanac Mine

A. G. Morgenthaler, owner of the Adanac mine, in Coleman township, Cobalt area, district of Timiskaming, operated the property throughout 1938. Rory Stewart was foreman in charge of operations. The mine address is Cobalt. The owner's address is 2108 South Second Street, Philadelphia, Pa.

The shaft on the property is 400 feet deep, with levels at 100, 200, 320, and 400 feet, and sublevels at 276 and 310 feet. During 1938 a winze, known as No. 3, was sunk from the 320-foot level, for a distance of 35 feet, and a level was established at an elevation of 355 feet. About 265 feet of drifting was done on the 321-, 355-, and 400-foot levels. Eight diamond-drill holes, having a total length of 607 feet, were drilled from surface.

Some 233 tons of silver-cobalt ore were produced from back and underhand stopes.

An average of 6 men was employed.

Beaver Mine

A. G. Morgenthaler operated the Beaver mine, in Coleman township, district of Timiskaming, under lease, from January 1 to June 15, 1938.

No development work was done during this period, but 8 diamond-drill holes, totalling 358 feet in length, were drilled from underground. Some small shipments of high-grade ore were made, and the lease was dropped. Operations were carried on under the direction of Rory Stewart, who employed 3 men.

An account of the operation of this mine during the last five months of the year appears on page 229 of this report, under the heading of Cobalt Products, Limited.

Murphy and Landry

Ambrose Murphy and A. P. Landry, of Cobalt, operated the Coniagas mine, in Coleman township, Cobalt area, district of Timiskaming, throughout 1938. An average of 8 men was employed.

A new headframe and two ore bins were built during the year. No development work was done. Some 4,360 tons of mill rock were hoisted, of which 1,360 tons were sent to the O'Brien mill for treatment.

Nerlip Mines, Limited

Nerlip Mines, Limited, was incorporated in February, 1932, with an authorized capitalization of 500,000 shares of no par value. In 1937, the capitalization was increased by the creation of an additional 1,000,000 shares of common stock of no par value and 100,000 shares of preferred stock of no par value. The officers and directors are: C. H. Mathews, president; A. B. Pilliner, vice-president; M. A. Gough, secretary-treasurer; L. B. Cuddy, H. W. Alles, T. W. Friend, and Wm. Ambler, directors. The head office is at 46 Wolverton Avenue, Toronto. The mine address is Cobalt.

The company owns a property consisting of 40 acres in Coleman township, Cobalt area, district of Timiskaming. Operations during 1938 were carried on from January 1 to June 30, and from November 8 to December 31.

The 2-compartment, vertical shaft was deepened from 620 to 700 feet. A total of 1,205 feet of drifting and 190 feet of crosscutting was done. Six diamond-drill holes, having a total length of 1,414 feet, were drilled from underground. A dry-house and powder-magazine were built.

A. B. Pilliner was manager, employing 13 men during the periods of operation.

Nipissing Mining Company, Limited

Nipissing Mines Company, Limited, which was incorporated in September, 1917, has a capital of 1,200,000 shares of $5 par value. The officers and directors of the company are: E. P. Earle, president and treasurer; Alexander Fasken, vice-president and secretary; Richard T. Greene, Dr. F. R. Bennetto, Halstead Lindsley, and Hugh Park, directors. The head office is at the Excelsior Life Building, Toronto. The New York office is at 165 Broadway. The mine address is Cobalt.

The operating company is the Nipissing Mining Company, Limited, which was incorporated in 1904, 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; Hugh Park, general manager; Richard T. Greene, C. W. Nichols, Dr. F. R. Bennetto, Halstead Lindsley, directors. The executive offices are the same as those of the parent company.

No underground mining operations were carried on at the property in Coleman township, Cobalt area, district of Timiskaming, during 1937, but a small mill was operated from April 1 to October 30, concentrating low-grade material from the dumps. Some 4,987 tons were treated.

The following is taken from the report of the general manager for the year ended December 31, 1938:—

Operations at Cobalt were confined to the milling of low-grade cobalt ores and some leasing. Production amounted to 388 tons of crude ore and concentrate, of which 341 tons were shipped. The profit was more than sufficient to cover all expenses at Cobalt. The value of the shipments, not including inventory, was about $41,000.

J. H. Plouffe

J. H. Plouffe, of Cobalt, operated the Watts mine, in Coleman township, Cobalt area, district of Timiskaming, under lease in 1938.

No underground work was done. Silver ore obtained from the dumps was shipped to Deloro for treatment.

C. W. Price

C. W. Price, of Cobalt, operated the Foster mine, in Coleman township, Cobalt area, district of Timiskaming, under lease from January to June, 1938, employing 2 men.

Some 14 tons of silver-cobalt ore were mined and shipped for treatment.

For an account of the operation of this property from July 15 to December 31, see next paragraph.

R. H. Ringsdorf

R. H. Ringsdorf, of Cobalt, operated the Foster mine, in Coleman township, Cobalt area, district of Timiskaming, under lease, from July 15 to December 31, 1938. Some 25 feet of drifting, 15 feet of raising, and 20 feet of surface-trenching, 15 feet deep, were done.

About 14 tons of silver-cobalt ore were mined and shipped for treatment.

An average of 4 men was employed.

Rowe and Stuckey

Alfred Rowe and Charles Stuckey, Box 79, Cobalt, leased the surface and dumps of the Frontier mine, in South Lorrain township, district of Timiskaming, from May 1 to November 30, 1938.

Work was confined to picking rock from the dumps. About 25 tons of silver-cobalt-nickel ore were shipped.

Silver Valley Mines, Limited

Silver Valley Mines, Limited, was incorporated in June, 1933, with an authorized capitalization of 3,000,000 shares of $1 par value. The officers and directors are: E. N. Tabah, president; Charles A. Zenkert, vice-president; Douglas Banks, secretary-treasurer; Arthur I. Land and Paul Gagnon, directors. The head office is at 66 King Street West, Toronto. The mine address is Elk Lake.

The property is in Leith and Charters townships, Gowganda area, district of Timiskaming.

The mine was dewatered and an examination was made during the summer of 1938. A bulk sample of two tons of silver-cobalt ore was taken.

Alphonse Belanger was in charge.

Donald E. Sirola

Donald E. Sirola, Box 271, Kirkland Lake, leased the Silver Queen mine, in Coleman township, Cobalt area, district of Timiskaming, during part of 1938.

About 9 tons of cobalt ore were shipped. An average of 4 men was employed.

Stewardson and Moran

F. Stewardson, 536 St. Marks Street, Fort William, and V. Moran carried on some operations at the Lily of the Valley mine, in Paipoonge township, district of Thunder Bay, in 1938.

About 5 tons of silver ore were treated in a small mill on the property, and the concentrates were shipped to Trail, B.C.

J. H. Sutherland

J. H. Sutherland, of Cobalt, operated the Lawson mine, in Coleman township, Cobalt area, district of Timiskaming, during 1938, under a lease from La Rose–Rouyn Mines, Limited.

Some 24 tons of silver-cobalt ore were obtained from open cuts. An average of 3 men was employed.

W. D. Taylor

W. D. Taylor, of Cobalt, operated the Lorrain Trout Lake mine, in South Lorrain township, district of Timiskaming, from June to December, 1938.

A small hoisting plant was installed. No development work was done. Production came from old pillars left by previous operators. About 129 tons of silver-cobalt ore were shipped to the O'Brien mill for treatment, and the concentrates were sent to Deloro.

An average of 6 men was employed.

Thornham and Presse

J. T. Thornham and Albert Presse, Box 385, Cobalt, operated No. 122 vein of the Nipissing mine, in Coleman township, Cobalt area, district of Timiskaming, under a lease during 1938. A 5- by 5-inch air hoist was installed. About 139 tons of cobalt ore were mined and shipped.

An average of 3 men was employed.

Thomas Wainwright and Partner

Thomas Wainwright, of Cobalt, and a partner obtained a lease on the Red Jacket property, in Coleman township, Cobalt area, district of Timiskaming, and operated it during the early part of 1938 under the name of Wainanwatt.

A small mining plant was installed and 42 tons of silver-cobalt ore was produced from the 100-foot level and the dump. An average of 6 men was employed.

An account of later work done by W. E. McCready and Partner appears on page 231 of this report.

TALC

Canada Talc, Limited

Canada Talc, Limited, has an authorized capitalization of 250,000 shares of $1 par value, of which 200,000 have been issued. The officers and directors are: E. S. James, president; Roy Taylor, vice-president, secretary-treasurer, and general manager; C. A. Cameron, director. The head office and mine office are at Madoc.

The company owns and operates the Connolly and Henderson mines, in Huntingdon township, Hastings county. The combined properties consist of 3 claims, totalling 350 acres.

During 1938 the Henderson shaft, now known as No. 4, was deepened to 541 feet, and a level was established at 443 feet. A long heading to connect the workings of the two properties was begun from the 250-foot level of the Connolly. A total of 650 feet of drifting, 100 feet of crosscutting, and 125 feet of raising was done on the two properties.

Some 10,366 tons of talc were mined, of which 10,166 tons were milled.

The Gillespie mill was dismantled and some of the equipment was moved to the Canada Talc mill, which was enlarged to accommodate it.

An average of 29 men was employed throughout the year.

Madoc Talc and Mining Company, Limited

The Madoc Talc and Mining Company, Limited, was incorporated in January, 1938, with an authorized capitalization of 250,000 shares of $1 par value, of which 135,000 have been issued. The officers and directors are: W. R. Bonter, president; S. R. Westfall, vice-president; R. R. Fenn, secretary-treasurer; F. C. Dempsey and J. L. Bonter, directors. The head office and mine office are at Trenton. The mine address is Gunter.

The property, known locally as Soapy Mountain, consists of 6 claims, on lot 16, concession XII, and lots 16 and 17, concession XIII, Cashel township, Hastings county. The claim numbers are E.O. 2,756 to 2,769 and 2,805.

Operations were carried on from January to October, 1938. A shaft was sunk to a depth of 90 feet and 135 feet of crosscutting was done at that elevation.

An average of 5 men was employed under the direction of Jas. E. Doyle.

ZINC

Lennox Mines Company, Limited

The Lennox Mines Company, Limited, was incorporated in December, 1936, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 284,655 have been issued. The officers and directors are: George Beausoleil, president; Wm. A. Grange, vice-president; Charles Fournier, secretary-treasurer; Dr. M. J. E. Dube, director. The head office is at Napanee. The mine address is Enterprise.

The property consists of 300 acres in concessions XV and XVI, Sheffield township, Lennox and Addington county.

Operations were carried on from January 1 to February 19, 1938. Two shallow shafts, 18 and 52 feet deep, were sunk, and about 100 feet of surface-trenching, from 5 to 10 feet deep, was done.

METALLURGICAL WORKS

Algoma Steel Corporation, Limited

During 1938 only one blast furnace was operated by the Algoma Steel Corporation, Limited, located at Sault Ste. Marie. No. 4 furnace was in blast from January 2 to October 3 and from December 20 to 31, producing a total of 114,494 tons of iron.

Jas. H. Bell was blast furnace superintendent.

Canadian Furnace, Limited

The directors of Canadian Furnace, Limited, are as follows: Richard C. Yates, managing director; H. L. Caulkins, P. G. Harrison, and W. S. Ober, directors. The address is Port Colborne.

The following table shows the number of days the furnace operated and the tonnage of iron produced during 1938:—

Grade	Tons	No. of days operated
Pig iron	53,933	193
Spiegeleisen	12,942	52
Total	66,875	245

An average of 110 men was employed during the periods of operation. D. J. Higgon is superintendent.

Canadian Industries, Limited

During 1938 the plant of Canadian Industries, Limited, located at Copper Cliff, was in continuous operation.

The three 50-ton-per-day sulphuric acid units were operated to capacity. These units manufacture the acid from converter gases produced at the smelter of the International Nickel Company. The oleum unit was also operated at full capacity. The nitre-cake unit, in which sodium sulphate is treated with sulphuric acid to produce nitre cake, was operated at about 30 per cent. of capacity.

An average of 39 men was employed. E. H. Jordan was works manager.

Deloro Smelting and Refining Company, Limited

The blast furnace at the plant of the Deloro Smelting and Refining Company, Limited, operated throughout 1938. Silver production amounted to 1,087,703 ounces. Arsenic and cobalt products were also produced. An average of 160 men was employed.

The officers of the company are: J. A. O'Brien, president and chairman; S. F. Kirkpatrick, vice-president and managing director; S. B. Wright, general manager; F. A. Bapty, secretary-treasurer; R. A. Elliott, works superintendent. The address of the company is Deloro.

International Nickel Company of Canada, Limited

The refinery of the International Nickel Company of Canada, Limited, at Port Colborne was operated continuously throughout the year. An account of the operations appears on page 227 of this report.

Ontario Refining Company, Limited

The copper refinery of the Ontario Refining Company, Limited, situated at Copper Cliff, was operated at capacity throughout 1938, producing a total of 145,000 tons of refined copper. Another 30-ton electric furnace was added to the equipment.

An average of 723 men was employed. F. Benard was plant manager.

Steel Company of Canada, Limited

The Steel Company of Canada, Limited, operated both "A" and "B" furnaces throughout the year. The average number of men employed was 168. H. S. Hilton is works manager, J. T. Slee is blast furnace superintendent, and N. B. Clark is assistant 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. The address is Hamilton.

MINING ACCIDENTS IN 1938

By

Chief Inspector of Mines, D. G. Sinclair, Toronto; Inspectors, A. E. Cave, Kenora; W. O. Tower, J. B. Taylor, D. P. Douglass, Kirkland Lake; A. S. Bayne, Port Arthur; D. F. Cooper, Sudbury; E. B. Weir, Timmins; A. R. Webster, Toronto.

Accidents during 1938

During the year 1938, at the mines, metallurgical works, quarries, and clay, sand, and gravel pits regulated by the Mining Act, there were 2,195 accidents to employees reported to the Department of Mines up to January 16, 1939. Sixty-one fatalities, arising out of 48 separate accidents, were reported.

These returns represent a decrease of 575 (21 per cent.) in the total number of accidents reported and an increase of 9 in the number of fatalities recorded over the preceding year.

The report shows a fatality rate of 1.97 men killed per thousand men employed, which is an increase of 0.35 per thousand over the preceding year, but is 0.42 per thousand lower than the average for the past twenty-five years.

The number of accidents involving fatalities was 48, one less than the preceding year, but during the year there were 7 accidents in which more than one man was killed, 5 of which were responsible for two deaths each, one involving four deaths, and one involving five deaths.

There were 70 non-fatal accidents per thousand men employed, which is a decrease of 15 (18 per cent.) from the rate for 1937.

The percentage of non-fatal accidents followed by infection decreased from 8.7 per cent. in 1937 to 7.5 per cent. in 1938.

Employment in the industry fell off somewhat in the year. Returns in this respect indicate a decrease of approximately 4 per cent. for the year. This loss was occasioned mainly through slackening of employment at non-producing mines, as returns show a slight increase of employment at producing mines but somewhat less than half the number of men employed at non-producing mines in the preceding year.

Fatal Accidents

A comparison of fatal accidents for the past five years is given in the following table:—

Distribution	1934	1935	1936	1937	1938
Mines, underground	23	26	45	36	36
Mines, surface	2	2	5	5	2
Metallurgical works	5	3	4	5	5
Quarries	1	0	2	1	1
Clay, sand, and gravel pits	2	1	0	2	4
Total	33	32	56	49	48

ANALYSIS OF FATALITIES AT MINES, 1934–1938

Cause	1934	1935	1936	1937	1938
	per cent.	per cent.	per cent.	per cent.	per cent.
Fall of ground	31	47	20	20	32
Run of ore or rock	8	6	8	0	2
Shaft accidents	8	9	28	44	28
Explosives	18	16	16	17	26
Miscellaneous, underground	27	16	18	12	10
Surface	8	6	10	7	2

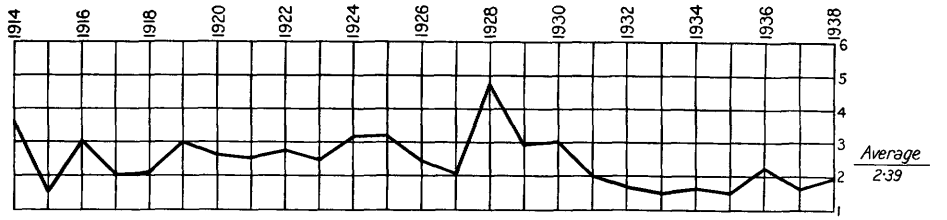


Diagram showing fatalities per thousand men employed between the years 1914 and 1938.

By months the fatal accidents occurred as follows:—

Month	No. accidents	No. men killed
January	4	4
February	4	9
March	4	8
April	2	3
May	4	5
June	3	3
July	2	2
August	4	4
September	7	7
October	4	4
November	4	4
December	6	8
Total	48	61

Classifying the fatalities according to industries gives the following:—

Gold mines	38
Gypsum mines	0
Nickel mines	12
Silver mines	0
Talc mines	0
Metallurgical works	6
Quarries	1
Sand, clay, and gravel pits	4
Total	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	23,437	50	2.13
Metallurgical works	5,928	6	1.01
Quarries	810	1	1.23
Clay, sand, and gravel pits	680	4	5.88
Total	30,855	61	1.97

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	8	14	15	15	2	2	2	61

TABLE OF FATAL ACCIDENTS IN MINES, METALLURGICAL WORKS, QUARRIES, AND GRAVEL, SAND, AND CLAY PITS, 1914–1938

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
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	34	19,302	1,254	20,556	1.65
1935	36	21,444	1,528	22,972	1.57
1936	65	25,725	2,547	28,272	2.30
1937	52	28,938	3,220	32,158	1.62
1938	61	29,434	1,421	30,855	1.97

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	American	British	Finn	Italian	Jugo-Slav	Pole	Swede	Ukrainian	Total
Cage tender		1							1
Conductor				1					1
Driller		10	3		6	2	3	2	26
Drill helper		2					1		3
Engine driver		1							1
Farmer		1							1
Furnace charger					1				1
Grizzlyman		1						1	2
Labourer		3				1			4
Machinist		1							1
Manager	1								1
Motorman		1							1
Nipper		1							1
Shaft inspector								1	1
Shaftman		4	5		1				10
Shovel operator		1							1
Trammer		3							3
Tuyere puncher		2							2
Total	1	32	8	1	8	3	4	4	61

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	145	247
Falling objects	76	139	215
Tramming	3	148	151
Flying objects, sledging, etc.	23	117	140
Strain while lifting	29	96	125
Rock or ore at chute	.....	114	114
Falling rock or ore, drilling, etc.	.....	109	109
Drilling machines	.....	106	106
Hand tools	49	52	101
Crushed between two objects	22	79	101
Handling rock or ore	5	93	98
Fall of rock or ore at face	.....	89	89
Nails or splinters	26	50	76
Machinery	46	17	63
Running into or striking objects	2	36	38
Fall down shaft, winze, or stope	.....	34	34
Cage, skip, or bucket	.....	28	28
Explosives	.....	24	24
Burns	15	.....	15
Rock or air blast	.....	13	13
Transportation	4	.....	4
Electricity	4	.....	4
Explosions from carbide	1	1	2
Poisoning from cyanide	2	.....	2
Gas	.....	1	1
Unclassified	10	.....	10
Total	419	1,491	1,910

The causes of non-fatal accidents at metallurgical works were:—

Falling objects	29	Transportation	4
Fall of persons	9	Electricity	4
Burned by slag, matte, or scrap	9	Cranes, ladles, or hooks	3
Strain while lifting	9	Hand tools	2
Machinery	6	Gas	1
Crushed between two objects	5	Running into or striking objects	1
Handling material	5	Unclassified	2
Flying objects, sledging, etc.	4		
Burns	4	Total	97

The causes of non-fatal accidents at quarries were:—

Handling material	27	Transportation	4
Fall of persons	18	Flying objects, sledging, etc.	3
Falling objects	11	Running into or striking objects	2
Fall of rock	11	Explosives	2
Machinery	9	Cranes	1
Strain while lifting	8	Unclassified	3
Hand tools	6		
Crushed between two objects	6	Total	111

The causes of non-fatal accidents at sand, gravel, and clay pits were:—

Fall of material	5	Machinery	1
Fall of persons	5	Hand tools	1
Falling objects	5	Running into or striking objects	1
Strain while lifting	5	Unclassified	2
Flying objects, sledging, etc.	2		
Crushed between two objects	2	Total	29

Infection

Records show that infection followed in 161 cases out of a total of 2,147 accidents:—

Location	No. of accidents	Accidents followed by infection	Per cent. infection
Mines, underground	1,491	107	7.1
Mines, surface	419	36	8.5
Metallurgical works	97	5	5.1
Quarries	111	12	10.8
Clay, sand, and gravel pits	29	1	3.4
Total	2,147	161	7.5

Non-fatal Accident Frequency

The following table gives the respective non-fatal accident frequency at mines, metallurgical works, quarries, and clay, sand, and gravel pits, based on number of accidents per thousand men employed, for the years 1928 to 1938, inclusive.

1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
141	126	117	100	98	95	93	90	83	85	70

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
Drilled into dynamite	7	9	1	1	8	10
Premature blast	4	5	3	6	7	11
Walked into blast	2	3	1	1	3	4
Fumes from blasting	1	2	3	3	4	5
Cap detonated while carrying explosives	1	1	.....	.....	1	1
Insufficient cover from blast	1	1	.....	.....	1	1
Blasting switch closed too soon	1	1	.....	.....	1	1
Blast came through diamond-drill hole	1	1	.....	.....	1	1
Delayed at blast by falling rock	1	1	.....	.....	1	1
Delayed too long at blast	1	1	2	2	3	3
Concussion from blast	1	1	.....	.....	1	1
No warning of blast given	.....	.....	1	1	1	1
Total	21	26	11	14	32	40

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:—

1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Total
.....	6	.....	.....	.....	.....	.....	.....	.....	.....	6

The following table shows the total number of non-fatal electric accidents during the last ten years:—

1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Total
14	10	7	3	4	4	6	4	2	8	62

Classification of Non-fatal Accident Rates at Producing Mines

In the following table the producing mines employing more than 50 men are arranged in order, according to their rate of non-fatal accidents per thousand men employed:—

0—50	Frood (International Nickel) McIntyre-Porcupine Young-Davidson (Hollinger) Levack (International Nickel) Garson (International Nickel) Hollinger mine Creighton (International Nickel) Lake Shore
51—100	Ross (Hollinger) Matachewan Consolidated O'Brien (Cross Lake) Falconbridge (mine only) Wright-Hargreaves Toburn Howey **Average—75 accidents per thousand men** Little Long Lac Hasaga Sylvanite Gold Eagle Naybob Moneta Dome Coniaurum New Golden Rose
101—150	Paymaster Consolidated Vipond (Mace) J-M Consolidated Upper Canada Lebel Oro (Long Lake) Hard Rock Golden Gate St. Anthony McKenzie Red Lake Kirkland Lake Gold Miller Lake O'Brien Bidgood Hallnor Teck-Hughes Algoma Summit Sturgeon River
151—200	Omega Buffalo Ankerite Pickle Crow MacLeod-Cockshutt Delnite Central Patricia Kerr-Addison Cline Lake Red Lake Gold Shore Macassa Pamour Wendigo Madsen Red Lake Sachigo River Northern Empire Tombill
201—250	Leitch Bankfield
251—300	Raven River
Over 300	Sand River

Mine Fires

Anoki Gold Mines, Limited

A fire occurred at about 5 A.M., on November 26, at the Diesel compressors of the Anoki gold mine. These two Diesel compressors were being used temporarily pending the installation of electric power, and were set up on timbers in the open, between the office and a bunk-house, about 125 feet from the shaft.

The Diesel operator and one other workman were the only men on the job. Taking advantage of a temporary shut-down, the Diesel operator was cleaning his engines and making some operating adjustments. He was carrying a pail containing gasoline for cleaning some small parts of the engine. As he was setting this down close to the engines some of the gasoline splashed into his Coleman lantern. In an instant all the gasoline was on fire, and in a very short time the fuel oil on the timber foundations and on the engines was in flames.

In the next few minutes the operator emptied the contents of two 2½-gallon Phomene extinguishers at the base of the flames, but it was not until almost all the excess oil had burned out that he was able to bring the fire under control. For a period of probably twenty minutes the flames were intense, due to the gasoline and fuel oil, and considerable damage was done to the compressors. Fortunately the nearest buildings were at sufficient distance from the compressors to save them from catching fire.

Comet Leasing Company

The shaft-house of No. 3 shaft at the Kerr Lake mine, which is operated by the Comet Leasing Company, was destroyed by fire on November 29.

The 2-compartment shaft, 320 feet deep, is not being used for hoisting at present. The manway is used as a travelway for the miners and contains the air lines. The workings from this shaft are connected with the Hargrave No. 3 shaft and Kerr Lake No. 13 shaft. Air circulates down the Kerr Lake No. 3 shaft and up the Hargrave No. 3 shaft, which is on a hill.

The fire broke out at 1.30 P.M., while six men were underground on the 125-foot level. The smoke descended the shaft and emerged from the Hargrave shaft. Only minor damage was done to the shaft collar, and no one was injured.

Although the cause of the fire was ascribed to a cigarette butt, it is suspected that it was due to an overheated stove. Trouble had been experienced with the shaft freezing and it seems most probable that a stove had been kept burning in the shack to attempt to control the down-draft. At the time of the inspector's visit on December 1 an 8-inch pipe had just been installed in the shaft from the collar to the 70-foot level with the intention of using it as a smoke-stack for a wood- or coal-burning heater on that level. This practice has been forbidden.

International Nickel Company of Canada, Limited

A small section of trolley-box was set on fire at the junction of No. 6 crosscut and No. 1 south drift, on the 2,800-foot level of the Frood mine, about 3.30 A.M., on November 17.

Level Boss D. Branckely noticed a blue flame on the trolley wire at this location and opened the sectional switch at No. 2 ore-pass. He put out the fire with a Pyrene extinguisher. The inside of the trolley-box was charred.

About 9 A.M., on December 9, the crusherman pulling No. 4 ore-pass at the 3,400-foot level crusher of the Frood mine found that the sulphide ore had

become sufficiently heated from oxidation to cause included wood particles to burst into flames on leaving the pass.

The ore in this pass below the 3,100-foot level had been there since October, when No. 4.1 ore-pass had been put in service to replace it. This replacement had been made because the hanging wall of No. 4 ore-pass below the 3,100-foot level had begun to spall badly, and it was close to No. 4 shaft. It was to be backfilled with waste rock, and kept full during the removal of the ore by dumping the fill as the ore was pulled. This work, however, had been delayed by a shortage of fill and at December 9 there still remained nearly 3,000 tons of ore, containing about 20 per cent. sulphur, to be pulled. It had been known for some time prior that this ore was heating.

As soon as the occurrence was reported immediate steps were taken to pull out the ore as rapidly as possible and to replace it simultaneously with fill. The Mine Rescue Station was notified and equipment was supplied and serviced until the work was completed.

The heated ore was put through the crusher and hoisted through No. 4 shaft to the surface bins where it was cooled with water. As pulling progressed calcined ore appeared and there were several minor dust explosions. Water was then introduced into the pass from above. This eliminated the dust but produced a great deal of steam, which hindered the work. An All-Service mask was used by the crusherman, but he had to be relieved at frequent intervals owing to the heat. Two men wearing McCaa apparatus stood by to assist the crusherman in case he was overcome.

This work was continued until the afternoon of December 15, by which time only fill-rock was coming out of the pass. No damage was done by the occurrence. There was no danger of gases spreading through the mine as the pass is located on the exhaust side of the mine ventilation.

New Golden Rose Mines, Limited

The Diesel plant building of New Golden Rose Mines, Limited, was slightly damaged by fire on November 21. The fire was discovered about 6.30 A.M., but appeared to have been burning slowly for some time previously. It was confined between the roof and a false ceiling of fire-resistant material. A small section on the under side of the roof was charred, as were the timber roof-trusses in the section. No members were burnt through, and no holes were burnt in the roof.

The building is constructed with walls and gable roof of solid 2- by 4-inch timbers, laid to give a 4-inch thickness. The walls are covered on the outside with Asbestoside, with the exception of the south wall, which is not covered. They are lined inside with fire-resistant material. The roof is covered with heavy Flexstone roofing.

The plant consists of two Diesel-driven generators and three Diesel-driven compressors. The later exhaust into vertical stacks located near the south wall of the building. These stacks vary in height from 2 feet to 8 feet above the eaves of the building.

It appears that the fire started on the outside of the south wall of the building just below the eaves, and directly opposite the Diesel exhaust stacks. It is believed that burning particles from the exhausts lodged under the eaves and started the fire.

Little damage was done to the plant other than to a V-belt, which was burned by falling embers. The building is about 300 feet from the shaft.

Pickle Crow Gold Mines, Limited

A fire occurred in the powder-house on the 1,050-foot level of the Pickle Crow mine on April 2, about 2 P.M.

This powder-house is located at the face of No. 1,001 W drift. In the wall of the powder-house is a small window at which the powderman is supposed to leave his light while in the powder-house. There are two shelves at the face of the drift, the upper one 3½ feet above the floor. The poster setting forth the "Rules and Regulations Governing Explosives" hangs above this shelf and is tacked to the cover of the powder-box to ensure its being in place.

No powder was used on the 1,050-foot level on the night shift of Saturday, April 2. The day shift did not work on Sunday. The Sunday night shift and the powderman who had been on day shift on Saturday were on shift Sunday night. The powderman coming off shift on Monday morning reported that a small fire had occurred in the powder-house. On investigation it was found that T. Greaves, employed as a powderman, had entered the powder-house on Saturday night, carrying a carbide lamp on his hat and had made out his explosives report. While he was thus engaged the flame of his lamp apparently came in contact with the Explosives poster. Greaves left the powder-house without noticing that anything was wrong, and the fire had continued until the poster was about two-thirds burned and the wood to which it was attached was charred. There were five cases of explosives in the powder-house at the time. Greaves was suspended for a week as punishment.

Prosecutions

Rex *vs.* J. Ryga

A charge was laid against J. Ryga, a mucker, at the Sylvanite Gold Mines, Limited, as follows:—

That J. Ryga, in the township of Teck, in the district of Timiskaming, on or about the 1st day of March, 1938, did unlawfully before blasting, fail to cause all entrances to No. 2,611 drift at the point where No. 1 chute is located in said drift, in the Sylvanite Gold Mines, Limited, in the said township of Teck, to be effectively guarded so as to prevent inadvertent access to said place while such blasting was going on, contrary to the provisions of Section 160, subsection 61, of the Ontario Mining Act, being R.S.O. 1937, Chapter 47.

A plea of guilty was entered before Magistrate S. Atkinson at Kirkland Lake, on March 31. The minimum fine of $10.00 and costs, or 30 days, was imposed. The fine and costs were paid.

Mine Rescue Stations

During the year normal activities were carried out at the three mine rescue stations, at Timmins, Kirkland Lake, and Sudbury.

The older types of electric cap lamps originally installed in the stations were replaced during the year by the newer Model "K" Edison cap lamps.

The increased activity in the Larder Lake area made the possibility of rapid transportation of the Kirkland Lake rescue equipment necessary. Because of this a specially designed rescue truck was installed at Kirkland Lake.

A course of training in the use of gas masks was carried out during the year in the Little Long Lac–Beardmore area.

Summary of Rope Tests

The following is a summary of the tests made in the Wire Rope Testing Laboratories of the Department of Mines during 1938:—

Tests for Ontario mines under Act	563
Special informative tests	17
Tests for wire-rope manufacturers	21
Tests for mines outside Ontario	39
Other tests	2
Total	642

Classes for Prospectors, 1938-39

By W. D. Harding

Introduction

During the period between October, 1938, and March, 1939, prospectors' classes were conducted at 18 different places in Ontario. The instructors were W. D. Harding, J. McBean, and J. E. Thomson.

Character of Instruction

The character of the instruction given during the past season was similar to that given in 1937–38. Most of the instruction was devoted to the study of mineralogy and geology. Discussions were held regarding practical prospecting, geophysical prospecting, claim-staking, claim valuation, and mining law. Demonstrations of gold-panning were given at several places.

Summary of Class Attendance

The details of the attendance at the various classes held during the past season is presented in the following schedule:—

Instructor and place	Period of course	Total registration at mineralogy classes	Average daily attendance at mineralogy classes	Average daily attendance at evening lectures	Total student hours, afternoon and evening	Practical experience in prospecting or mining	Repeat course
W. D. HARDING:	1938						
Perth	Oct. 24–29	30	18.3	34.6	393	9	2
Ottawa	Nov. 7–12	64	47.9	47.6	812	14	4
Hamilton	Nov. 21–26	123	92.3	107.5	1,538	19	11
Havelock	Nov. 28–Dec. 3	30	23.7	35.2	460	7	1
	1939						
Hornepayne	Jan. 9–13	14	10	19	155	6	6
Hearst	Jan. 16–19	15	7.8	.....	62	3	3
Geraldton	Jan. 23–28	39	27.1	37.1	512	24	20
Port Arthur	Jan. 30–Feb. 4	58	41.3	41.4	699	28	14
Fort William	Feb. 6–11	63	50	43	698	32	17
Rainy River	Feb. 14–18	69	56	39.7	719	5	2
Kenora	Feb. 20–25	44	36.8	28.5	584	19	19
Ignace	Feb. 28–Mar. 3	28	18.8	24.8	287	13	1
Sault Ste. Marie	Mar. 6–11	50	41.8	36	682	13	6
Thessalon	Mar. 13–18	29	19.3	20.2	333	9	4
J. E. THOMSON:							
Toronto	Jan. 9–14	387	302.2	305	4,942	80	42
J. MCBEAN:							
Haileybury	Jan. 9–14	40	26.3	21	421	14	19
Larder Lake	Jan. 16–21	39	27.8	34.2	505	26	7
Timmins	Jan. 23–28	35	20.1	42.4	420	28	9
Total	.....	1,157	.....	.....	14,222	349	187

Analysis of Class Attendance

During the period covered by the above table, prospectors' classes in Ontario were attended by a total of 1,157 persons,who received altogether 14,222

student hours of instruction, These results compare favourably with those of 1937–38, when a total of 1,015 persons received 15,468 student hours of instruction. In the middle of the 1937–38 season the length of the course given at each town was reduced from 8 days to 6 days. The practice of giving 6-day courses was continued throughout all of the past season. The falling off in the total of student hours for the past season may be attributed largely to the shortened courses.

Approximately 30 per cent. of the total registration is represented by men who have had experience at prospecting or mining work. Those who repeated the prospectors' course represented 16 per cent. of the total registration.

Decline in Exploration Activity

At most places where classes were held, prospectors were definitely concerned by the decline that has marked prospecting activities during the past year. During 1938 the total number of claims recorded in Ontario was only 9,047. In 1937 the total number of recorded claims was 15,292. This comparison reflects a definite relaxation in prospecting effort throughout the province. Meetings of prospectors were held for the purpose of discussing remedies for the situation. Representations were made to the government with the result that early in 1939 the laws pertaining to claim-staking and to mining securities were revised. The new regulations will become effective on June 26, 1939.

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PRODUCTION OF GOLD MINES, 1938

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Area	Ore raised	Material discarded (sorted)	Ore milled	Bullion produced: Gold content — Quantity	Gold content — Value, Canadian funds	Silver content — Quantity	Silver content — Value	Total value of bullion, Canadian funds
	tons	tons	tons	ounces		ounces		
PORCUPINE BELT								
Buffalo Ankerite	378,840	16,002	362,838	84,362.659	$2,968,959	5,936	$2,505	$2,971,464
Coniaurum	188,975	.....	188,975	47,517.110	1,671,645	9,062	3,585	1,675,230
Delnite	86,346	.....	85,816	18,811.738	662,148	1,715	722	662,870
Dome	601,700	.....	601,700	206,956.764	7,281,192	28,651	12,097	7,293,289
Hallnor	76,025	.....	60,979	38,959.693	1,371,957	2,845	1,184	1,373,141
Hollinger	1,737,331	.....	1,734,647	439,193.873	15,458,203	89,937	38,601	15,496,804
McIntyre-Porcupine	872,740	.....	872,740	234,736.747	8,260,186	66,954	28,483	8,288,669
Moneta	53,070	.....	54,577	28,823.233	1,014,247	4,521	1,906	1,016,153
Naybob[1]	7,832	.....	10,339	1,179.256	41,525	139	59	41,584
Pamour	515,843	.....	515,193	94,012.341	3,309,251	10,882	4,579	3,313,830
Paymaster Consolidated	193,117	.....	190,107	39,721.613	1,398,260	9,589	4,044	1,402,304
Porcupine Lake	4,856	16	4,714	623.761	21,978	33	14	21,992
Preston East Dome	6,129	.....	.....	3,933.194	138,252	693	312	138,564
Ross (Hollinger)	44,558	.....	44,399	13,170.115	462,772	11,691	4,995	467,767
Vipond (Mace)	61,980	.....	62,070	6,505.556	228,838	1,027	434	229,272
Miscellaneous[2]	.....	.....	.....	162.223	5,706	.....	.....	5,706
Total	4,829,342	16,018	4,789,094	1,258,669.876	$44,295,119	243,675	$103,520	$44,398,639
KIRKLAND LAKE AREA								
Bidgood	52,886	.....	52,636	17,412.197	$613,126	10,582	$4,445	$ 617,581
Golden Gate	11,090	.....	11,090	4,756.500	167,527	535	232	167,759
Kirkland Lake Gold	92,665	.....	92,665	42,102.777	1,482,064	4,046	1,705	1,483,769
Lake Shore	921,837	.....	921,837	429,182.466	15,105,341	105,254	44,294	15,149,635
Lucky Kirkland	70	.....	70	24.000	844	.....	.....	844
Macassa	111,525	.....	110,718	50,213.021	1,766,494	8,266	3,457	1,769,951
Mesabi	1,485	84	1,193	130.404	4,599	16	6	4,605
Morris Kirkland	22,519	.....	22,929	3,187.435	111,686	4,907	2,084	113,770
Sylvanite	185,681	.....	190,714	68,623.115	2,414,705	11,922	5,029	2,419,734
Teck-Hughes	380,215	.....	380,215	102,815.500	3,617,831	17,654	7,453	3,625,284
Toburn	62,952	10,518	52,434	31,553.197	1,110,164	5,270	2,221	1,112,385
Upper Canada[3]	6,424	.....	6,270	1,509.709	53,286	623	261	53,547
Wright-Hargreaves	434,650	.....	434,650	221,203.519	7,784,795	38,078	16,080	7,800,875
Miscellaneous[2]	.....	.....	.....	58.490	2,057	.....	.....	2,057
Total	2,283,999	10,602	2,277,421	972,772.330	$34,234,519	207,153	$87,277	$34,321,796
LARDER LAKE AREA								
Kerr-Addison	148,642	.....	148,642	27,805.420	$980,167	1,312	$546	$980,713
Omega	176,852	.....	176,852	24,565.413	864,446	3,612	1,522	865,968
Raven River	25,101	1,137	23,964	5,687.948	199,888	982	414	200,302
Total	350,595	1,137	349,458	58,058.781	$2,044,501	5,906	$2,482	$2,046,983
MATACHEWAN AREA								
Matachewan Consolidated	154,409	.....	154,409	23,309.835	$820,487	4,802	$2,068	$822,555
Young-Davidson	359,819	.....	359,226	35,389.035	1,245,810	8,452	3,564	1,249,374
Total	514,228	.....	513,675	58,698.870	$2,066,297	13,254	$5,632	$2,071,929
SUDBURY DISTRICT								
Bousquet[4]	.....	.....	.....	16.676	$587	2	$1	$588
Long Lake (Lebel Oro)	34,472	.....	34,627	6,420.966	226,088	18	8	226,096
New Golden Rose	40,181	.....	40,161	13,959.011	491,543	2,201	953	492,496
Smith-Thorne (Tionaga)	2,272	150	2,122	629.691	22,227	108	45	22,272
Total	76,925	150	76,910	21,026.344	$740,445	2,329	$1,007	$741,452
ALGOMA DISTRICT								
Algold	8,542	.....	8,542	705.673	$24,821	96	$41	$24,862
Algoma Summit	67,121	451	66,670	5,820.746	204,760	266	115	204,875
Cline Lake[5]	37,284	.....	32,344	7,351.770	259,335	1,074	446	259,781
Deep Lake	.....	.....	.....	12.600	443	5	2	445
Minto (Jubilee and Cooper)	7,831	.....	7,831	2,114.205	74,504	36	15	74,519
Parkhill[4]	315	.....	315	204.205	7,146	7	3	7,149
Total	121,093	451	115,702	16,209.199	$571,009	1,484	$622	$571,631
THUNDER BAY DISTRICT								
Bankfield	47,632	.....	47,500	18,393.022	$647,225	2,019	$849	$648,074
Hard Rock	88,286	12,212	76,074	18,378.483	647,103	2,316	972	648,075
Leitch	35,715	5,131	30,584	20,159.904	709,564	559	235	709,799
Little Long Lac	128,130	30,810	97,320	43,849.118	1,543,519	3,487	1,471	1,544,990
MacLeod-Cockshutt	139,410	12,419	126,291	25,518.362	899,916	1,602	666	900,582
Magnet	3,446	.....	2,946	1,751.822	61,550	217	90	61,640
Northern Empire	59,688	.....	59,332	22,822.918	803,036	2,374	1,008	804,044
St. Anthony	33,383	4,879	28,945	6,225.538	219,239	1,815	762	220,001
Sand River	45,230	9,560	35,670	12,897.747	459,080	917	386	459,466
Sturgeon River	45,697	17,540	28,157	14,432.361	507,654	3,219	1,357	509,011
Tashota[6]	329	.....	329	450.000	15,809	749	328	16,137
Theresa (Caouette claims)	.....	.....	190	15.471	544	.....	.....	544
Tombill	23,750	.....	26,486	11,001.433	386,996	1,344	558	387,554
Total	650,696	92,551	559,824	195,896.179	$6,901,235	20,618	$8,682	$6,909,917
KENORA AND RAINY RIVER DISTRICTS								
Orelia	.....	.....	.....	23.388	$817	10	$5	$822
Straw Lake Beach	2,395	2,022	2,475	525.673	18,558	55	23	18,581
Wendigo[7]	35,141	5,100	30,041	10,160.280	357,765	2,198	960	358,725
Total	37,536	7,122	32,516	10,709.341	$377,140	2,263	$988	$378,128
PATRICIA PORTION								
Argosy[8]	1,700	50	1,636	1,014.200	$35,300	168	$70	$35,370
Central Patricia	102,852	1,476	101,376	45,596.051	1,605,299	4,365	1,840	1,607,140
Gold Eagle	56,394	12,583	43,811	10,269.894	361,412	4,969	2,104	363,516
Hasaga[9]	8,052	287	3,206	698.626	24,673	522	320	24,993
Howey	538,444	90,329	448,115	34,244.281	1,205,506	10,751	4,526	1,210,032
J-M Consolidated	18,280	1,275	17,005	3,983.371	140,282	2,978	1,250	141,532
McKenzie Red Lake	79,783	16,462	63,321	25,284.865	889,998	5,714	2,406	892,404
Madsen Red Lake	44,663	.....	44,663	9,269.484	326,910	2,209	917	327,827
Pickle Crow	135,808	20,461	115,915	78,564.987	2,765,729	8,440	3,562	2,769,291
Red Lake Gold Shore	34,073	5,797	23,858	4,480.706	157,434	673	290	157,724
Sachigo River	8,837	2,660	6,084	10,682.727	376,441	1,324	552	376,993
Total	1,028,886	151,380	868,990	224,089.192	$7,888,984	42,113	$17,838	$7,906,822
Miscellaneous prospectors[10]	.....	.....	.....	119.287	$4,196	.....	.....	$4,196
Total for gold mines	9,893,300	279,411	9,583,590	2,816,249.399	$99,123,445	538,795	$228,048	$99,351,493
Nickel-copper refining	.....	.....	.....	80,222.000	$2,821,809	.....	.....	.....
In Cobalt ores	.....	.....	.....	5.317	187	.....	.....	.....
Total gold output, 1938	.....	.....	.....	2,896,476.716	$101,945,441	.....	.....	.....
CALENDAR YEAR 1937								
Porcupine Belt	.....	.....	4,303,047	1,120,477.546	$39,203,243	229,708	$101,917	$39,305,160
Kirkland Lake Area	.....	.....	2,317,802	977,996.901	34,209,514	211,630	92,620	34,302,094
Larder Lake Area	.....	.....	62,740	21,515.747	752,609	3,080	1,347	754,026
Matachewan Area	.....	.....	470,310	52,351.025	1,831,441	12,419	5,413	1,836,854
Sudbury District	.....	.....	56,067	11,468.954	401,260	1,123	487	401,747
Algoma District	.....	.....	113,390	16,739.544	585,670	1,037	463	586,133
Thunder Bay District	.....	.....	272,500	108,148.419	3,783,859	18,017	7,905	3,791,764
Kenora and Rainy River Districts	.....	.....	30,393	7,834.526	274,057	1,522	661	274,718
Patricia Portion	.....	.....	800,649	195,098.984	6,825,907	35,867	15,608	6,841,515
Miscellaneous	.....	.....	.....	32.250	1,129	.....	.....	1,129
Total for gold mines, 1937	.....	.....	8,426,898	2,511,643.896	$87,868,689	514,403	$226,421	$88,095,110
Nickel-copper refining and Cobalt ores	.....	.....	.....	75,450.122	2,640,000	.....	.....	.....
Total gold output, 1937	.....	.....	.....	2,587,094.018	$90,508,689	.....	.....	.....

[1]Test milling from April to September; 49.84 tons of concentrates stored.
[2]Recovered from scrapped machinery, etc.
[3]Using mill of Morris Kirkland.
[4]Clean up.
[5]Includes 77.53 ounces gold, $2,746.44, custom-milling for the Edwards mine.
[6]Includes metal content from concentrates shipped, excluding 22,105 pounds of copper.
[7]Also produced 284,598 pounds of copper.
[8]As reported for first quarter.
[9]Using mill of Red Lake Gold Shore.
[10]As received at Royal Mint, Ottawa.

KIRKLAND LAKE GOLD AREA

ANNUAL PRODUCTION STATISTICS BY MINES, 1911–1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Year	Lake Shore		Teck-Hughes		Wright-Hargreaves		Sylvanite		Kirkland Lake Gold		Toburn (Tough-Oakes Burnside[1])		Macassa		Bidgood		Moffatt-Hall		Morris Kirkland		Miscellaneous[2]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1911																					675	4,650	675	4,650
1912																								
1913					3	1,127					2,220	66,632									4,160	21,177	6,383	88,936
1914											3,734	117,644											3,734	117,644
1915											26,196	555,539											26,196	555,539
1916											39,865	711,626											39,865	711,626
1917			11,257	66,722							38,695	342,830											49,952	409,552
1918	16,749	416,414	14,774	80,570							22,000	139,683									3	1,113	53,526	637,780
1919	11,081	263,354	18,387	169,590					11,324	56,263													40,792	489,207
1920	19,779	545,311	30,646	277,878					40,812	322,533													91,237	1,145,722
1921	21,817	540,450	34,693	359,844	36,053	481,892			43,966	268,566													136,529	1,650,752
1922	24,279	476,461	41,194	604,006	66,181	767,445			37,489	226,527	16,108	107,617									6,496	10,082	191,747	2,192,138
1923	23,203	557,186	38,314	1,137,523	79,242	762,761			45,449	223,990	1,803	12,174											188,011	2,693,634
1924	56,168	1,104,550	44,209	1,035,338	84,487	1,094,462			8,091	46,513	8,438	47,548											201,393	3,328,411
1925	109,273	1,958,720	55,220	996,645	147,939	1,913,468					34,152	263,064										1,526	346,584	5,133,423
1926	171,197	2,775,000	87,074	1,600,613	153,392	2,150,844			10,829	126,999	43,871	309,709											466,363	6,963,165
1927	236,818	3,375,053	153,881	2,781,962	209,164	2,151,916	40,479	429,424	52,648	473,673	38,999	153,215											731,989	9,365,243
1928	279,661	4,073,965	317,213	4,951,707	256,331	1,838,510	69,791	738,146	57,883	414,596	14,396	82,316											995,275	12,099,240
1929	430,170	6,126,688	330,340	5,081,078	188,238	1,734,728	74,523	689,465	53,595	353,915												11,925	1,076,866	13,997,799
1930	550,501	7,847,508	338,555	5,403,030	220,430	2,432,888	81,213	794,459	52,106	534,154												32,805	1,242,806	17,044,844
1931	816,580	11,650,281	444,410	6,286,668	266,352	3,078,754	91,621	921,216	52,628	615,882											1	1,662	1,671,591	22,554,463
1932	818,698	14,317,113	475,700	6,631,755	295,525	3,984,125	96,891	930,305	56,492	592,451	14,689	227,956											1,757,995	26,683,705
1933	808,917	14,377,716	474,700	6,166,619	285,465	4,955,960	96,937	1,072,977	49,487	400,622	36,913	666,894	8,101	110,172							35	6,411	1,760,555	27,757,371
1934	836,023	16,305,819	442,745	5,801,691	354,418	7,572,292	111,767	1,740,384	64,952	703,300	36,230	708,119	66,557	1,111,098	2,433	6,804	8,476	87,071				13,150	1,923,601	34,049,728
1935	836,322	16,259,720	417,917	4,901,862	361,149	7,528,563	152,281	1,917,606	71,920	777,430	35,360	714,261	68,627	1,067,196	11,148	43,870	7,912	79,498			1	10	1,962,637	33,290,016
1936	**887,571**	**15,882,078**	**403,712**	**4,747,833**	**400,310**	**7,588,550**	**162,185**	**2,099,128**	**84,679**	**746,189**	**34,440**	**723,295**	**70,878**	**1,260,414**	**26,518**	**362,318**			3,130	18,044	**774**	**4,611**	**2,074,197**	**33,432,460**
1937	900,321	15,546,656	412,430	4,381,676	436,500	7,855,856	174,566	2,222,815	84,886	1,249,724	37,465	920,351	90,617	1,464,561	44,732	431,847			35,970	202,687	315	25,891	2,217,802	34,302,064
Total	7,855,128	134,400,043	4,587,371	63,464,610	3,841,179	57,894,141	1,152,254	13,555,925	879,236	8,133,327	485,574	6,870,473	304,780	5,013,441	84,831	844,839	16,388	166,569	39,100	220,731	12,460	135,013	19,258,301	290,699,112

[1]Acquired by Toburn Gold Mines, Limited, in 1931.
[2]See table of "Miscellaneous Production" to the right.

MISCELLANEOUS PRODUCTION, KIRKLAND LAKE GOLD AREA

Mine	Year	Quantity	Value
		tons	$
Gold Pyramid	1911	175	650
Golden Summit	1936, 1937	737	1,688
Golden Gate (Lucky Cross[1])	1913, 1933, 1935-1937	2,786	21,523
Mesabi (Bourkes[2])	1918, 1936, 1937	105	4,330
Ontario-Kirkland[3]	1922	6,496	10,082
Swastika	1911, 1913	2,160	11,172
Trout Creek	1931	1	1,662
Miscellaneous[4]	1925, 1929, 1933, 1934, 1937		83,906
Total		12,460	135,013

[1]Acquired by Golden Gate Mining Company, Limited, from Kirkland Gateway Gold Mines, Limited.
[2]The property of the Bourkes Syndicate was acquired by Mesabi Gold Mines, Limited, in 1937.
[3]Now owned by Kirkland Gold Rand, Limited.
[4]This includes gold recovered from scrapped machinery, origin unknown, and high-grade.

PORCUPINE GOLD BELT

Annual Production Statistics by Mines, 1910-1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Insert to face page 14

Year	Hollinger		Schumacher[1]		Ross[2]		McIntyre-Porcupine		Dome		Vipond[3]		Porcupine Crown (Northcrown[4])		Coniaurum (Newray[5])		Buffalo Ankerite[6]		Ankerite[7]		Marbuan (March[8])		Paymaster Consolidated[9]		Paymaster[10]		Dome Lake and West Dome Lake[11]		Night Hawk Peninsular[12]		Munro Croesus		Gillies Lake-Porcupine (Rochester[13])		Naybob (Hayden[14])		McLaren-Porcupine		Pamour		Delnite		Miscellaneous[15]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	$
1910	.....	31,194	.....	.....	.....	.....	.....	.....	.....	4,355	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35,549
1911	.....	6,000	.....	.....	.....	.....	.....	.....	.....	4,277	432	5,160	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	432	15,437
1912	45,195	909,181	.....	.....	.....	.....	14,500	77,657	75,088	737,499	5,168	16,259	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	139,951	1,740,596
1913	138,291	2,488,022	.....	.....	.....	.....	29,669	236,299	131,149	1,242,625	.....	.....	19,715	326,803	2,456	18,858	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25	4,200	321,305	4,316,807
1914	208,936	2,719,355	.....	.....	.....	.....	62,284	549,166	221,390	1,059,238	9,700	73,628	40,857	685,135	11,607	125,255	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20,212	554,774	5,231,989
1915	334,750	4,206,015	9,240	48,236	.....	.....	101,955	750,812	317,740	1,530,287	35,899	246,053	46,419	602,436	.....	36,925	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,727	102,880	.....	.....	100	73,215	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	139	9,134	857,969	7,605,993
1916	601,854	5,073,401	46,463	225,301	.....	.....	136,489	1,218,073	440,900	2,153,820	43,041	176,686	51,273	578,322	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,542	16,814	.....	.....	477	51,722	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,327,039	9,494,139
1917	514,301	4,261,928	37,323	198,605	.....	.....	175,893	1,710,204	359,570	1,480,174	34,971	209,738	39,111	377,904	340	1,447	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,388	44,434	.....	.....	1,541	60,046	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31	877	1,179,469	8,345,367
1918	578,755	5,752,371	19,098	92,842	.....	.....	176,976	1,578,444	.....	82,127	15,134	82,868	10,907	124,474	401	1,516	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,229	103,745	.....	.....	692	64,780	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,562	16,214	816,754	7,899,381
1919	711,882	6,722,266	.....	.....	.....	.....	185,018	1,978,014	187,580	1,290,301	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,433	23,910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,831	27,089	1,092,744	10,041,580
1920	650,205	6,939,629	.....	.....	.....	.....	191,032	2,515,861	295,220	2,243,926	.....	.....	17,898	190,713	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,707	52,531	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,003	11,246	1,162,065	11,953,906
1921	1,072,493	10,015,712	.....	.....	.....	.....	172,287	1,985,803	355,680	2,386,357	.....	.....	.....	7,943	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,580,460	14,395,815
1922	1,491,381	12,436,395	.....	.....	.....	.....	217,208	2,042,931	368,400	4,178,936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,664	2,076,989	18,662,724
1923	1,366,352	10,622,262	.....	.....	.....	.....	291,428	2,583,336	399,800	4,405,199	2,623	24,532	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,114	60,765	38,326	268,518	518	27,375	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,845	2,060,721	17,674,549
1924	1,659,776	13,574,776	.....	.....	.....	.....	390,459	3,625,493	493,400	4,307,624	52,427	603,234	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35,235	[16]235,091	39,758	196,947	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,270	2,642,502	22,445,680
1925	1,929,528	15,746,668	.....	.....	.....	.....	419,640	3,721,499	530,200	4,365,923	61,203	565,213	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,453	3,015,607	24,834,794
1926	1,932,559	14,829,655	.....	.....	.....	.....	498,653	3,862,074	555,700	3,940,053	79,717	631,836	.....	.....	.....	.....	.....	.....	23,060	140,588	4,655	11055	.....	.....	28,049	63,551	36,946	220,758	21,604	111,154	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	780	3,180,943	23,811,304
1927	2,178,329	14,539,538	.....	.....	.....	.....	522,880	3,965,210	543,300	4,031,575	90,863	667,724	.....	.....	.....	.....	.....	.....	69,863	359,005	4,566	19839	.....	.....	62,129	135,025	16,982	[16]87,919	.....	166	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60	223,243	3,488,972	24,029,244
1928	1,778,470	10,706,235	.....	.....	.....	.....	524,695	4,201,808	548,000	3,915,051	88,896	694,426	.....	.....	52,005	220,534	.....	.....	66,606	289,960	32,627	133879	.....	.....	94,050	183,271	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	255	39,739	3,185,604	20,384,903
1929	1,549,157	9,519,092	.....	.....	.....	.....	550,100	4,314,803	452,900	3,590,537	107,984	824,726	.....	.....	103,293	635,485	.....	.....	12,912	71,684	48,434	256303	.....	.....	.....	.....	35,142	155,797	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47,701	2,864,820	19,460,413
1930	1,625,868	10,276,546	.....	.....	.....	.....	565,510	4,700,726	67,600	774,943	114,667	910,581	.....	.....	122,972	738,941	.....	.....	.....	878	53,953	306282	.....	.....	.....	.....	.....	15,662	.....	.....	.....	.....	7,815	56,913	.....	.....	.....	.....	.....	.....	.....	.....	61,940	2,558,385	17,843,392
1931	1,640,705	10,532,380	.....	.....	.....	.....	617,425	4,962,211	542,600	3,636,805	100,223	586,304	.....	.....	130,585	783,096	.....	.....	.....	.....	58,462	228507	.....	.....	.....	.....	.....	.....	.....	.....	550	4,171	1,396	5,439	.....	.....	.....	.....	.....	.....	.....	.....	33,587	3,091,946	20,772,501
1932	1,754,863	11,685,512	.....	.....	.....	.....	723,285	6,155,757	536,450	4,581,131	107,197	513,504	.....	.....	144,654	977,007	55,267	247,536	.....	.....	26,812	89566	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,520	.....	.....	2,580	1,497	.....	.....	.....	.....	.....	.....	155	31,944	3,351,263	24,289,974
1933	1,727,102	13,821,174	.....	.....	.....	.....	754,360	7,589,845	546,500	6,103,340	107,562	700,354	.....	.....	145,657	945,765	111,402	650,591	.....	.....	2,800	5288	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,592	3,188	[17]26	326	.....	.....	.....	.....	5,630	98,978	3,402,632	29,928,849
1934	1,900,490	15,108,883	.....	.....	.....	.....	851,345	8,289,262	547,600	7,177,087	101,806	539,243	.....	.....	138,114	979,156	131,720	712,898	.....	.....	26,030	113422	13,824	69,522	.....	.....	.....	.....	.....	.....	205	10,467	.....	.....	.....	.....	50	339	.....	.....	.....	.....	530	2,491	3,711,714	33,002,770
1935	1,837,153	14,700,511	.....	.....	.....	.....	869,100	8,653,496	549,100	7,236,606	106,393	418,962	.....	.....	151,055	1,134,596	159,383	1,035,987	.....	.....	59,380	290542	79,845	567,076	.....	.....	.....	.....	.....	.....	1,237	25,513	5,122	56,933	10,68	23,666	600	3,840	.....	.....	.....	.....	230	5,222	3,829,279	34,202,950
1936	1,755,768	14,530,414	.....	.....	27,540	225,775	869,000	8,105,612	553,900	7,315,168	105,487	463,391	.....	.....	168,715	1,390,261	271,736	1,888,829	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13	2,904	18,410	166,531	.....	.....	.....	.....	138,187	809,933	.....	.....	68	45,522	4,049,786	35,920,945
1937	1,719,199	14,877,898	.....	.....	31,336	351,746	870,160	8,176,793	576,300	7,485,321	94,240	406,668	.....	.....	166,980	1,462,212	343,093	2,332,513	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,911	132,381	.....	16,615	200	2,314	276,168	2,044,049	38,750	228,437	52	1,574	4,303,047	39,305,160
Total	32,703,362	256,643,021	112,124	564,984	58,876	577,521	10,781,351	97,551,189	10,176,067	91,319,286	1,465,633	9,360,890	226,180	2,893,730	1,338,834	9,451,054	1,072,601	7,368,354	172,441	862,115	317,769	1,454663	404,289	2,879,842	184,228	384,647	183,488	1,120,306	99,688	576,785	5,333	326,713	54,502	462,482	14,854	44,966	876	6,819	414,355	2,853,982	38,750	228,437	16,571	723,925	59,847,172	487,646,711

[1]Purchased by the Hollinger in 1922.
[2]The Ross mine in Hislop township is owned by the Hollinger Consolidated.
[3]Acquired by Anglo-Huronian, Limited, in 1933 and by Mace Gold Mines, Limited, in 1937, together with properties of Inspiration Gold Mines, Limited.
[4]The Porcupine Crown was acquired by Northcrown Porcupine Mines, Limited, on May 15, 1920, and by Vipond Consolidated Mines, Limited (now Mace Gold Mines, Limited) in 1926.
[5]The Rea mine (production of which is shown in the figures for 1913, 1914, and 1915) was operated by Newray Mines, Limited, in 1917 and 1918. In 1924 the Newray was taken over by Coniaurum Mines, Limited.
[6]Buffalo Ankerite Gold Mines, Limited, acquired the Ankerite in 1932 and the Marbuan in 1936. The figures for 1936 and 1937 include production from both mines.
[7]The Ankerite was taken over by Buffalo Ankerite Gold Mines, Limited, in 1932; its production since that date is shown under Buffalo Ankerite.
[8]The March was taken over by Marbuan Gold Mines, Limited, in 1933; the Buffalo Ankerite operated the Marbuan mill in 1933, treating 2,800 tons from the dump o' the New York Porcupine Gold Mines, Limited. The Marbuan was taken over by Buffalo Ankerite Gold Mines, Limited, in 1936; its production since that date is shown under Buffalo Ankerite.
[9]Paymaster Consolidated Mines, Limited, incorporated in 1930, is a merger of West Dome Lake Gold Mines, Limited, and United Mineral Lands Corporation (which owned the Paymaster mine). Practically all the production from 1934 to 1937, inclusive, came from the old Dome Lake and West Dome Lake shafts.
[10]Now owned by Paymaster Consolidated Mines, Limited.
[11]From 1915 to 1920, the production shown was from the Dome Lake mine, except 300 tons with a value of $2,462 from the West Dome Lake in 1918. In 1922 the properties were amalgamated as Consolidated West Dome Lake Mines, Limited, and in 1930 acquired by Paymaster Consolidated Mines, Limited.
[12]Acquired by Porcupine Peninsular Gold Mines, Limited, in 1933.
[13]The Rochester mine and other property was acquired from Porcupine United Gold Mines, Limited, in 1933.
[14]The Hayden mine was acquired by Naybob Gold Mines, Limited, in 1934.
[15]See table of "Miscellaneous Production" to the right.
[16]In 1927 it was discovered that an erroneous return had been made for the year 1925 and that the figure should have been $235,091 instead of $237,758, as shown in previous tables. The figure for 1927 was altered to make allowance for this discrepancy of $52,667. The present table now shows the correction applied to the year 1925.
[17]Shipped to Noranda smelter by J. M. McLaren.

Miscellaneous Production, Porcupine Gold Belt

Mine	Year	Quantity	Value
		tons	$
Amca	1937	.....	1,298
Blue Quartz (Amal. Goldfields)	1923, 1926, 1928	.....	1,303
	1934	500	663
Canusa (Scottish-Ontario)	1927, 1928	315	12,688
	1933, 1935	.....	2,152
Clifton (Preston)	1914, 1922-1924	.....	30,575
Concordia (Jones-Porter)	1935	230	580
Davidson Consolidated	1918-1920	9,371	53,914
	1926	.....	146
De Santis	1933	5,630	18,386
Gold Reef	1915, 1917	128	2,135

Mine	Year	Quantity	Value
		tons	$
Hill Gold (Beatty tp.)	1918	25	635
J. Huddlestone and P. Clyne	1923, 1925	.....	3,257
Hughes	1926	.....	30
Northern Turnbull	1934	30	172
Porcupine Lake	1937	52	1,287
Porcupine Pet	1914, 1915	.....	10,551
Porphyry Hill	1913, 1915	46	6,236
J. Spence (Triple Lake)	1932	155	2,738
Tommy Burns	1917	21	289
Miscellaneous[1]	1925, 1927-1937	68	574,890
Total		16,571	723,925

[1]This is high-grading and recoveries from scrapped machinery.

THUNDER BAY DISTRICT

Insert to face page 18

Annual Production Statistics of Gold Mines, 1905–1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Year	Ardeen (Moss[1])		Bankfield		Harkness-Hays		Leitch		Little Long Lac		North Shores (McKellar-Longworth[2])		Northern Empire		Sand River		St. Anthony[3]		Sturgeon River		Tashota[4]		Miscellaneous		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,100	58,304	.....	.....	.....	.....	[5]1,100	2,378	14,200	60,682
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	540	8,858	.....	.....	.....	.....	.....	.....	540	8,858
1912	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,500	61,327	.....	.....	.....	.....	.....	.....	11,500	61,327
1913	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,432	20,408	.....	.....	.....	.....	.....	.....	6,432	20,408
1917	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,967	.....	.....	.....	.....	.....	.....	.....	1,967
1918	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,603	18,340	.....	.....	.....	.....	.....	.....	3,603	18,340
1920	.....	.....	.....	.....	[6]1	63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,771	.....	.....	.....	.....	.....	.....	1	8,834
1921	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	320	5,069	.....	.....	.....	.....	.....	.....	320	5,069
1923	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,707	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,707
1924	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[7]114	.....	.....	114
1929	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	678	2,388	.....	.....	.....	.....	.....	.....	678	2,388
1930	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	458	.....	.....	.....	.....	.....	.....	8	458
1931	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34	315	.....	.....	34	315
1932	25,363	196,473	.....	.....	32	1,474	.....	.....	.....	.....	179	15,480	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25,574	213,427
1933	34,789	270,077	.....	.....	.....	.....	.....	.....	.....	.....	11	288	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34,800	270,365
1934	38,143	216,094	.....	.....	.....	.....	.....	.....	5,485	85,480	.....	.....	22,507	195,647	.....	.....	21,618	123,198	.....	.....	.....	.....	[8]230	37,638	87,983	658,057
1935	5,884	32,531	.....	.....	17	2,252	.....	.....	62,073	1,108,269	1,404	29,358	45,736	645,296	.....	.....	44,550	303,152	.....	.....	12,827	76,627	[9]3,329	49,568	175,820	2,247,053
1936	39,545	234,134	.....	.....	27	2,019	.....	[10]2,048	83,555	1,500,792	2,214	26,212	64,645	1,002,521	.....	.....	28,408	160,394	1,290	20,711	23,590	224,183	.....	.....	243,274	3,173,014
1937	.....	.....	26,437	390,212	.....	.....	23,058	449,260	104,931	1,638,545	.....	202	65,026	706,179	2,537	11,932	17,896	156,225	17,978	310,102	14,454	122,960	[11]183	6,147	272,500	3,791,764
Total	143,724	949,309	26,437	390,212	77	5,808	23,058	451,308	256,044	4,333,086	3,808	73,247	197,914	2,549,643	2,537	11,932	148,65$_3$	928,859	19,268	330,813	50,905	424,085	4,842	95,845	877,267	10,544,147

[1]Originally known as the Huronian; this mine produced in the seventies, but no records are available; acquired by Ardeen Gold Mines, Limited, in 1933, and by Kerry Gold Mines, Limited, in 1937.
[2]Acquired from Schreiber Gold Mines, Limited, by North Shores Gold Mines, Limited, in 1933.
[3]Records are incomplete; operations were reported from 1905 to 1907. This property was formerly owned by Northern Gold Reef, Limited.
[4]In addition to gold values shown, this mine produced large quantities of copper (see detailed gold table in previous reports).
[5]Empress (no statistics available, data taken from report of J. H. Chewett, April 22, 1897).
[6]W. S. Jackson claims; acquired by Harkness-Hays in 1925.
[7]Mary J. Coveney.
[8]Dikdik (owned by J. Bruce McMartin).
[9]Dikdik, 3,295 tons, $49,118; Caouette claims (Afton), 34 tons, $450.
[10]Surface ore.
[11]Cook Lake, 32 tons, $918, milled by Little Long Lac; Maloney Sturgeon, 1 ton, $2,549; and Schreiber Pyramid, 150 tons, $2,680.

PATRICIA PORTION OF KENORA DISTRICT

Insert to face page 20

ANNUAL PRODUCTION STATISTICS OF GOLD MINES, 1911–1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Year	Argosy (Casey Summit[1])		Bathurst (Car Lake[2])		Central Patricia		Gold Eagle		Howey		Hudson-Patricia		J-M Consolidated (Jackson Manion)		McKenzie Red Lake		Pickle Crow		Red Crest (Rowan Discovery)		Red Lake Gold Shore		Sol D'Or[3]		Miscellaneous		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[4]30	57	30	57
1923	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[5]124	.....	124
1924	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[6]126	.....	126
1929	.....	.....	.....	[7]3,107	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[8]11,524	.....	14,631
1930	.....	.....	.....	.....	.....	.....	.....	.....	110,438	460,857	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	110,438	460,857
1931	.....	.....	.....	.....	.....	.....	.....	.....	211,552	914,291	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	211,552	914,291
1932	.....	.....	.....	.....	.....	.....	.....	.....	284,664	1,268,780	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	284,664	1,268,780
1933	.....	.....	.....	.....	.....	.....	.....	.....	344,135	1,161,436	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	175	3,700	.....	[9]505	344,310	1,165,641
1934	4,094	30,673	.....	.....	11,536	219,562	.....	.....	481,757	1,594,223	.....	.....	3,443	35,389	.....	.....	.....	.....	.....	.....	.....	.....	130	2,551	.....	([10])	500,960	1,882,398
1935	.....	.....	.....	.....	35,192	777,570	.....	.....	484,966	1,332,950	.....	.....	1,381	12,851	36,117	533,223	37,277	878,745	174	3,828	.....	.....	119	1,444	.....	.....	595,226	3,540,611
1936	9,872	130,027	307	2,702	58,466	1,144,154	.....	.....	528,528	1,251,588	8,228	54,934	12,160	119,603	52,465	747,795	63,758	1,612,451	417	5,893	14,918	138,706	34	1,075	.....	[10]4,766	749,153	5,213,694
1937	31,741	353,981	.....	.....	77,119	1,392,840	6,599	73,005	447,344	1,095,508	3,000	10,232	31,225	334,475	58,001	860,214	98,063	2,270,113	.....	.....	47,557	451,147	.....	.....	.....	.....	800,649	6,841,515
Total	45,707	514,681	307	5,809	182,313	3,534,126	6,599	73,005	2,893,384	9,079,633	11,228	65,166	48,209	502,318	146,583	2,141,232	199,098	4,761,309	591	9,721	62,475	589,853	458	8,770	30	17,102	3,596,982	21,302,725

[1]Bought by Argosy Gold Mines, Limited, in 1935.
[2]Acquired by Gleemar Gold Mines in 1937 from Bathurst Gold Mines, Limited.
[3]This property was operated in 1933 by the Highgrade Syndicate and in 1934 by J. Hendrick, when it was acquired by Sol D'Or Gold Mines, Limited.
[4]J. Tingley.
[5]R. McDonald.
[6]N. McDonald.
[7]High-grade
[8]Bobjo, $11,510 (high-grade); P. Edwards, $14.
[9]Geo. Singleton, $137; G. A. Rowan, $368.
[10]W. D. Cooper and P. A. Barry produced gold from the McIntyre Birch Lake property in 1934, reported in 1936.

ONTARIO'S GOLD MINING INDUSTRY

ANNUAL PRODUCTION STATISTICS BY AREAS, 1885-1937

(Value includes gold and silver, and exchange premium and equalization have been added since 1920)

Insert to face page 22

Year	Southeastern Ontario		Larder Lake area		Kirkland Lake area		Porcupine belt		Matachewan area		Sudbury district		Algoma district		Thunder Bay district		Rainy River district		Kenora district		Patricia portion of Kenora district		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910	[1]124,569	587,843									[2]9,320	55,982	[3]12,809	78,797	[4]14,200	60,682	[5]32,196	279,590	[6]220,141	1,322,247			413,235	2,385,141
1910	500	3,349						35,549			3,294	18,553	1,660	7,040						3,791			5,454	68,282
1911			125	314	675	4,650	432	15,437			1,750	9,828		627	540	8,858			300	6,981	30	57	3,852	46,752
1912	4,221	13,963					139,951	1,740,596							11,500	61,327	50	400	425	2,101			156,147	1,818,387
1913	9,950	24,088	480	14,005	6,383	88,936	321,305	4,316,807			20,646	114,833			6,432	20,408							365,196	4,579,077
1914	127	2,739		5,204	3,734	117,644	554,774	5,231,989			45,458	217,103											604,093	5,574,679
1915	1,036	4,043			26,196	555,539	857,969	7,605,993			44,271	282,123											929,472	8,447,698
1916					39,865	711,626	1,327,039	9,494,139			26,846	187,103							1	130			1,393,751	10,392,998
1917	860	593			49,952	409,552	1,179,469	8,345,367								1,967			40	279			1,230,321	8,757,758
1918			1,502	11,334	53,526	637,780	816,754	7,899,381							3,603	18,340			208	216			875,593	8,567,051
1919		300	735	2,631	40,792	489,207	1,092,744	10,041,580										211					1,134,271	10,533,929
1920			4,637	29,888	91,237	1,145,722	1,162,065	11,953,906							1	8,834	2	108	291	2,367			1,258,233	13,140,825
1921				549	136,529	1,650,752	1,580,460	14,396,815							320	5,069							1,717,309	16,052,185
1922		1,056			191,747	2,192,138	2,076,989	18,662,724		987													2,268,736	20,856,905
1923			4,818	73,262	188,011	2,693,634	2,060,721	17,674,549						153		1,707			915	3,012		124	2,254,465	20,446,441
1924			24,178	152,072	201,393	3,328,411	2,642,502	22,445,680								114						126	2,868,073	25,926,403
1925			36,651	271,161	346,584	5,133,423	3,015,607	24,834,794						41									3,398,842	30,239,419
1926			48,761	229,650	466,363	6,963,165	3,180,943	23,811,304					415	1,847									3,696,482	31,005,966
1927			65,592	338,600	731,989	9,365,243	3,488,972	24,029,244															4,286,553	33,733,087
1928			43,275	174,681	995,275	12,099,240	3,185,604	20,384,903															4,224,154	32,658,824
1929			22,343	161,717	1,076,866	13,997,799	2,864,820	19,460,413					33	2,057	678	2,388			34	182		14,631	3,964,774	33,639,187
1930			31,738	219,726	1,242,806	17,044,844	2,558,385	17,843,392					1,824	3,147	8	458					110,438	460,857	3,945,199	35,572,424
1931			32,038	235,347	1,671,591	22,554,463	3,091,946	20,772,501					18,530	155,812	34	315			33	3,855	211,552	914,291	5,025,724	44,636,584
1932			35,001	182,053	1,757,995	26,683,705	3,351,263	24,289,974	6,805	70,142	22	2,993	35,704	351,654	25,574	213,427			48	3,888	284,664	1,268,780	5,497,076	53,066,616
1933			5,459	71,766	1,760,555	27,757,371	3,402,632	29,928,849	38,004	495,984			35,296	429,238	34,800	270,365		4,624			344,310	1,165,641	5,621,056	60,123,838
1934			33,457	153,948	1,923,601	34,049,728	3,711,714	33,002,770	100,054	614,909	12,320	68,600	42,041	484,874	87,983	658,057	870	13,525	25	2,242	500,960	1,882,398	6,413,025	70,931,051
1935			35,227	148,266	1,962,637	33,290,016	3,829,279	34,202,950	325,521	1,510,729	40,474	274,980	66,015	604,425	175,820	2,247,053		671	3,675	98,973	595,226	3,540,611	7,033,874	75,918,674
1936			114,472	470,507	2,074,197	33,432,460	4,049,786	35,920,945	378,918	1,476,505	10,555	80,615	90,868	801,133	243,274	3,173,014		105	36,144	380,339	749,153	5,213,694	7,747,367	80,949,317
1937		238	162,740	754,026	2,217,802	34,302,064	4,303,047	39,305,160	470,310	1,836,854	56,067	401,747	113,390	586,133	272,500	3,791,764	330	1,737	30,063	272,981	800,649	6,841,515	8,426,898	88,094,219
Total	141,263	638,212	703,229	3,700,707	19,258,301	290,699,112	59,847,172	487,646,711	1,319,612	6,006,110	271,023	1,714,460	418,585	3,506,978	877,267	10,544,147	33,448	300,971	292,343	2,103,584	3,596,982	21,302,725	86,759,225	828,163,717

[1]1891 to 1909, inclusive.
[2]1897 to 1908, inclusive.
[3]1893, 1904, 1908.
[4]1897, 1905 to 1907.
[5]1897 to 1909, inclusive.
[6]1885 to 1909, inclusive.

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART X, 1939

Geology of the Ashigami Lake Area, by H. W. Fairbairn - - 1-15

Notes on Several Properties in the District of Sudbury, by T. C. Phemister - - - - - - - - - - - - - - 16-28

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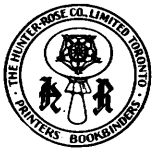

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COLOURED GEOLOGICAL MAP

(In pocket at back of report)

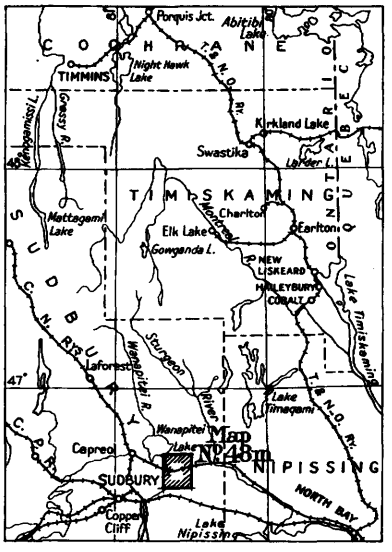
Map No. 48m—Ashigami Lake Area, District of Sudbury, Ontario. Scale, half a mile to the inch.

Geology of the Ashigami Lake Area

By H. W. Fairbairn

INTRODUCTION

The Ashigami (Ashganing) Lake area includes the township of Street, most of Scadding, and parts of Davis and Loughrin townships, in the district of Sudbury. Its northwest corner touches Outlet bay of Wanapitei lake, which is about 25 miles northeast of Sudbury. The area mapped during the summer of 1938 comprises about 90 square miles. Despite a scarcity of exposures in places, the main contacts have been mapped fairly accurately, and the various horizons have



Key map showing the location of the Ashigami Lake area, district of Sudbury. Scale, 60 miles to the inch.

been correlated with those in adjoining areas. In certain localities a scale of 200 feet to the inch was used in mapping, and the distances were chained. In general, however, pace-and-compass traverses were used and the mapping was done on a scale of half a mile to the inch.

Acknowledgments

The field work was lightened considerably through the kind assistance of employees of the Canadian National Railways at Crerar, the Forestry Branch at Skead, the geological staff of the International Nickel Company at Copper Cliff, and Stanley Wright of Fort Erie. A considerable part of the mapping was carried out by H. W. Salter. P. D. Bugg and G. D. Keeler proved capable junior assistants. To all of these organizations and individuals, as well as to others not mentioned, the writer expresses his appreciation.

Acknowledgment is further made to the Bureau of Geology and Topography, Ottawa, for permission to use parts of a manuscript map of W. H. Collins in the

preparation of the map accompanying this report. The areas for which this map was used include the country south of the Canadian National railway and west of the Wanapitei river, and an east-west strip about a mile wide along the south boundary of the map.

Means of Access

The area may be reached by air in a few minutes from the Sudbury airport. The northwest corner is accessible by water from Skead on the Canadian National railway. The northeastern section may be reached by rail from Crerar or Ess Creek, from which points good roads and portages lead north to Ashigami (Ashganing) and Kukagami (Kuta) lakes. The southeastern part of the area is accessible by automobile from Markstay on the Trans-Canada highway to the south. The southwest corner is easily reached by canoe from the dam on the Wanapitei river just south of the map area. It is possible to drive by car to within a quarter of a mile of Crerar, and to the south shore of Kukagami lake, on recently repaired lumbering roads. In wet weather, however, parts of these roads can be used only by wagons.

Previous Work

No detailed work has previously been completed in the vicinity of Ashigami lake. In 1856 Murray[1] explored the Wanapitei river in the course of a reconnaissance survey in the region north of Lake Huron. Bell[2] describes the rocks of Wanapitei lake in his report of his work in the summers of 1888, 1889, and 1890. Collins[3] and his assistants in 1912 mapped an area south of Wanapitei lake which includes much of the Ashigami Lake area. In 1921 Quirke[4] surveyed the entire area surrounding Wanapitei lake. Bruce[5] visited the area in 1931 in the course of a geological survey to the east. Collins commenced detailed mapping in the Ashigami Lake area in 1934, the work being interrupted by his ill-health and death. Points of agreement or disagreement with these earlier investigations will be considered later in this report.

Topography

The relief in the area averages 100 to 200 feet. Quartzite, gneiss, gabbro, and conglomerate account for most of the elevations and are scattered fairly evenly throughout the area. There is little regional uniformity in the strike of the ridges; locally, as east and west of Crerar, the parallelism is marked. Southwest of Ashigami lake a sand and gravel plain obscures practically all of the bed rock. In places swamps and muskegs cover extensive areas; elsewhere exposures are abundant. The boundary line separating Street and Scadding townships on the west from Loughrin and Davis townships on the east forms an approximate local drainage divide. On the west the streams flow into Wanapitei river and lake; on the east the drainage is toward the Sturgeon river. Much of the shore of the Wanapitei river is flooded land, extending in places almost half a mile from the original river bed.

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[1]Alexander Murray, Geol. Surv. Can., Rept. of Progress, 1853-56, pp. 171-179.

[2]Robert Bell, "Report on the Sudbury Mining District," Geol. Surv. Can., Vol. V, 1890-91, pt. F, pp. 7, 8.

[3]W. H. Collins, "Geology of a Portion of Sudbury Map-Area, South of Wanapitei Lake, Ontario," Geol. Surv. Can., Sum. Rept. 1913, pp. 189-195.

[4]T. T. Quirke, "Wanapitei Lake Map-Area," Geol. Surv. Can., Sum. Rept. 1921, pt. D, pp. 34-50.

[5]E. L. Bruce, "Geology of the Townships of Janes, McNish, Pardo and Dana," Ont. Dept. Mines, Vol. XLI, 1932, pt. 4, pp. 1-28.

Natural Resources

Lumbering has been in the past an important industry, especially in the Wanapitei drainage basin. White pine is the chief commercial wood and small stands are still to be found. In Loughrin township birch is being shipped out at present for firewood. Most of the area is heavily forested, except for a recently burned section west of Ashigami lake. White pine and birch, balsam, poplar, spruce, jack pine, and red pine are abundant. In the vicinity of the roads in Loughrin township there is a considerable amount of cleared land, which is either farmed or used for pasturage. Ashigami and Kukagami lakes are splendid fishing grounds, in which bass, pickerel, and trout are the chief game fish.

Wanapitei river and lake have furnished power for some years to the Falconbridge Nickel Company plant. There is no other important source of power in the Ashigami area.

GENERAL GEOLOGY

No rocks older than the Huronian are exposed in the Ashigami Lake area. Sediments and sedimentary gneisses form the greater part of the outcrops, interrupted in places by intrusive dikes and sills. The sediments occupy the north and west sides of the area and are greatly disturbed by folding and faulting. The sedimentary gneisses occupy the southeastern section. The intrusives, as far as known, lie only in the sediments, and are in part unaltered. Some of them undoubtedly occur within the area of gneisses as well.

The chief problems in mapping the area are: (1) the separation of the Bruce sediments from the Cobalt sediments, and the nature of the contact, (2) the identification of the formations within the Bruce series, and (3) the nature of the contact of the gneiss with the sediments of both the Cobalt and Bruce series.

The table of formations follows in part that set up by Collins in recently published maps.[1] No change is necessary for the Bruce and Cobalt series. There is disagreement, however, about the inclusion of the gabbro and granite in the Huronian. His own earlier reports, and the present opinions of other investigators, place these intrusives much later in the time scale. As the Ashigami Lake area does not offer conclusive evidence which would help to solve the problem, the succession of events is recorded simply by grouping the intrusives together as late pre-Cambrian.

RECENT and PLEISTOCENE:		Sand, gravel, clay, etc.
		Major unconformity
LATE PRE-CAMBRIAN:		Olivine diabase dikes. Stratiform pink and grey gneisses, probably in large part granitized Huronian sediments. Granite stringers and pegmatite dikes. Gabbro sills and dikes (Nipissing diabase type).
HURONIAN:	COBALT:	Gowganda formation: Undifferentiated assemblage of conglomerate, greywacke, and quartzite, in part of glacial origin.
		Minor unconformity
	BRUCE:	Serpent: White feldspathic quartzite, finely banded. Espanola formation: Thin-bedded calcareous greywacke; brown- and grey-weathering limestone. Bruce: Buff-weathering boulder conglomerate. Mississagi: White to grey feldspathic quartzite with argillite bands and pebble beds. Ramsay Lake: Boulder conglomerate and coarse grit.
UNDIFFERENTIATED:		Quartzite schist; biotite schist.

[1]W. H. Collins, "Copper Cliff Sheet" and "Espanola Sheet", Dept. Mines and Resources, Maps Nos. 291A, 292A, 1938 (no report).

Bruce Series

Prior to 1938 all the members of the Bruce series had been recognized in the Ashigami Lake area, with the exception of the Ramsay Lake conglomerate. Collins had mapped the outcrops in the Wanapitei river section south of the railway, and Quirke's reconnaissance mapping covered the northwest section. Bruce rocks extend to the east boundary of the area, and perhaps beyond, since the quartzite mapped as "Sudbury series(?)" a few miles to the east by Bruce[1] is similar to the Mississagi quartzite on Ashigami lake. To the west an unbroken succession of Bruce formations extends to Lake Superior, a distance of more than 200 miles. Since the various horizons have been thoroughly studied by Collins,[2] no further descriptions are necessary here beyond mention of typical occurrences.

Ramsay Lake Conglomerate

The Ramsay Lake conglomerate has a very limited occurrence. The most accessible exposure lies in the northeast corner of Street township, less than half a mile west of mile 124 on the railway. It is more correctly described here as a conglomeratic grit, and passes upward into the feldspathic quartzite of the Mississagi formation. The white quartz grains which stand out conspicuously on weathered surfaces are as characteristic here as in the well-known localities near Sudbury. The quartzite on the west also faces west, thus establishing the age relation of the two rocks. The base of the conglomerate is not exposed, the nearest rock being a quartzite schist to the southeast almost half a mile distant. Discussion of this schist will be reserved for a later place.

The second occurrence of Ramsay Lake conglomerate is in the southeast corner of Scadding township. In appearance it is not very typical of the formation. It contains many pebbles and boulders, and the conspicuous white quartz grains are absent. Its position at the base of 6,000 feet of Mississagi quartzite is the principal reason for including it in the Ramsay Lake formation. Its own base is not exposed, the nearest exposures being intrusive gabbro. It may possibly represent nothing more than a conglomerate horizon within the Mississagi.

The conspicuous discrepancy in the strikes of these two occurrences is a structural feature which suggests an east-west fault. This will be taken up later.

Mississagi Quartzite

Mississagi quartzite occurs in two extensive areas, one on the south side of Ashigami lake, the other in Street township along the Wanapitei river. It is typically feldspathic and usually coarse, with colours varying from white to grey. Massive beds 1 to 2 feet thick are characteristic, and unusually well developed cross-bedding makes determination of sequence an easy matter. In only one locality can an approximation of the thickness of the formation be made. From the tip of the main peninsula on Ashigami lake southward to the Ramsay Lake conglomerate (part of section line C-D) a thickness of 6,000 feet is probable. The proximity of the gneiss, together with the gaps between outcrops, do not allow a safe estimate to be made along the Wanapitei river.

The quartzite was seen in contact with the overlying Bruce conglomerate in only one locality. The occurrence is at the tip of the main peninsula of Ashigami lake and on a neighbouring island, where the transition occurs within a few feet from coarse feldspathic quartzite to boulder conglomerate. West of the Wanapitei river Collins' map shows contacts in three places. These were not visited.

[1] E. L. Bruce, op. cit., map No. 41f.
[2] W. H. Collins, "North Shore of Lake Huron," Geol. Surv. Can., Mem. 143, 1925.

Bruce Conglomerate

The most extensive occurrence of Bruce conglomerate is in the western parts of Scadding and Street townships in the neighbourhood of the Wanapitei river. The outcrops are mostly isolated and show few contacts with the underlying quartzite and overlying limestone. Localities for the former have already been noted. The best locality showing a limestone contact is at the rapids on the Wanapitei river (part of section line A-B) where the boulder conglomerate passes upward into calcareous silt and brown-weathering dolomitic limestone.

A second occurrence of Bruce conglomerate straddles Ashigami lake in a thin belt which is faulted off to the northwest and pinches out to the southeast. Its maximum thickness is estimated at 600 feet. The exposures here are in many places highly sheared and difficult to separate from the neighbouring Gowganda conglomerate. Most of the upper contact of the Bruce conglomerate is likewise the intersection line of the former pre-Cobalt erosion surface with the present-day surface. A contact of Bruce and Gowganda formations is seen on one of the small islands in Ashigami lake, but owing to deformation little can be learned concerning the nature of the unconformity. On the east side of the main peninsula in the lake the strikes of the two formations are discordant, and only a few feet of soil separates them.

A third occurrence of Bruce conglomerate lies just north of Ess Creek station. As the map shows, no contacts with other sediments are found, the identification being on lithological grounds alone. The conglomerate here, as well as elsewhere in the area, shows all the characteristics of Bruce conglomerate previously described by Collins—a distinctive buff-weathered surface and a dark matrix in which individual quartz grains show a black glassy lustre. The pebbles and boulders are largely granite and are firmly cemented into the matrix.

Espanola Formation

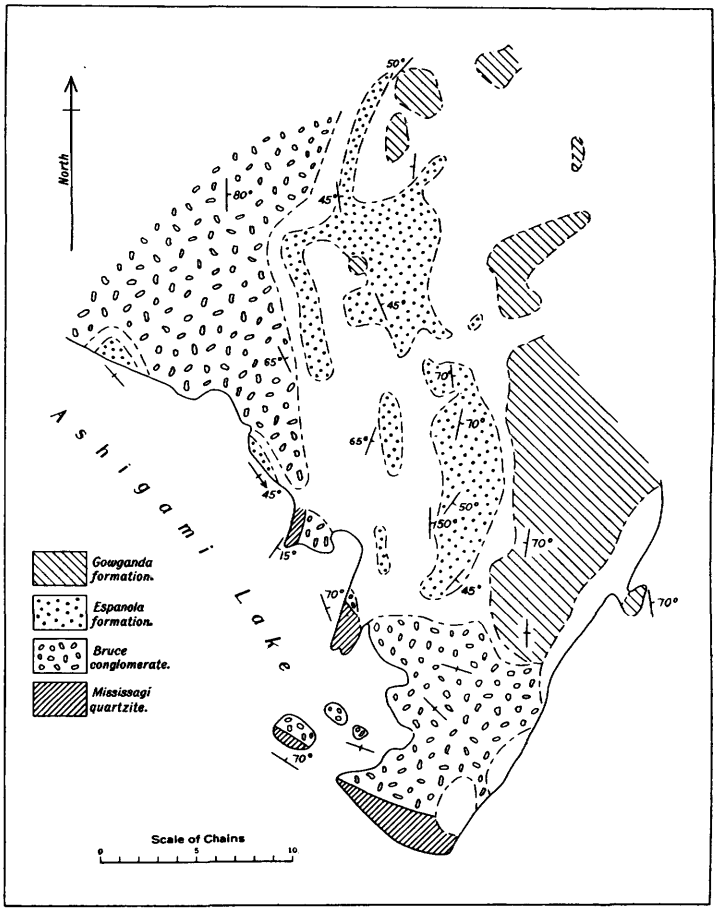
Occurrences of the Espanola formation are limited in areal distribution but are highly important in determining the sequence and structure. The formation consists of a basal limestone member and an upper greywacke phase. Both are corrugated and serrated on weathered surfaces due to compositional differences of the thin beds. Detailed descriptions may be found in Collins'[1] report. The limestone corresponds to the Bruce limestone found west of Sudbury. Along the Wanapitei river it shows a thickness of about 250 feet in two localities. In places it is brown-weathering and dolomitic, in others it is grey-weathering and non-dolomitic. The greywacke occurs less commonly and well-developed examples are found in only two localities, on Portage island in the Wanapitei river and on the east side of the telephone line in the western part of Scadding township. A thickness of 300 feet or more has been noted.

The usual occurrence of the Espanola formation consists of small exposures of limestone averaging about 100 feet in thickness. As the underlying Bruce conglomerate is not bedded and the overlying Serpent quartzite is difficult to separate from the Mississagi, the limestone, where found, serves as a key to the succession. Occurrences showing these relations are found in the northwestern part of Street township, on Portage island, and just north of the Alkin gold mine. In this last-mentioned locality the limestone passes upward through a few feet of silty material into a finely banded quartzite, which is the Serpent. On an island in Ashigami lake and on the main peninsula the limestone forms locally the pre-Cobalt erosion surface. Details of the contact relations may be seen in the

[1]W. H. Collins, "North Shore of Lake Huron," Geol. Surv. Can., Mem. 143, 1925, pp. 51-55.

sketch map below. Deformation has thickened and thinned the Espanola formation to a considerable extent, as seen in the drift-covered country in the southern part of Scadding where a few feet of the limestone is wedged in between conglomerate and intrusive gabbro.

Of the metamorphic minerals described by Collins[1] only scapolite is commonly seen with the unaided eye. One thin section shows a scapolite metacryst fractured by deformation, which occurred after its growth in the limestone.



Geological sketch map of the main peninsula on Ashigami lake.

Serpent Quartzite

Serpent quartzite occurs in the central part of Scadding township and west of the Wanapitei river. The latter locality was previously known; the former was mapped by Quirke[2] as Mississagi quartzite. Since, however, this supposed Mississagi is underlain by limestone, there is no alternative but to map it as Serpent. It resembles the Mississagi in texture, colour, and composition but, as noted elsewhere by Collins,[3] it has a fine banding and lacks the well-defined cross-

[1]W. H. Collins, op. cit., p. 145, plate VIII B.
[2]T. T. Quirke, op. cit., map No. 1948.
[3]W. H. Collins, op. cit., p. 56.

bedding characteristic of the Mississagi. A fault separates it from the true Mississagi on Ashigami lake. In this locality the Serpent forms the pre-Cobalt erosion surface. Good contact relations with the Gowganda are to be found about 2 miles east of Outlet bay in the central part of Scadding township. As the top of the quartzite is everywhere an erosion surface, its thickness is unknown. Collins[1] has noted a maximum thickness of 1,500 feet west of Sudbury.

Cobalt Series

The Cobalt series is represented only by the Gowganda formation in the Ashigami Lake area and is widely distributed over the northeastern part of the area. It consists of the usual greywacke, boulder conglomerate, and quartzite, in part well-bedded, in part structureless. Owing to the glacial origin of the Gowganda no attempt was made in mapping to separate the different rock types composing it. An introduction to the extensive literature on the Gowganda formation may be obtained from Collins'[2] memoir. No estimate of the thickness of the formation can be made from the occurrences in the Ashigami Lake area. Collins gives 3,000 feet as an approximate figure.

Bruce-Cobalt Unconformity

An erosional unconformity has been described by Collins to explain the Bruce-Cobalt contact in the Lake Huron region. In some places the Gowganda rests on Mississagi quartzite; in others it is in contact with Serpent quartzite. Since the Cobalt sediments show no dips varying more than 20 degrees from those of the Bruce sediments, at places where the two series are in contact, no marked deformation could have taken place prior to the deposition of the Cobalt series. Similar conditions were observed in the Ashigami Lake area. North of Crerar, Mississagi quartzite and Gowganda greywacke are separated by only a few hundred feet of drift. On Ashigami lake the Gowganda formation is in contact with the Bruce conglomerate and Espanola formation. Further northwest it is in contact with Serpent quartzite. Discrepancies in dips of the Bruce and Cobalt sediments do not average more than 10 degrees. A case for intervening orogeny and a major unconformity might be postulated from the relations on Ashigami lake, where the Cobalt rocks strike about north-south, and the Bruce slightly north of west. Owing, however, to the complexity of the structure produced by post-Huronian deformation it would be unwise to emphasize this relation too greatly.

In the area ten miles to the east, Bruce[3] considers the quartzite and the Gowganda formation to be separated by a major unconformity, chiefly on the basis of great variation in dips in the two formations. For this reason he believes the quartzite to be Sudburian, although admitting its lithological similarity to the Mississagi on Ashigami lake. In the latter area there is no question as to the identity of the pre-Cobalt rocks as Bruce, even if a major unconformity could be proved.

More recently, Collins[4] states that the difference in dip of the Gowganda formation and Bruce series may be as great as 45 or 50 degrees in the Ashigami Lake area. The present mapping does not confirm this, and the unconformity is therefore considered to be of the same character as the minor one originally described by Collins west of Sudbury.

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[1]W. H. Collins, op. cit.
[2]W. H. Collins, ibid.
[3]E. L. Bruce, op. cit., pp. 13, 15.
[4]W. H. Collins, "Timiskaming Sub-Province," Bull. Geol. Soc. Amer., vol. 48, No. 10, 1937, p. 1444.

Late Pre-Cambrian

The Bruce and Cobalt period of sedimentation was followed by igneous activity. In the Ashigami Lake area there is no record of further deposition of sediments by which to date the various igneous phases. The intrusives are, for this reason, grouped as late pre-Cambrian, thus avoiding conflict with "Keweenawan" and "Killarnian" nomenclature. This undoubtedly oversimplifies the true field relations but is advisable until more definite evidence is at hand.

Gabbro

The earliest of the intrusives was gabbro, which was injected over large areas in northeastern Ontario as sills and dikes. Similar intrusives at Cobalt are called Nipissing diabase and are silver-bearing. To the west, toward Lake Superior, the same rock carries copper in places. In the Ashigami Lake area the gabbro is gold-bearing. It has been studied in detail from many localities and needs but brief description here. It is typically altered and greenish in colour. Later deformation has converted it to a schist in some localities. In thin section this schist contains abundant albitized plagioclase, actinolite, epidote, and sericite. Remnants of pyroxene still persist. Quartz and carbonate are common. The alteration is typical of basic igneous rocks and shows no unusual features. The gabbro occurs in bodies with a maximum width of half a mile and a length of several miles, and follows the strike of the intruded rocks. Whether sills or dikes predominate could not be determined. Both are probably common.

Acid dikes and quartz veins are associated with the gabbro. The dikes are seldom more than a few inches in width and have no continuity or parallelism within the gabbro. Two thin sections show almost pure soda plagioclase with minor amounts of microcline, actinolite, quartz, biotite, carbonate, and epidote. On the road north of Ess Creek station a similar small sodic dike cuts the Bruce conglomerate. In thin section it is seen to be highly fractured and is probably related to the nearby gabbro.

Quartz veins are common and vary greatly in size. None was seen of greater width than 3 or 4 feet. They may lie in shear zones within the gabbro, or may occur as discontinuous masses with little apparent structural control. Carbonate veins are commonly associated with the quartz and are very coarsely crystallized. An iron-bearing magnesite, breunnerite, is the common carbonate. Weathered surfaces of this mineral show a rusty coat of iron oxide, which is very conspicuous in the white quartz.

Gneisses

The southeastern part of the area is underlain by stratiform pink and grey gneisses, the continuation of gneisses lying to the southwest which are considered to be sedimentary. This view is confirmed in the Ashigami Lake area. The northwestern edge of the gneisses, facing the Huronian sediments, consists of finely banded granite gneiss, largely composed of feldspar, quartz, and biotite. To the southeast the grain-size increases in general, hornblende is abundant, and the fine banding gives place to highly contorted layers of light and dark minerals. No detailed petrographical examination of these gneisses has been made and as yet there has been no attempt to subdivide them into lithological units on account of the heavy forest cover. A thin section of the pink gneiss near the contact with the sediments shows abundant feldspar and quartz, with smaller amounts of green biotite. The feldspars are microcline and soda plagioclase. Apatite and zircon are common accessories, the latter showing pleochroic haloes where embedded in biotite.

The contact with the Huronian sediments is everywhere concealed. Usually it is marked by a valley. East and west of Crerar a narrow band of quartzite and biotite schist separates the gneisses from the known Huronian, and at two places a contact has been noted. It consists in each case of a few feet of extremely coarse sericite schist, and suggests a recrystallized fault zone between the schists proper and the gneiss. This relation will be discussed more fully later.

In three places pebbles have been found in the gneiss, in the northeastern part of Street township, south of the feldspar property in the northwestern part of Scadding township, and just south of Ess Creek station. The pebbles are mostly granite and have been greatly deformed. Their presence firmly establishes the gneiss as sedimentary and likewise excludes it as the "basement complex" on which all later pre-Cambrian sedimentation took place. From detailed studies to the southwest Collins and Quirke[1] concluded that the sedimentary portion of the gneisses represent metamorphosed and granitized Huronian sediments, and were able to trace the transitions in some cases. Although direct evidence of this kind has not been obtained in the Ashigami Lake area, it is believed that the gneisses are best explained on this basis. In the area a few miles to the east Bruce[2] has mapped similar gneisses as Sudbury (pre-Huronian). The present writer favours a Huronian age for the reason that unquestioned Huronian rocks occur in the area, whereas Sudburian rocks do not. The concealed contact unfortunately prevents a thorough study of the problem.

Dark hornblende-rich patches and bands in the gneiss may be explained as metamorphosed gabbro, as evidence elsewhere shows the granitization process to be later than the gabbro intrusions.

There is little evidence of widespread intrusion within the gneiss area. Here and there small pegmatite dikes are found. These are measured usually in a few tens of feet rather than in hundreds, and in one locality south of Crerar feldspar is obtained from such a dike. Small veins and dikelets of pink granite are also found. The nearest large granite mass in the gneisses is at Wanapitei village outside the Ashigami Lake area.

On the Tecumseh property in Davis township a small coarse-grained granite dike intrudes gabbro. It consists of pink orthoclase and quartz as essential minerals, with smaller amounts of chlorite and carbonate. There is a pronounced alteration of the gabbro into a hornblende–pink feldspar rock at the contact. No petrographic study has been made, as the exposures are inadequate. It is impossible at present to correlate this dike definitely with the igneous activity of the gneiss area to the south.

Olivine Diabase

Olivine diabase dikes are the youngest rocks of the area. They are less common in the Ashigami Lake area than elsewhere, only three small ones having been found. Detailed descriptions may be found in Collins' memoir.[3] The dikes strike a few degrees north of west, thus maintaining the conspicuous trend noted in other localities. Unlike the gabbro, they are fresh and massive, and postdate all the pre-Cambrian deformations.

Undifferentiated

For several miles east and west of Crerar the railway parallels a band of schists, which is bounded on the north by gabbro and Bruce conglomerate, and on the

[1]T. T. Quirke and W. H. Collins, "The Disappearance of the Huronian," Geol. Surv. Can., Mem. 160, 1930, pp. 56, 84-89, 102.
[2]E. L. Bruce, op. cit., map No. 41f.
[3]W. H. Collins, op. cit., pp. 82-84.

south by gneiss. The gabbro intrudes it, but no contact with the Bruce and Cobalt sediments has been found. A contact with the gneisses has been found in two places, and in each is marked by the development of a very coarse sericite schist. This schist may represent the recrystallized product of a fault zone to which solutions had ready access.

The main band of schist consists of two parts, a northern, quartzose member, and a southern, biotitic one. Both appear to be of sedimentary origin, and in the quartzite schist west of Ess Creek station a pebble has been found. Nothing is known of the age relations of the two horizons.

The northern, quartzose band consists largely of a fine quartz matrix. The grains are strained and the texture is irregular. Microcline and soda plagioclase porphyroblasts are commonly found in the quartz matrix, the plagioclase being partly sericitized.

The southern, biotitic band consists of an interlocking aggregate of recrystallized quartz, soda plagioclase, and green biotite. One thin section shows a considerable amount of brown biotite in addition to the green variety. Epidote and sericite are common. Apatite, magnetite, and zircon are common accessories. The latter shows pleochroic haloes where embedded in biotite.

In his compilation of the geology of the district of Sudbury, on a scale of 8 miles to the inch, Collins[1] mapped these schists as Cobalt. Since no explanatory notes accompany the map, and no definite field relations have been found, the schists are left as undifferentiated in this report.

Pleistocene and Recent

Glacial and post-glacial deposits are common in the area. Well-sorted gravels and sands are found at numerous localities, and in the settled section in Loughrin township are put to various uses, especially for the maintenance of roads. Unsorted material is also abundant and is found in drift areas without any conspicuous topographic expression. The most extensive drift area is north of the railway in the southern part of Scadding township and in the northern part of Street township. Owing to the heavy forest cover, however, little is known of the distribution of the underlying unconsolidated material, or of its thickness. Gravel and sand are commonly seen and in places may be as much as 100 feet thick.

Since the Wanapitei river is now a storage basin for much of its course through the area, and since most of the smaller streams lie in swampy country, no additional information is at hand concerning the distribution, kinds, and thicknesses of Pleistocene and Recent deposits.

STRUCTURAL GEOLOGY

The structural history of the Ashigami Lake area is also the history of the deformed belt extending west to Lake Superior. The pattern of folds and faults found here, however, is not easily interpreted, and the following paragraphs are for the most part descriptive. There is essential agreement with the structures indicated on Collins' unpublished manuscript map of the adjoining area to the west.

Faulting

The area is best divided into four structural units, one northwest of the main fault drawn on the map, the other three to the southeast. These latter units

[1]W. H. Collins, "Lake Huron Sheet," Geol. Surv. Can., Map 155A, 1933.

consist of the area north of the Crerar gabbro mass, the area to the southwest, and the area of gneisses. There is some evidence of an indirect nature to indicate that these three units are themselves separated by faults, but it has been thought inadvisable to indicate the contacts as such on the map.

The fault cutting through the northwest corner of Street township and the southeastern part of Scadding is the continuation of a fault shown by Collins to the southwest. Details are lacking, as his report on this area was never written, and the nature of the fault movements is unknown. On stratigraphic grounds particularly it was found necessary to extend it through the Ashigami Lake area. The evidence is seen on the map in the eastern part of Scadding township where the Mississagi and Bruce formations (lower part of the Bruce series) strike into the Bruce conglomerate, Espanola formation, and Serpent quartzite to the west. The intervening Cobalt rocks obviously do not constitute evidence for or against a fault as they are separated from the Bruce by an unconformity. The stratigraphic evidence is further supplemented by brecciation noted in several localities along the western arm of Ashigami lake and also to the southwest. This breccia cuts rocks on the shore of the lake which are probably Mississagi, although they are now highly silicified and shattered; it has also been noted in the neighbouring Gowganda conglomerate and in a hill of gabbro to the southwest. No detailed study of the brecciated rocks was made, owing to the extensive drift through which it is believed the fault passes. The breccia is similar in character, however, to that occurring east and west of Sudbury, and is probably its eastward continuation. Nothing is known concerning the nature of the faulting movements.

As already pointed out, the gneiss contact with the sediments is everywhere concealed, and in the vicinity of Crerar is marked by a band of schist. It is entirely possible that, although the gneisses represent metamorphosed Huronian sediments in large part, faulting has occurred at a later time. This might account for the depression which usually accompanies the concealed contact and also for the fact that no transitions from sediment to gneiss have been observed across the strike. A narrow band of coarse sericite schist has been noted in two places along the contact between the gneiss and undifferentiated schist bands which may represent a recrystallized fault contact. As there is no direct evidence, however, a fault contact is not shown on the map.

The gabbro mass west of Crerar separates two areas of Mississagi quartzite which appear to be stratigraphically discordant, that on the north striking approximately east-west and that on the south striking about north-south. It is possible that the gabbro has been intruded along a structural break and is the locus of a fault which to the east follows the gneiss contact and to the west is cut off by the main fault drawn on the map.

Shearing

Evidence of shearing is abundant throughout most of the area and affects all of the rocks with the exception of olivine diabase.

Shearing in the sediments is conspicuous on Ashigami lake, particularly within the zone mapped as Bruce conglomerate. Much of the difficulty in mapping the contact between Bruce and Cobalt rocks arose because of the intense shearing of the conglomerate members of the two series, which reduced them to conglomeratic schists of almost identical appearance. On the portage between Ashigami and Kukagami lakes, at the Mac-Auer property, there is well-developed shearing in the Gowganda greywacke. The gabbro along the railway between Crerar and Ess Creek shows intense shearing in places. As might be expected,

the prospects in the area are located for the most part on shear zones near, or in, gabbro. The shearing in both sediments and gabbro commonly follows pre-existing structures, such as bedding or the strike of a contact. Exceptions to this may be seen on Ashigami lake where the Bruce conglomerate is in places sheared in a north-south direction. Another instance is in the Espanola limestone on the Wanapitei river about 2 miles south of the lake, where a cleavage is developed which intersects the beds at almost right angles. Unfortunately, study of the shearing in the area has not solved any structural problems.

Folding

In common with the faulting and shearing, deformation has produced folds of varying complexity and extent. Only fragmentary evidence of them has been obtained, but their character can be judged from the prevalent steep dips (between 60 and 90 degrees for the most part) found throughout the area. A glance at the variation of the strikes in the gneisses shows something of the deformation produced in them by folding. No structural details, however, have been worked out. The significance of the constant southeast dip, which holds for many miles east and west of the Ashigami Lake area, is unknown.

As there are no horizons in the Gowganda formation that are continuous enough to be mapped, strikes and dips yield little information. The east-west strike north of Ess Creek station swings to the north near Ashigami lake. Dips are conflicting, however, and fold axes have not been located. West of the lake shearing and gabbro intrusion further confuse the pattern of folding.

The Bruce succession crossing Ashigami lake forms the south limb of a syncline whose north limb is concealed by the Gowganda. On the south and east the fold is cut off by gabbro; on the west by a fault. In Street township the Bruce formations along the Wanapitei river do not furnish any information about folding. To the west of the fault a synclinal axis approximately parallels the railway, and an anticlinal axis lies immediately to the south in the Bruce conglomerate, the two axes plunging northwest. The limestone bands in the conglomerate northeast of the railway in Scadding are regarded as infolded remnants associated with a series of folds in the conglomerate which have not been delimited. The Serpent quartzite band centring on Spar and Bugg lakes may be considered as the locus of a synclinal axis, the northern part of the fold being concealed by the Gowganda.

GEOLOGICAL HISTORY

The preceding description of the general geology and structure may be summarized as follows:—

The first event of which evidence is found was the subaerial formation of several hundred feet of bouldery soil of arkose and greywacke in the pre-Huronian peneplain[1] (Ramsay Lake). Submergence followed, and several thousand feet of feldspar-quartz sands were laid down on this residual soil (Mississagi). Deposition of a few hundred feet of gravel followed (Bruce), after which calcareous mud and silt (Espanola) were laid down. This cycle of sedimentation was then terminated with the deposition of several thousand feet of feldspar-quartz sand (Serpent). Consolidation of these sediments then took place. There was moderate folding, followed by uplift. The subsequent erosion was sufficient to remove in places all of the younger sediments and to expose the Mississagi quartzite. This terrain of Bruce sediments was later covered by several thousand

[1]W. H. Collins, op. cit., pp. 39-41.

feet of mixed greywacke, boulder conglomerate, and quartzite (Gowganda), probably of glacial origin. Of later pre-Cambrian sedimentation there is no record, but since the Gowganda glacial deposits were consolidated and deformed in pre-Cambrian time it is probable that submergence occurred, followed by deposition of later sediments, which have since been removed.

Consolidation of the Cobalt sediments was followed by folding of them, and by further folding of the Bruce series. This was accompanied by the intrusion of gabbro dikes and sills, which followed the trend of the structure created by folding. Still later came major granite intrusions, expressed in the Ashigami Lake area only by dikes of granite and pegmatite. The metamorphism was sufficiently intense to convert a large area of the folded Huronian sediments to biotite gneisses and hornblende gneisses. The next event consisted of faulting and brecciation on a regional scale, which greatly complicated the structures. After all deformation had ceased, small olivine diabase dikes were intruded along tension fractures trending slightly north of west. These dikes are unaltered.

At a later time, probably still in the pre-Cambrian, there was further erosion to give the present surface distribution of the formations. There is no record of Paleozoic sedimentation. During the last phase of the geological history, the Pleistocene glacial period, most of the accumulated unconsolidated material was removed, or shifted in position, and the drainage systems were altered. The melting of the ice resulted in the deposition of great quantities of gravel and sand, which now conceal the rock floor in many places.

ECONOMIC GEOLOGY

The only metal of possible importance in the Ashigami Lake area is gold. Quirke[1] has already considered the economic aspects of the region and only a brief recapitulation is necessary here. Native gold was discovered many years ago, sometimes in spectacular amounts, and prospecting has been carried on almost continuously to the present time. None of the properties has passed the development stage, as gold values have been found to be erratic and the structures not very persistent. It is remarkable that silver is of negligible value in these occurrences, in contrast with its abundance in apparently the same gabbro (Nipissing diabase) a few miles to the northeast in the Cobalt area.

The gold is commonly associated with quartz veins lying in shear zones in the gabbro. The veins are usually small and irregular. Sulphide mineralization, mostly pyrite and chalcopyrite, is weak, and there is a variable amount of iron-rich magnesium carbonate (breunnerite) in the veins. White, soda-rich feldspar dikes are also found but have not been shown to be genetically connected with the gold. Like the quartz veins, they are usually small and discontinuous.

Other deposits of possible economic importance include feldspar, garnet, gravel, and sand. A small feldspar deposit half a mile south of Crerar has already been successfully developed, and there are possibly others to be found within the area of gneisses. Garnet is very common everywhere in the gneisses, and seams of fairly high concentration have been noted. In one occurrence, three-quarters of a mile south of Ess Creek station, imperfect crystals 1 to 2 inches in diameter have grown together in an almost solid mass. If grade, volume, and marketing conditions permitted, such seams might be profitably developed.

Gravel and sand are used as road metal in the settled part of the area in Loughrin township. The material has local importance only and, as it is almost everywhere abundant, its geological relations need no further description.

[1]T. T. Quirke, op. cit., pp. 49, 50.

Description of Properties

A few gold prospects which have been worked in recent years warrant a brief description. They are as follows:—

Tecumseh Gold Mines, Limited

The property of Tecumseh Gold Mines, Limited, is in the northeastern corner of the area, south of Kukagami lake. Quartz veins with a maximum width of 20 inches have been traced in shear zones in gabbro for as much as 1,200 feet. Many of these contain erratic amounts of visible gold. Gold also occurs in sheared gabbro independently of quartz. Pyrite, chalcopyrite, and bornite are commonly present, and breunnerite veins cut the quartz in many places. Drilling has shown that the values are erratic, although in places the veins are high-grade.

Mac-Auer Gold Mines, Limited

The claims held by Mac-Auer Gold Mines, Limited, are between Ashigami and Kukagami lakes. A small shaft has been sunk along a shear zone in the Gowganda conglomerate and greywacke. Surface pits have a maximum width of 6 feet and show a few quartz stringers and lean mineralization of pyrite and chalcopyrite. The carbonate breunnerite is common. High values in gold are reported but are probably erratic. No gabbro occurs on the property. The last work was done in 1935.

Mount Aetna Gold Mines, Limited

The property of Mount Aetna Gold Mines, Limited, is situated north of Ess Creek station, on the road to Kukagami lake. A shaft has been sunk on a shear zone in Gowganda conglomerate about a quarter of a mile from a large gabbro sill. At the surface the ground is brecciated. At a depth of 87 feet the zone is highly silicified and is several feet wide. Pyrite, chalcopyrite, bornite, and pink calcite are abundant. No visible gold is reported.

Alkin Gold Mines, Limited

The claims held by Alkin Gold Mines, Limited, lie east of the Wanapitei river and are reached by road from the railway, 3 miles to the south. After several years of inactivity, work has been resumed on this property. A series of irregular veins and pockets of quartz has been uncovered for 300 feet parallel to the strike of a sheared gabbro mass. This zone is about 50 feet wide. There is some pyrite mineralization, and a considerable amount of visible gold has been reported. Altered sodic dikes are associated with the quartz veins but do not seem to be related to them. The structure does not appear to be very persistent.

Ess Creek Mining Syndicate, Limited

The claims held by Ess Creek Mining Syndicate, Limited, are in the immediate neighbourhood of Crerar. Insufficient work has been done to indicate the nature of the structure. No gold values have been reported.

Future of the Area

Gold occurrences in almost all cases are closely associated with gabbro, and are located in quartz-filled shear zones. All development work to date has indicated erratic distribution of gold values, and none of the properties has passed

the initial stages of development. In the light of past experience with this gabbro-gold association, here and in other localities, a large initial outlay is hardly warranted. On the other hand, further examination of the gabbro contacts, now mapped for the first time, could be made without great expense, in order to thoroughly exhaust the possibilities.

In the area of gneisses, garnet and feldspar prospects might be located. There is a market for material of suitable grade, and the cost of transportation is not a determining factor in this area. One feldspar deposit at Crerar has already been utilized, and others might be found.

Notes on Several Properties in the District of Sudbury

By T. C. Phemister

Introduction

During the field season of 1937 the writer, assisted by W. S. Savage, made a geological examination of a number of properties in the district of Sudbury. The writer wishes to acknowledge his indebtedness to the various companies and their officers for information provided and facilities afforded in the course of the field work.

Bousquet Gold Mines, Limited

The property of Bousquet Gold Mines, Limited, is located in township 11, district of Sudbury, 7 miles east of West River on the Algoma Eastern railway. It is about 11 miles southeast of Espanola and is reached by motor road to Green's Camps or Willisville and thence by boat along Charlton lake and Howry creek.

Examination of the property was handicapped by the fact that the mine was closed down. It was not possible, therefore, to examine the workings, and information regarding the occurrence of the ore at depth was obtained entirely from mine plans and through conversation with J. E. Jerome, the manager.

The surface and much of the underground geology is described in a report by H. C. Rickaby,[1] who visited the mine in the summer of 1934. The veins occur associated with the elongated intrusion of diabase, presumably a sill, which runs roughly east-west through the Cobalt series about a mile and a half south of Long lake, and they appear to be restricted to the small area where there is a sharp offset on the southern boundary of the outcrop of the igneous rock. This relation is shown clearly in the accompanying map of the surface in the vicinity of the mine. There is considerable doubt regarding the structural significance of this feature, whether it is only a primary irregularity of the outcrop or whether it has been brought about by faulting. The outcrops of diabase and quartzite are not sufficiently continuous to afford positive evidence on this matter, and it is not clear whether the sharp break of the southern boundary appears also on the northern side. The diabase exposed at this point does not show the evidence of cross-shearing that might be expected in the vicinity of a cross-fault.

The vein occurrences fall into two classes: (1) those formed along the contact of the diabase and the quartzite and (2) those formed within the igneous rock itself. Only the first of these has proved to be of commercial value, and to it belongs the main vein of the property, which is located on the southern contact immediately to the east of the break in the diabase outcrop.

The mineralogy of the veins is relatively simple. All are quartz veins, and the metallic minerals occurring in variable amounts are arsenopyrite, pyrite, chalcopyrite and, in some cases, visible gold. Siderite, ankerite, and calcite are abundant in some sections of the veins, and chloritized diabase appears as relic fragments in the vein in the igneous rock.

The Main Vein

The main vein has been explored by three levels at 150, 300, and 450 feet, and the general nature of its occurrence on the 150- and the 450-foot levels is

[1] H. C. Rickaby, "Notes on Mongowin Township and Vicinity," Vol. XLIV, pt. 7, p. 60.

shown in the accompanying plan. It follows the contact of the sill and the quartzite and is always on the east side of the nose of diabase, which pitches eastwards, being thus intersected by the shaft not far below the 150-foot level. The ore shoot has a width of 16 to 30 inches, and its length ranges from 384 feet at the surface to 344 feet on the 300-foot level, its westerly limit in all cases being but a few feet from the diabase nose. The dip is steep but changes from south to north twice in the vertical extent of the vein, though there does not appear to be any constant relation between this feature and the value of the ore.

Generally speaking, the arsenopyrite and siderite tend to occur most abundantly in the eastern parts of the upper levels and in the lower workings, the vein consisting elsewhere either of quartz alone or quartz with pyrite. It is this latter facies of the mineralization that is the richer, and the most valuable ore was taken out in a series of sublevels below the 300-foot level. Here the values are said to have ranged from 0.34 to 0.55 ounces of gold per ton over widths of 34.3 and 34.5 inches, respectively. According to the management, sampling of a 110-foot vein section on the 300-foot level yielded an average of $40.20[1] across an average width of 28 inches.

At 450 feet, the vein became too small both in width and in value to be mined at a profit and, as drilling did not disclose any valuable prolongation of the vein, the mine was closed. An interesting feature of the undertaking was the accidental circumstance, which became evident as mining progressed, that the levels and the shaft itself had been cut through the richest parts of the vein.

The Diabase Veins

Though the main contact vein itself does not continue at the surface into the diabase west of the nose, on the 150-foot level it is represented in this rock by a thin irregular quartz vein in sheared material. This occurrence was not further explored on the 300-foot level, but on the 450-foot level it was picked up again as a much wider vein, about 4 inches across, with somewhat indefinite walls and consisting of almost pure quartz, bluish-black in colour and containing visible gold in its fractures. Assays are said to have indicated a grade of about 0.09 ounces per ton across its width. Exploration at greater depths by drilling showed that, though the vein continued downwards, its values were too low for mining.

The other diabase vein is exposed at the surface, and its position is shown on the surface plan. Its occurrence is clearly controlled by a sheared zone in the diabase, along which replacement by quartz has taken place to give an irregularly defined quartz vein with a maximum width of 7 inches. As assays showed values ranging from nil to 70 cents per ton it has not been further explored.

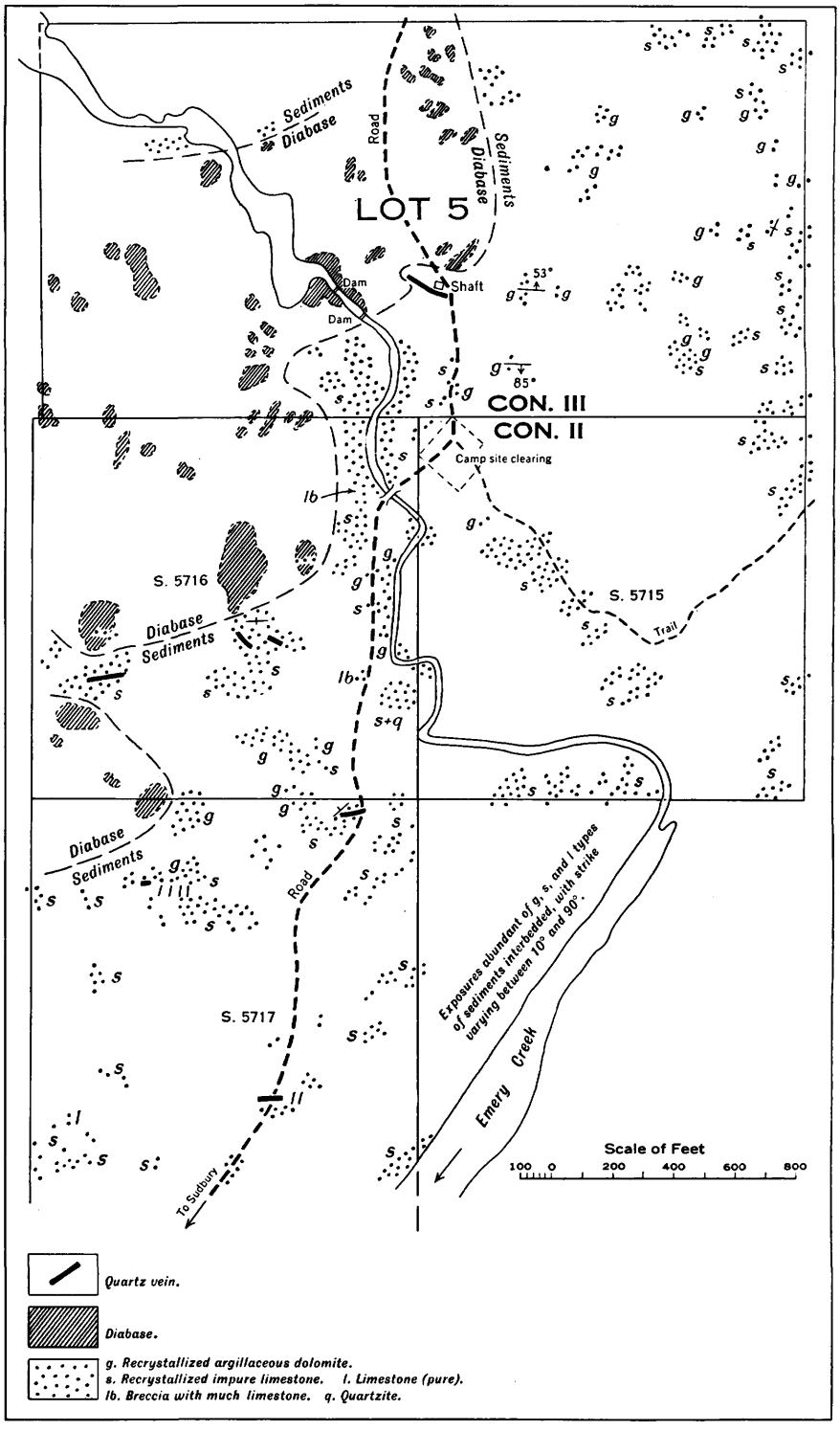
Production

A 50-ton mill was erected and operated from May, 1936, to July, 1937. During this period the total recovery was $163,589 from 17,129 tons of ore, or an average of $9.55 per ton.

Falcon Gold Mines, Limited

The property of Falcon Gold Mines, Limited, consisting of 5 patented claims, is situated in lot 5, concessions II and III of Falconbridge township. It lies adjacent to the old Wanapitei road, by which it can be reached from Sudbury, a distance of 30 miles. When the property was visited in 1937 underground development had been discontinued and the deposit was being explored by

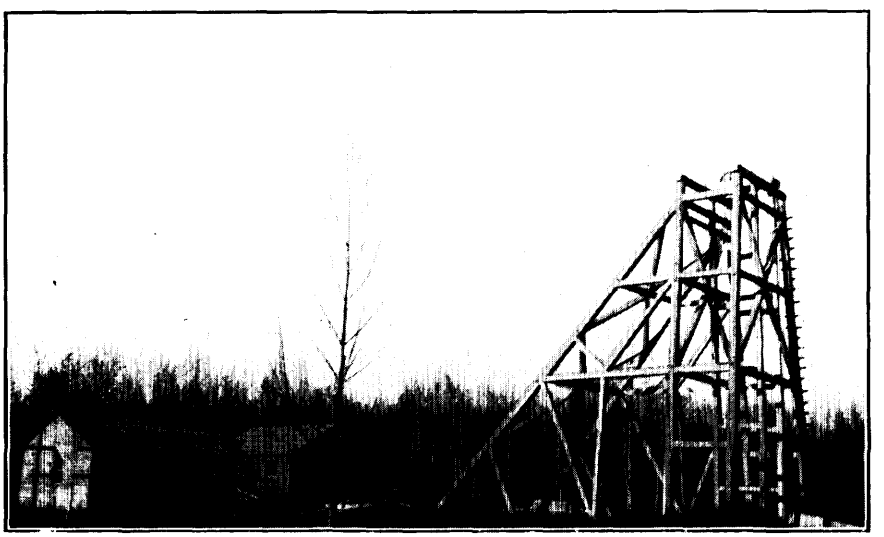
[1]Gold at $35.00 per ounce.



Geological sketch map of the property of Falcon Gold Mines, Limited, Falconbridge township (modified from map by J. E. Jerome).

diamond-drilling. The present report is based partly on the existing mine and drilling records and partly on examination of the surficial geology.

The geological setting of the ore body is a series of impure calcareous sediments containing small irregular beds of limestone and cut on the west side by diabase or gabbro, which is the most easterly prolongation of the intrusion which stretches southwestwards to Ramsay lake and which may be continuous with the Kelley lake gabbro. The accompanying sketch map shows these relations in detail. The sediments in the vicinity of the mine, may, for convenience of description, be grouped into 3 categories: (1) a banded marl with siliceous intercalations, now dynamically metamorphosed into a talc-actinolite-calcite schist in which the siliceous material, now quartzitic, appears as elongated nodules or fragments; (2) calcareous shale changed by recrystallization to "greenstone" consisting of



Surface plant, 1937, Falcon Gold Mines, Limited.

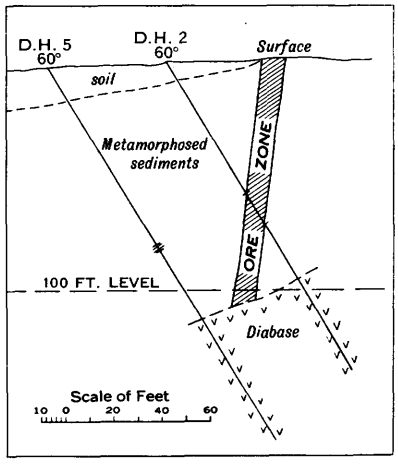
abundant actinolite and other amphiboles with some mica in a matrix probably consisting of calcite and zoisite; in appearance it closely resembles the diabase of the area from which, however, it may be distinguished by (a) its softness, (b) the fibrous character of its amphibole, (c) its more weathered surface, frequently pitted and thus contrasting with that of the diabase, which is usually smooth, (d) the presence of small calcite veins scattered through it; (3) limestone bands frequently showing intricate folding and weathering a deep brownish colour. All of these rock types may occur closely associated with one another and clearly interbanded, but they also form larger units in which their original sedimentary character is not so evident. As is usual in the dynamic metamorphism of such a rock series, the more readily recrystallizing layers, such as the impure calcareous rocks and the limestone, are readily deformed and flow around the more resistant masses, with a tendency always to develop elongated lenslike structures.

These sediments probably belong to the Bruce series and represent the Espanola formation of calcareous silts and magnesian limestone.

The ore body occurs in the rock (1) described above and is, at the surface, 60 to 70 feet from the contact with the diabase where it swings sharply westwards, as shown in the accompanying detailed map of the surface near the mine. Its underground extension has been explored by means of a shaft sunk in the

footwall to a depth of 46 feet and by a crosscut run 59 feet to the southwest cutting the ore body. Additional information is available from 18 drill-holes. From these various lines of evidence it is believed that the ore zone dips at a high angle to the south and is thus cut off by the diabase contact, which dips at a lower angle in the same direction, as shown in the accompanying drill-hole sections, which indicate also that the diabase-sediment contact becomes much flatter on the eastern side.

The ore zone itself is about 20 feet across at the surface, becoming somewhat narrower at depth, and its length is 165 feet on the outcrop. In the talc-actinolite rock, of which this zone is composed, shearing has developed a somewhat greater amount of the amphibole than usual. It is much intersected by small, discontinuous quartz and calcite veins, which run generally parallel to the schistosity, and associated with these occurs pyrite mineralization, which



Vertical section through drill-holes Nos. 2 and 5, Falcon mine.

forms the ore. The pyrite appears as cubes, and less commonly as pyritohedra, about a quarter of an inch across but sometimes attaining a diameter of 1 inch. The highest gold values appear to be associated with this coarse pyrite.

The ore body itself has an average width within this zone of 6.2 feet, is 150 feet long, and certainly extends to a depth of 200 feet. The average grade is reported to be $11.30 per ton.[1] Other quartz veins, some carrying pyrite, occur in the sediments, but so far none carrying good gold values has been discovered.

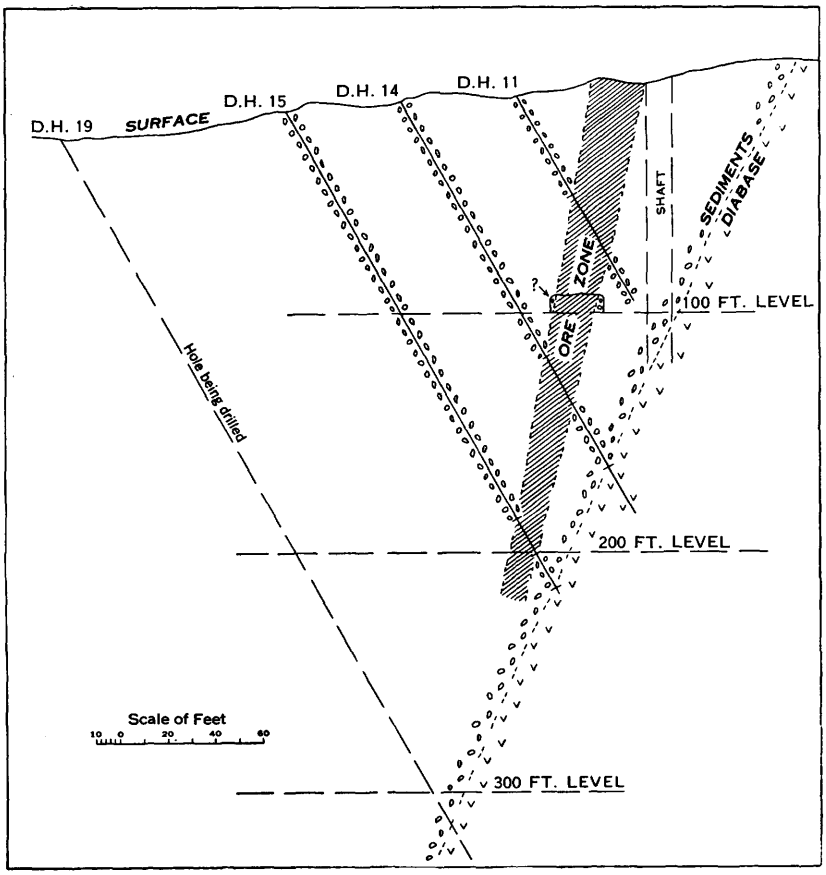
Harwood Lake Mines, Limited

The property of Harwood Lake Mines, Limited, is situated in the vicinity of Leech and Harwood lakes in township 90, south of Lake Panache. It is reached most conveniently by way of Long lake, to which there is a side road from the Espanola–Little Current highway. When the property was visited in 1937 no work was being done on any of the claims. The manager, J. G. Farquharson, kindly put all of his information at the disposal of the writer, and the following report is based mainly on the data obtained from him.

[1] Gold at $35.00 per ounce.

The deposits occur wholly in the Gowganda formation, which here consists of a somewhat argillaceous quartzite containing pebbles and in the southern part of the property of conglomerate bands. Immediately north of Leech lake, in the vicinity of the camp site, diabase occurs, but the exact shape of the intrusion is not clear from the present exposures.

There are four principal deposits: (1) a highly mineralized zone in quartzite close to the contact with the diabase just south of the camp site north of Leech

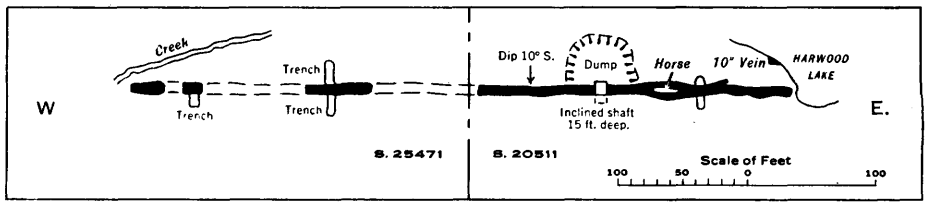


Vertical section through drill-holes Nos. 11, 14, 15, and 19, Falcon mine.

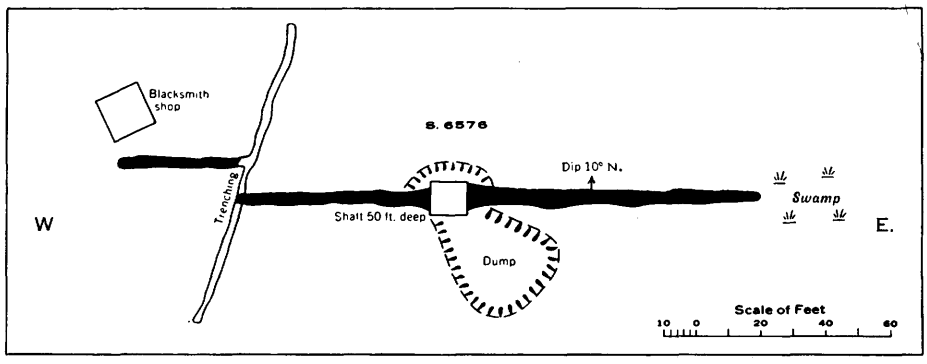
lake; (2) the so-called "sulphide dike" lying between the eastern part of Leech lake and the western part of Harwood lake; (3) the "white quartz vein" immediately west of Harwood lake; (4) the "blue quartz vein" half way between Leech lake and Murray lake. The positions of these are shown in the accompanying sketch map, on which are shown also the diamond-drill holes.

1. No distinct vein occurs in the mineralized zone in quartzite, but over a width of 2 feet the quartzite is highly charged with pyrite. This mineralized zone has been explored by a shaft and two small pits to the east, which show it to be contained wholly in the quartzite though close to the diabase contact. It is on this body that the most recent drilling has been done, holes 6 and 6A being run towards it.

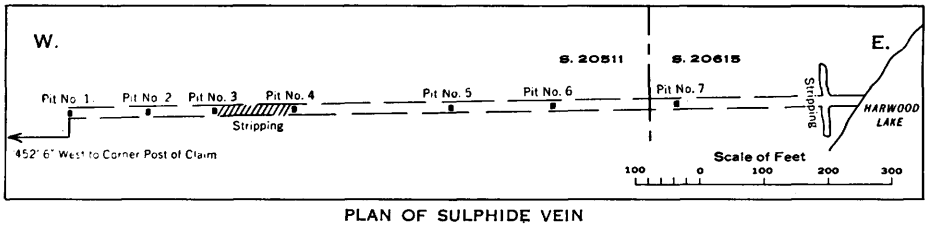
2. The "sulphide dike" consists of a few narrow quartz-pyrite veins not exceeding 3 inches in width, usually running along the strike of the quartzite-conglomerate country rock, but occasionally forming short transverse stringers. Pyrite is the main sulphide, but a little arsenopyrite is also present. This vein zone has been uncovered for 1,200 feet, but towards the east and west ends the mineralization decreases. Pit No. 2, where $31.15 over a width of 27 inches, was said to have been obtained, had unfortunately slumped before the property was visited.



PLAN OF WHITE QUARTZ VEIN



PLAN OF BLUE QUARTZ VEIN



PLAN OF SULPHIDE VEIN

Surface plans of the principal showings, Harwood Lake Mines, Limited
(by J. G. Farquharson, October, 1935).

3. The "white quartz vein" is a massive quartz vein, dipping steeply to the south, 6 feet across at its widest part but narrowing at both ends to about 2 feet. The immediately adjacent greywacke material is sheared and iron-stained, but the vein itself shows very little obvious trace of mineralization, though a small amount of pyrite was detected here and there. The accompanying plan indicates the extent of the work done.

4. The most southerly occurrence on the property is the "blue quartz vein." It is from 2 to 3 feet wide and has been exposed over a length of about 180 feet. It is practically vertical and at its western end is offset 15 feet to the

north. A shaft has been put down to 50 feet but could not be examined at the time of the visit. Mineralogically the vein is peculiar in the abundance of siderite that it contains. This siderite was apparently formed before the quartz, for the latter conforms to the boundaries of the carbonate rhombohedra. Sulphides are rare.

A total of 4,000 feet of diamond-drilling has been carried out on the property, 12 holes having been put down, of which 7 were on the "sulphide dike," 2 on the mineralized zone near the camp site, and 1 on the white quartz vein. Their positions are shown on the accompanying sketch map.

The following data with respect to the drilling have been supplied by the management:—

Hole No.	Direction	Angle	Length	Core sample	Assay value
			feet	feet	
1	South	56	148	.....	.....
2	South	68	434	280-284	$162.75
3	South	67	555	127½-128	9.45
4	South	65	421	.....	.....
5	South	60	442	.....	.....
6	South	68	507	.....	.....
6A	South	66	479	.....	.....
7	South	50	32	.....	.....
7A	South	48	304	146	2.80
8	South	45	340	247-249	5.25
9	Vertical	.....	122	105-110	1.05
10	North	68	222	.....	.....

Lake Geneva Mining Company, Limited

A lead-zinc deposit owned by the Lake Geneva Mining Company, Limited, is situated in concession VI, lot 8, Hess township, and at present is reached from Geneva station, 3 miles by boat to the east end of the lake and 1⅛ miles by road from there to the mine itself. A road was being built to the mine from Benny station at the time the property was examined.

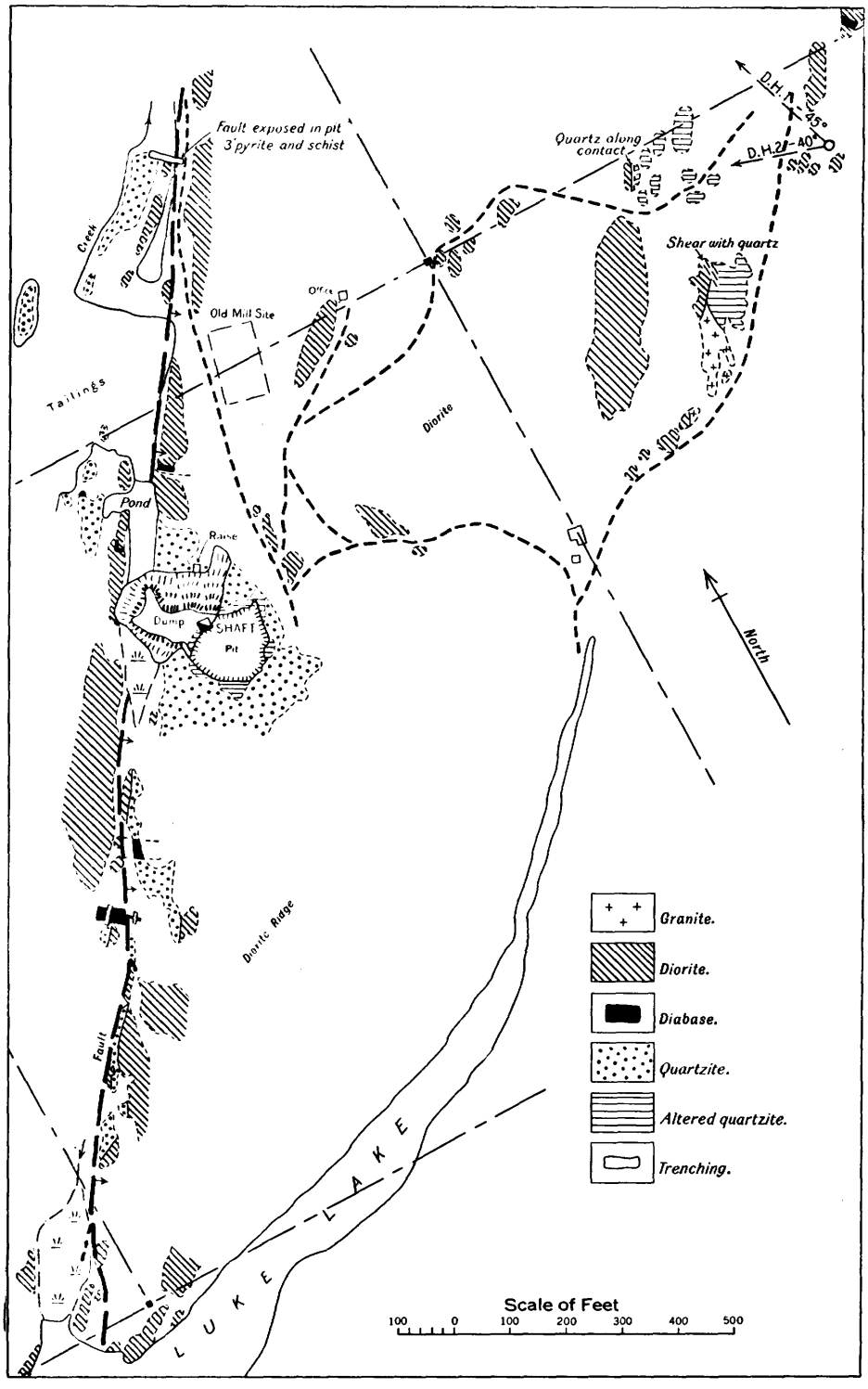
Owing to destruction of the power-house by fire the underground workings were flooded and inaccessible. Information concerning the property was supplied by C. Tolmann, consulting geologist.

The original work was in a series of trenches northwest of the present shaft, and this is the only exposure of ore at the surface. The main exploration consists of 20 diamond-drill holes, which roughly define the shape of the ore body. A shaft has been sunk to 400 feet and a drift run along the ore zone at the 235-foot level. This drift has opened up the vein for 400 feet, and three raises have been cut. The station for the second level has been put in at 375 feet.

The rocks in which the ore occurs have been classified by Quirke[1] as Serpent formation, by Osborne[2] as Keewatin, though, as both point out, they differ from the typical rocks of these stratigraphical groups. Without making a detailed map of the area and determining the ages of all the granites present and the nature of the metamorphism connected with them it is not possible to decide between these alternatives or to explore others. The rocks themselves are greywackes, quartzites, and hornblende and mica schists, and all have been injected by granite, partly in

[1]T. T. Quirke, "Geneva Map-Area, Sudbury District, Ontario," Geol. Surv. Can., Sum. Rept. 1920, pt. D, pp. 10, 11.

[2]F. F Osborne, "The Cartier-Stralak Area, District of Sudbury," Ont. Dept. Mines, Vol. XXXVIII, 1929, pt. 7, p. 62.



Geological sketch map showing outcrops along the fault zone and around the drill-hole, Long Lake mine (by A. B. Yates).

the form of *lit par lit* stringers and partly as crosscutting veins. There is also present an older diabase, which is cut by the granite and is now recrystallized. The general strike of these rocks is northwest.

An interesting feature of the geology of the area is the presence north of the ore occurrence of a crush breccia similar to that of the Sudbury area. The rocks of the breccia are all represented in the adjacent formations, and the fragments range from a few inches up to 20 feet in diameter. The matrix does not show the pronounced flow structures of the Sudbury rock but has a dense almost hornstone base enclosing fragments. So far as can be determined this crush breccia has no connection with the ore.

The ore occurrence runs parallel to the strike of these country rocks and dips from 40° to 60° S. W. The vein represents both fissure-filling and replacement and contains within it relic slabs of the original rock. Within its workable length the vein ranges in width from a fraction of an inch to 7 feet, the average being about 4 feet 6 inches. On the northwest side this vein has been drifted on only up to a diabase dike, into which it appears to finger but does not maintain its values. On the west side of the dike, drilling has shown the vein to persist, and hole No. 6 is said to have intersected 6 inches of material running 12 per cent. zinc

As the vein pinches and the grade becomes too low for mining southeast of the shaft, the future possibilities seem to be to the west and at deeper levels. The possibility of other parallel veins has not yet been fully explored.

The principal mineral of the ore is sphalerite, which occurs in a very dense, fine-grained form. With it are associated galena and pyrite, but the latter is usually not distinguishable in the hand specimen. Minor amounts of arsenopyrite are also present.

A general idea of the grade of the ore is given by these average figures furnished by the company:—

	Gold, value per ton	Silver, ounces per ton	Lead	Zinc	Width
			per cent.	per cent.	feet
Between 1st raise and shaft.....	$0.44	2.52	3.82	8.99	4.6
Between 2nd raise and 1st raise.....	.49	3.00	6.79	16.26	4.2
Between 3rd raise and 2nd raise....	.46	3.36	5.77	13.66	.....

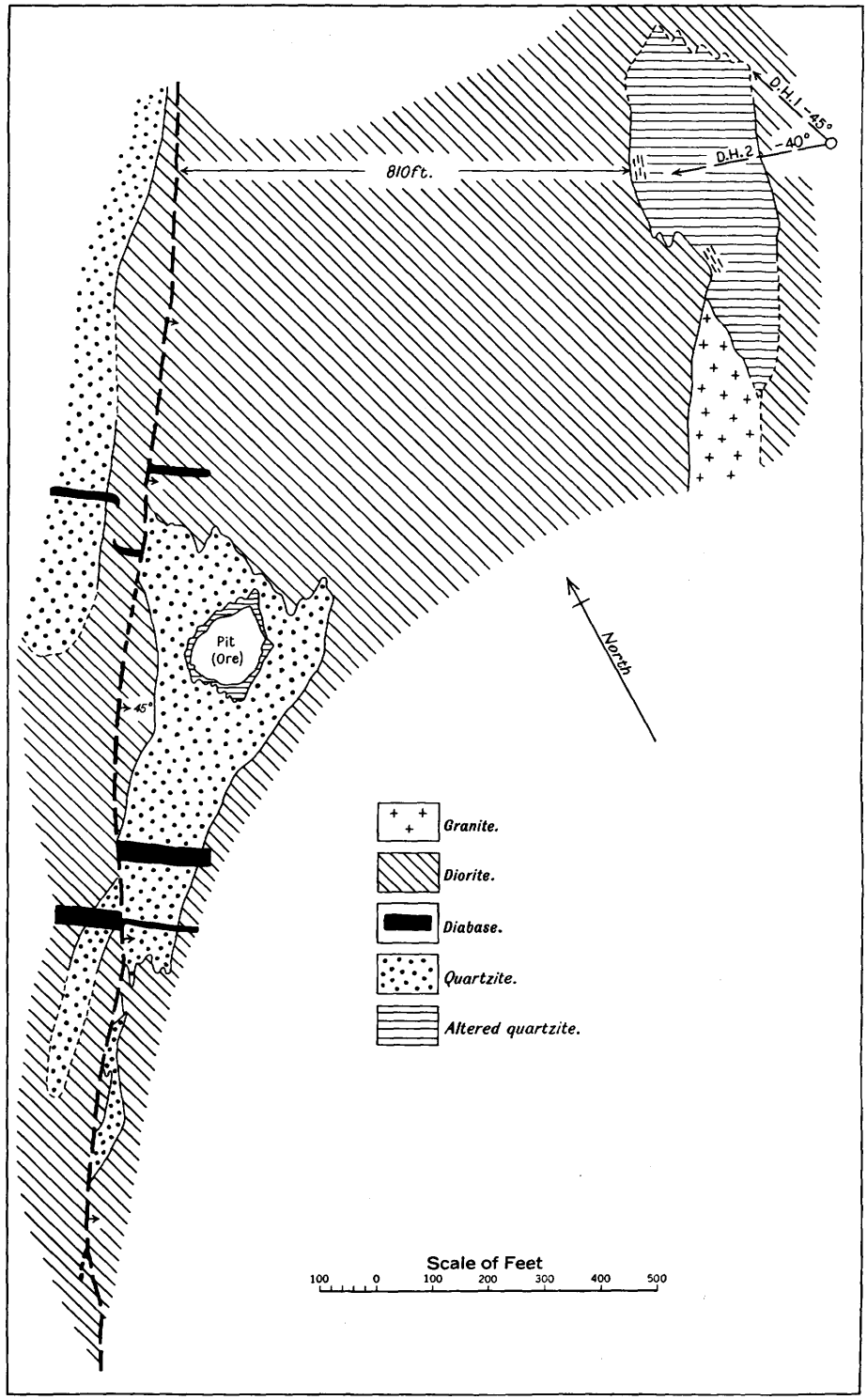
Just before the power-house fire, the mill was treating 80 tons of ore per day containing about 9 per cent. zinc and 3 per cent. lead.

Lebel Oro Mines, Limited

Long Lake mine, which is owned by Lebel Oro Mines, Limited, is located in township 69 south of the western end of Long lake and just north of Luke lake. It is reached by a motor road leaving the main highway at Naughton and is about 30 miles from Sudbury. The geology of the area has been described by Baker.[1]

The rocks in which the deposit occurs belong to a division of the Mississagi quartzite, which here is cut by a large body of intermediate to basic rock which has been called diorite. This intrusive appears to be of the same general character as the older gabbros and diabases of the region and shows considerable variation

[1]M. B. Baker, "Long Lake Gold Mine, Sudbury District," Ont. Bur. Mines, Vol. XXVI, 1917, pp. 157-162.



Generalized geological map of the Long Lake mine (by A. B. Yates).

in both mineralogy and texture. The mineralization is controlled by the presence of a fault, which runs about N. 40° E., and its relation to the rocks is shown in the accompanying map by Yates. This map makes it clear that the ore occurs in a large mass of quartzite, which appears to be an inclusion in the diorite but which is bounded on the west by the fault plane. The fault has been exposed in the mine workings and its dip varies, so that it presents a definitely curved surface. Thus, near the surface it dips at 45 degrees; lower down it steepens to 55 degrees; still lower it is 60 degrees; and then it flattens again, and at a depth of 330 feet the dip is 45 degrees.

The ore is in the form of an impregnation in the quartzite, which otherwise shows very little sign of mineralization. No vein is present, though at the fault plane, in the hanging wall, mineralized cracks appear carrying pyrite. This type of material is high grade. The main ore shoot is roughly elliptical in cross-section with its major axis parallel to the fault plane. In the lower workings the fault plane forms the footwall of the ore body. From the point of view of future development it is important to determine whether the fault was formed before or after the mineralization. Baker considered that the ore was faulted mainly on the evidence of dragged ore in the fault plane. Subsequent and more extensive exposure of the fault plane and its gouge suggest that the broken and cracked rock passing into gouge has been mineralized after the disturbance. As Yates' map shows, later olivine diabase dikes have been displaced by the faulting, and an attempt has been made by measuring their dip and horizontal displacement to calculate the throw and heave of the fault. On this basis an inclined bore-hole was put down to the east of the fault to pick up the ore in what would be its faulted position. This hole was in diorite all the way, which would suggest that the ore is a post-faulting phenomenon. Two points, however, must be remembered in interpreting this result: (1) To make the calculation it is necessary to know accurately the dip of the dikes; and (2) if the original mineralization was restricted to the quartzite, there must always be a doubt as to the age of the mineralization until the other part of the quartzite "inclusion" is located.

The ore is at present worked from an open pit, which is an extension of that shown in the accompanying sketch map. It is hoisted from a shaft situated just southwest of the pit, and from the shaft four levels have been established at 80, 180, 255, and 330 feet.

Since so little mineralization accompanies the ore, assaying is the only means of defining the ore body. Assays show that the quartzite close to the surface carries only a few cents of gold to the ton.

From the commencement of milling operations in June, 1937, to the end of the year, 23,687 tons of ore were milled, yielding $150,422, or an average of $6.35 per ton.

Owen Nickel Property

The Owen nickel property of Falconbridge Nickel Mines, Limited, is situated in the northern part of Mongowin township and is about 7½ miles by road from Espanola, from which it is readily accessible by car. The work carried out so far consists of the excavation of several small pits and a short drill-hole put down in the northeastern corner of the property. In addition, a very detailed and thorough magnetometer survey has been carried out and the rock outcrops defined. A copy of this survey accompanies the present report.

The rocks of the area are greywackes and quartzites of the Gowganda formation, the general strike of which is east and west. Apparently later than these rocks, though the relations are by no means clear, is a small body of

medium-grained granite, which is poorly exposed in the southern part of the property. The rock immediately associated with the mineralization forms a roughly ellipsoidal area, which suggests a lens-shaped intrusion in the sediments; to the east it forms small dikelike offshoots. There is practically no data regarding the shape of the mass at depth, but the evidence of the bore-hole on the north side suggests that the contact may be dipping outwards into the sediments. The rock itself is ultrabasic, a diallage peridotite or lherzolite showing the typical poikilitic relations of the pyroxene and olivine. Much of it is altered to serpentine, especially along lines of minor shearing, and carbonate-filled cracks are common.

The mineralization consists of pyrrhotite and chalcopyrite disseminated through parts of the peridotite as irregular stringers and short veinlets and, so far as the present meagre data show, is confined to the margin of the igneous rock. The pyrrhotite and chalcopyrite are usually extremely fine-grained. Small grains of magnetite are present, an important fact to note in interpreting the magnetometer survey.

The assays reported to date show the following range and distribution of nickel, copper, and gold:—

	Ni	Cu	Au
	per cent.	per cent.	ounces
Disseminated ore	1.04	0.07	0.01
	1.05	.07	.01
	.55	3.00	trace
Faintly disseminated ore	.21	.44	.....
Disseminated ore with massive patches	.28	.89	.....
Heavily disseminated (coarse-grained sulphides)	.84	.39	.....
Massive ore (very fine grained)	3.82	2.38	.....
Massive pyrrhotite	2.43	trace	.01

Another interesting feature of the rock, and the one which first caused the property to be examined, is the occurrence of a veinlike mass of titaniferous magnetite. The vein is about 6 inches wide, and the magnetite forms elongated crystals, which build radiating groups like those in botryoidal hematite. This deposit has been described by E. S. Moore.[1]

[1]E. S. Moore, Econ. Geol., Vol. XXVII, 1932, pp. 387-390.

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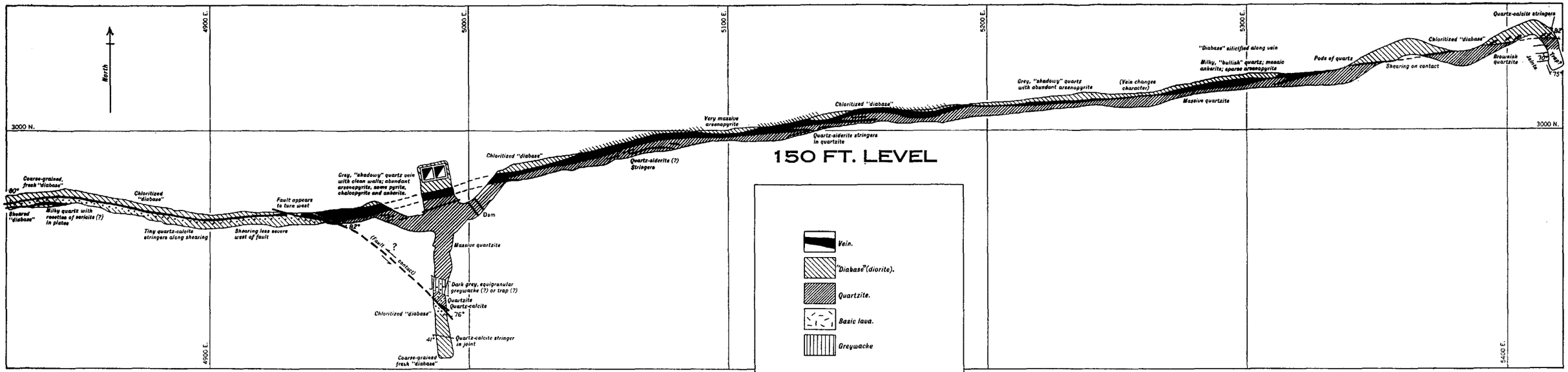
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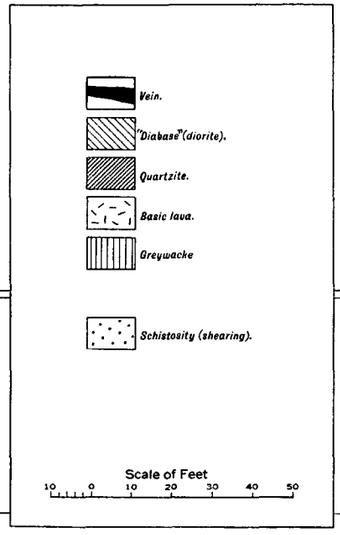
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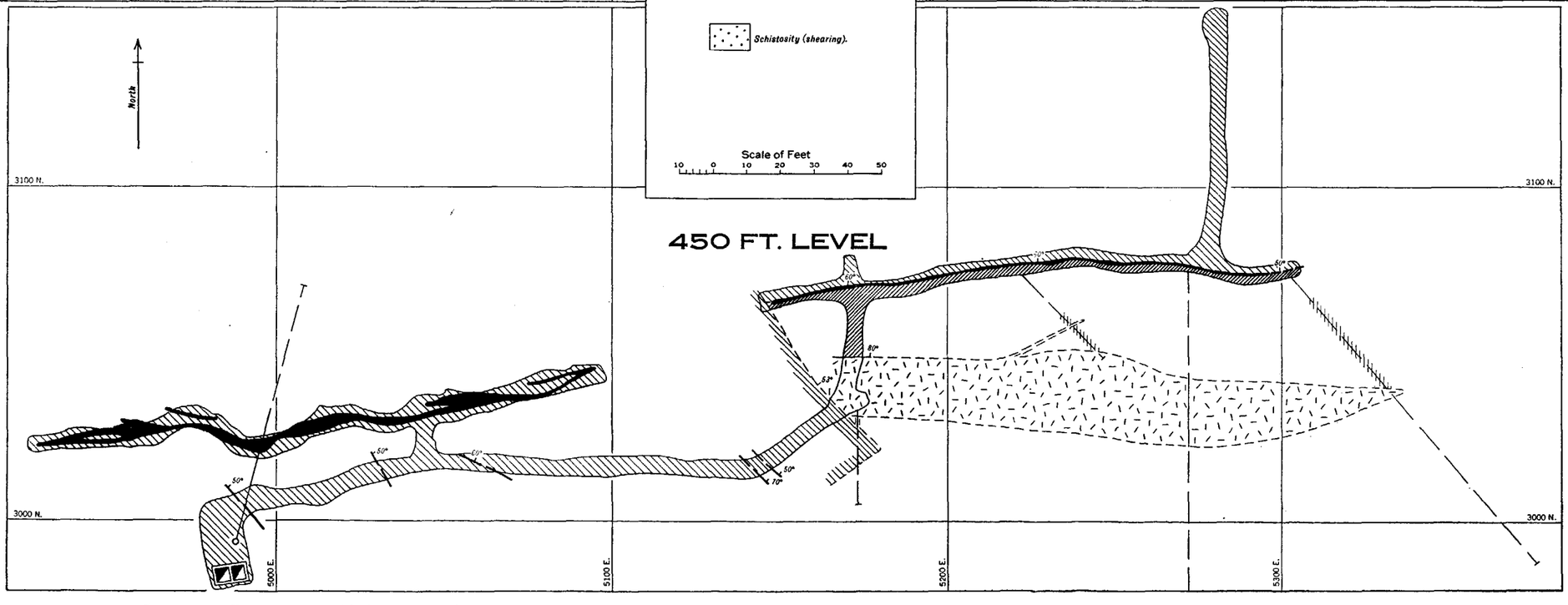
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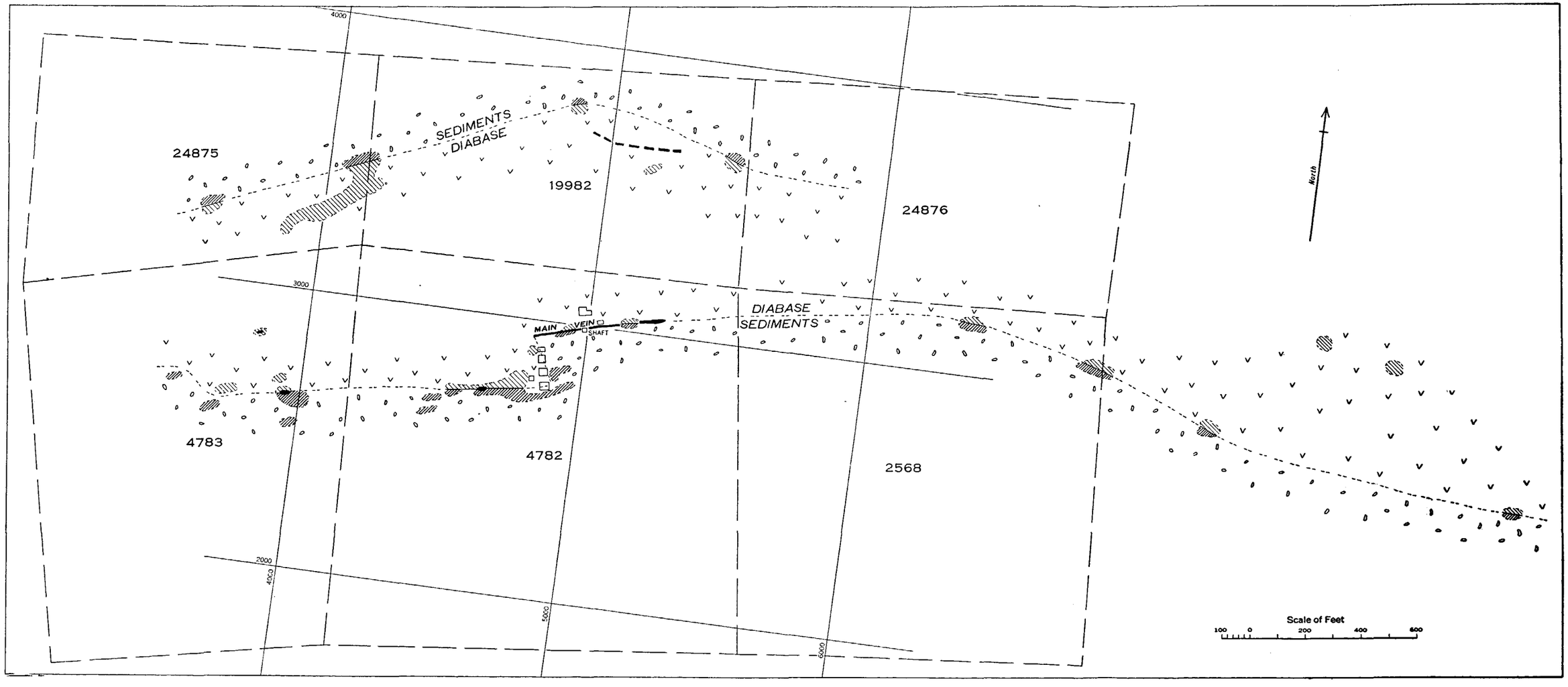
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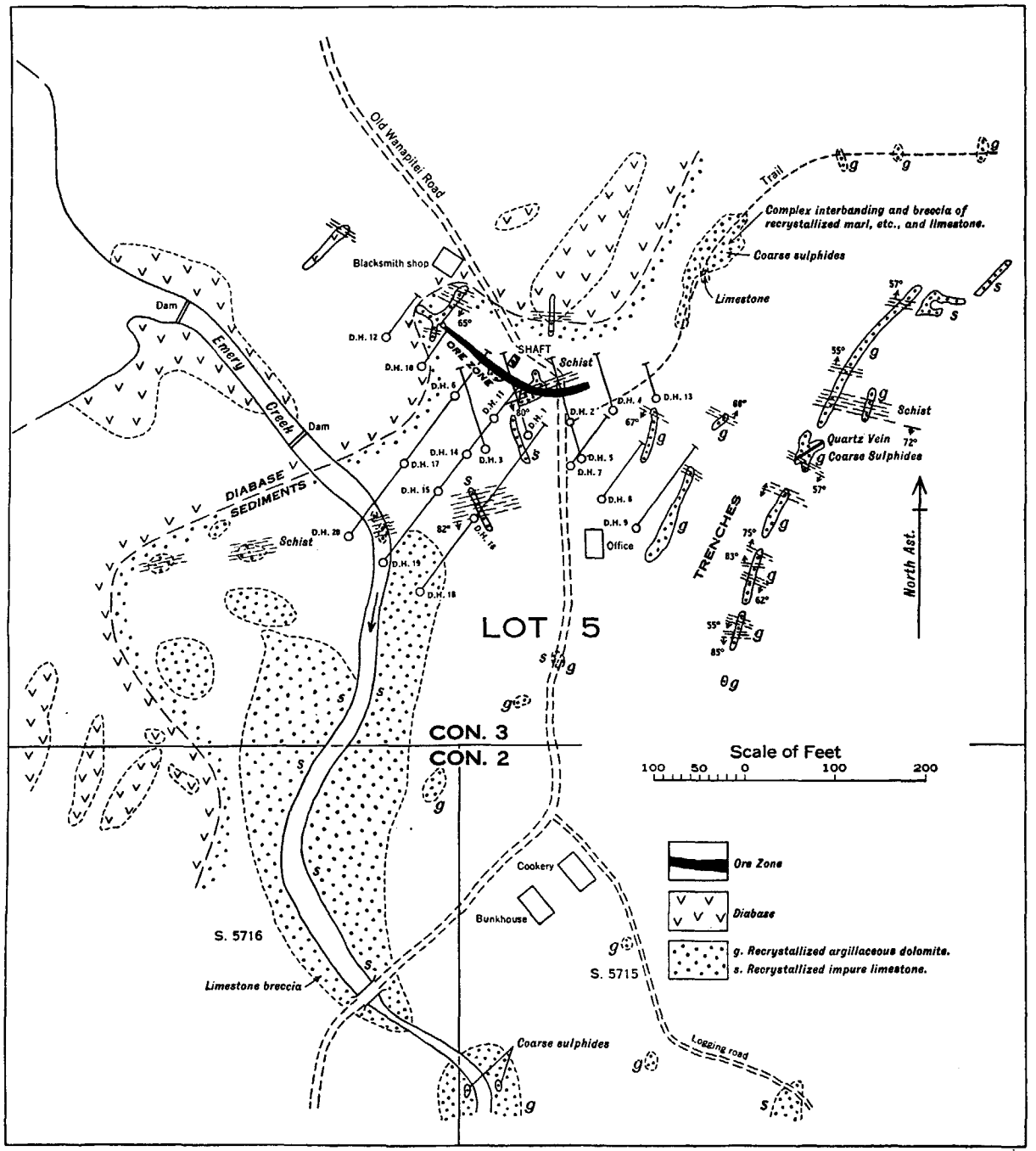


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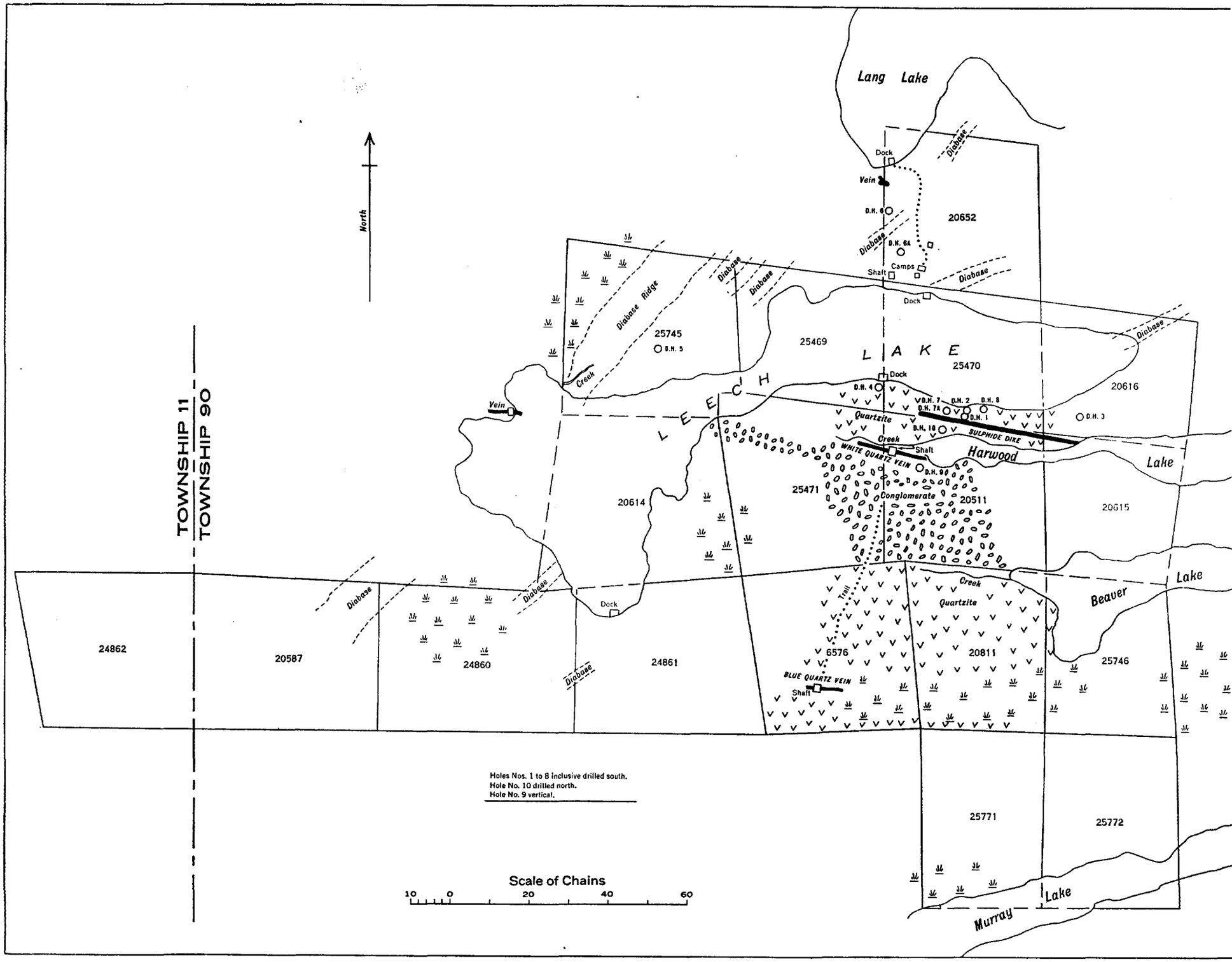
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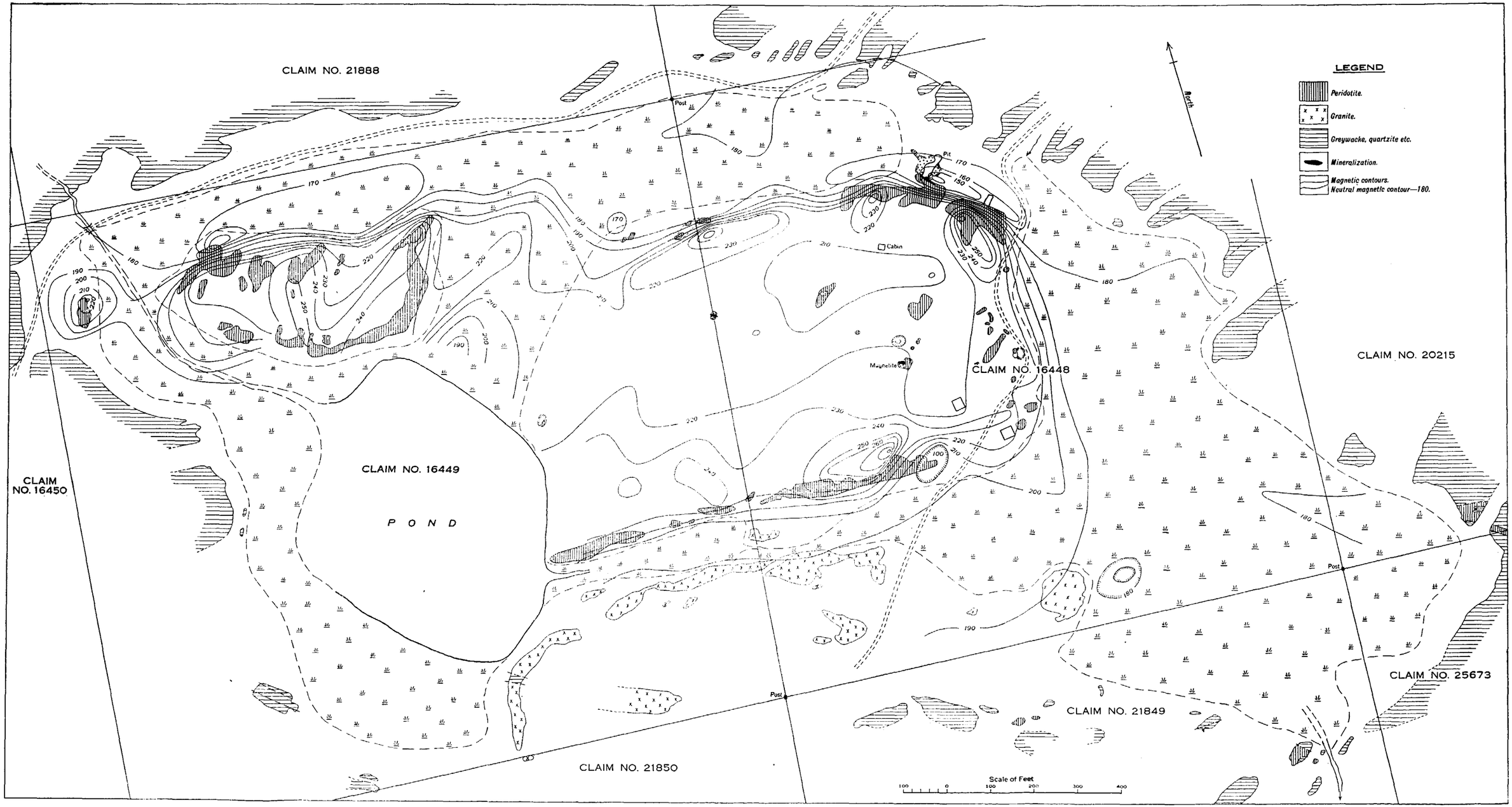
PLAN SHOWING SURFACE GEOLOGY ON THE PROPERTY OF BOUSQUET GOLD MINES, LIMITED
(Made by geologists of the company)



DETAILED PLAN SHOWING SURFACE GEOLOGY AND DIAMOND-DRILLING AT THE PROPERTY OF FALCON GOLD MINES
(Modified from map by J. E. Jerome)



GEOLOGICAL SKETCH MAP OF THE PROPERTY OF HARWOOD LAKE MINES, LIMITED
(Made by J. G. Farquharson, October, 1935)



SKETCH MAP SHOWING SURFACE GEOLOGY AND MAGNETIC CONTOURS OF THE OWEN PROPERTY OF FALCONBRIDGE NICKEL MINES, LIMITED
(Made by geologists of the company)



PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. ROBERT LAURIER, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART XI, 1939

Geology of the Flack Lake Area

By

W. D. HARDING

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(In pocket at back of report)

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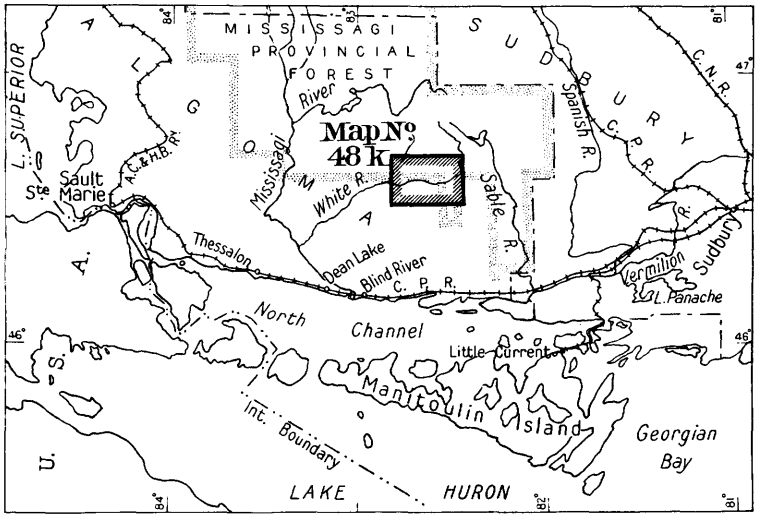
Geology of the Flack Lake Area

By W. D. Harding

INTRODUCTION

During the summer of 1938 the Ontario Department of Mines undertook a geological survey of the Flack Lake area. This field consists of a rectangular block 18 miles long and 12 miles wide situated in the district of Algoma, about 25 miles north of Lake Huron. It lies approximately half way between Sudbury and Sault Ste. Marie and includes all of townships 157, 151, and 145, and most of townships 1A, U, and Q. Townships 1A, U, Q, and 145 are situated in the Mississagi Provincial Forest.

Thessalon and Blind River are the nearest commercial centres to the area.



Key map showing the location of the Flack Lake area.
Scale, 50 miles to the inch.

Acknowledgments

During the field season the writer was ably assisted by John H. Low, Alex. MacLaren, and E. O. Chisholm. Mr. Low and Mr. MacLaren are responsible for a considerable part of the geological mapping.

The many courtesies that were extended to the members of the party by Mr. and Mrs. Stewart McElrea of Camp 11, township U, are gratefully acknowledged.

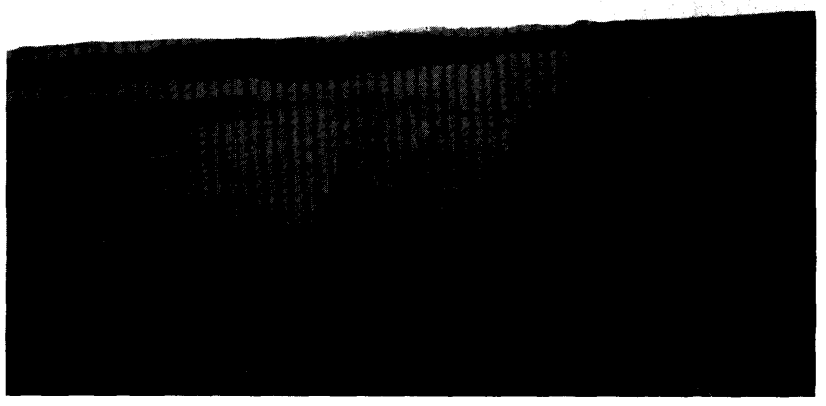
Co-operation in the form of information and hospitality was received from Mr. and Mrs. J. Christman and Mr. J. Michael, of Flack lake, from members of the Ontario Forestry Branch post situated on the White river, and from others too numerous to mention.

Access

The Flack Lake area may be reached by motor road either from Dean Lake station on the Canadian Pacific railway, or from the village of Iron Bridge on the Sudbury–Sault Ste. Marie highway. The motor road was originally built as a

logging road. It ends at McElrea's tourist camp on McElrea lake in the western part of township U. The distance from Iron Bridge to McElrea's camp is approximately 50 miles. In the southwestern part of township 1A a small branch motor road strikes southeast from the main road to Cobre lake, a distance of about 2 miles. There is no motor road access to townships Q, 157, 151, and 145. During the summer of 1938 Christman's tourist camp at Flack lake was accessible by means of a tractor road and a canoe route. A tractor road connects the Ontario Forestry Branch station on the White River road to Wilkie lake. Flack lake can be easily reached by canoe from Wilkie lake. Township 151 is best reached by a canoe route which connects Flack lake with Semiwite lake. Township Q is accessible by canoe from Rawhide lake. The best route to township 145 is by means of lakes and trails from the east end of Rawhide lake. This route crosses the Boland river and gives access to various lakes situated in the western part of township 145.

Many of the lakes scattered throughout the area are accessible by airplane.



Flack lake looking east from Baldy mountain.

History of Development

Prospecting activities in the area north of Lake Huron began over a hundred years ago. The first discoveries of importance were those of the Bruce Mines section, where valuable copper deposits were found in 1846–47. Following these discoveries prospectors searched the area surrounding Bruce Mines, and showings of various minerals, including copper, iron, and gold, were found at scattered places. No very important developments, however, resulted. The early prospectors apparently confined their efforts largely to the sections lying close to Lake Huron, and there is no evidence to show that they penetrated as far north as Flack lake. The rough topography of the Flack Lake area coupled with the fast-flowing, unnavigable streams and the lack of roads and trails made it a forbidding section to the early explorers. In general the area north of Lake Huron remained largely unknown until after the building of the Canadian Pacific railway.

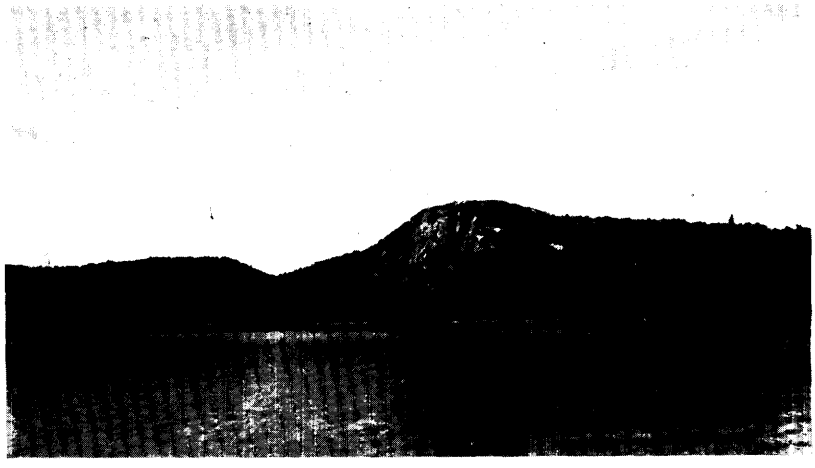
Part of the boundaries of the townships comprising the Flack Lake area were surveyed as early as 1857. It was not until 1909, however, that surveys of all township boundaries of this area were completed.

Between 1914 and 1916, W. H. Collins made a geological map of the Blind River area situated directly south of the Flack Lake area.[1]

The first commercial activities, other than trapping and hunting, in the Flack Lake area began during the latter part of the last century in the form of logging operations. The names of some of the lakes and streams date from that period. They perpetuate memories of early loggers such as Flack, Boland, and Cobre. The last logging operations in the area were conducted in the vicinity of Mount lake about 1930.

The first claims in the Flack Lake area were located in township 157 in 1921, and since that time a few scattered locations have been made in townships 157 and 1A. The early stakings, however, have been abandoned and at the present time there are only two groups held in the area.

During the past few years the Flack Lake area has attained some popularity as a summer resort for campers and tourists. The high altitude, the rough topography in the form of precipitous rocky hills and deep valleys, and the numerous clear-water lakes, which abound in fish, combine to make this section attractive to vacationists.



Baldy mountain from Flack lake.

Topography

The Flack Lake area is situated on the Lake Huron watershed in a rather high section of the Laurentian plateau. The rugged surface is characterized by numerous hills and ridges, some of which are precipitous in character. Altitudes range from about 1,100 to 1,800 feet above sea-level. The rough topography may be attributed partly to scattered masses of resistant diorite. The largest mass of this kind forms the south shore of Rawhide lake, which in places rises as a steep cliff to a height of over 400 feet above the water. A large bare hill of quartzite, known locally as Baldy mountain, situated directly west of Flack lake, rises to a height of over 600 feet above lake-level. The topographic features of townships 145 and 151 appear to be somewhat less pronounced than those of the remainder of the area.

[1]W. H. Collins, "North Shore of Lake Huron," Pub. No. 2052, Geol. Surv. Can., Mem. 143, 1925.

The area is drained chiefly by small, fast-flowing streams, which form part of the Mississagi River system. The largest of these is the Boland river, which flows westward through each of the six townships that comprise the area. On account of numerous stretches of fast-water rapids, falls, and repeated log jams, this river can be travelled by canoe only with the utmost difficulty. Numerous clear-water lakes occupy the low areas. Rock is abundantly exposed in all the townships.

GENERAL GEOLOGY

The consolidated rocks of the area are all pre-Cambrian in age. They were formed in four distinct geological periods. The oldest rocks belong to the Keewatin epoch. They consist dominantly of volcanics, most of which are represented by basic lavas. Tuffs, agglomerates, detrital sediments, and iron formation also occur in this group.

Algoman granites of various types intrude the Keewatin rocks.

On the peneplaned basement of highly folded Keewatin and Algoman rocks were laid down various types of Huronian sediments. They consist mostly of conglomerates and quartzites. The Huronian rocks have been gently folded and in places deeply eroded.

This assemblage is intruded by Keweenawan diorite and diabase, which are the youngest pre-Cambrian rocks.

Unconsolidated deposits of sand and gravel formed in Pleistocene and Recent times are scattered over this eroded pre-Cambrian basement.

The following table indicates the stratigraphic sequence of the rocks of the area, the oldest being at the bottom.

Table of Formations

QUATERNARY	
RECENT:	Unconsolidated stream sediments.
PLEISTOCENE:	Unconsolidated glacial sands, gravels, clays, and lake deposits.
PRE-CAMBRIAN	
KEWEENAWAN:	Quartz and calcite veins. Dikes, sills, bosses, and irregular-shaped intrusions of diabase and diorite.
	Intrusive contact
HURONIAN:	COBALT SERIES: Upper white quartzite. Banded cherty quartzite. Lorrain: Quartzite and pebble conglomerate. Gowganda: Boulder conglomerate.
	BRUCE SERIES: Conglomerate, quartzite, arkose.
	Unconformity
ALGOMAN:	Quartz veins; pegmatite dikes. Granite and granite gneiss.
	Intrusive contact
KEEWATIN:	Iron formation. Basic intrusives(?). Basic volcanics with intercalated sediments.

Keewatin

The Keewatin rocks are confined mostly to an irregular-shaped belt, which ranges in width from 2 to 3 miles and strikes westward through the southern parts of townships 145, 151, and 157. This belt includes basic volcanics, basic intrusives, and sediments. Most of the Keewatin rocks strike approximately east-west and dip almost vertically. In general the planes of schistosity lie parallel to

the beds and flows. Owing to the abundance of granite intrusions many sections of the Keewatin belt have been highly metamorphosed. Rocks of hybrid composition, therefore, occur in many localities. The mapping of some of these areas is, therefore, necessarily arbitrary.

Volcanics

The Keewatin volcanics consist largely of pillow and amygdaloidal types of andesites and basalts. Some of the best outcrops occur in township 145 southwest of Rooster lake, in township 151 south of Semiwite lake, and in township 157 west of Samreid lake. Ropy lavas are exposed about a mile south of Semiwite lake in the western part of township 151. The areas of soft chloritic schists are rather small. Rocks of this type occur in the middle of the southern part of township 145 and in the western part of township 151. The margins of the Keewatin belt in township 145 are composed largely of hornblende schists and various types of hybrid rock ranging from hornblendite to granite. No extensive beds of tuffs or agglomerates were identified. Some thin beds of mica schist exposed near the boundary in the eastern part of township 151 may be of tuffaceous origin. Thin lenses of basic agglomerates occur in the greenstone area in the southeastern part of township 145. Some beds of highly metamorphosed fragmental material associated with lavas and sediments in the section west of Samreid lake in township 157 may be of volcanic origin.

Basic Intrusives

The presence of Keewatin intrusives in the area examined was not positively established. At many scattered locations, however, basic lava flows appear to grade imperceptibly into massive types in which lava structures are absent. It seems reasonable, therefore, to assume that some of these types may be the intrusive equivalents of the adjacent andesites and basalts. One mass of this character situated between Dollyberry and Giberry lakes resembles the Keweenawan diorite found abundantly in the area. This mass, however, is cut by granite dikes and is, therefore, included among the Keewatin rocks.

Sediments

Numerous bands of Keewatin sediments occur at scattered locations between lava flows in the Keewatin belt. None of the sedimentary horizons are extensive. Most of them range in width from a few inches to a few feet. In most cases their lengths could not be determined. In the southwestern part of township 145 a few thin streaks of greywacke are interbanded with lava flows. Some bands of mica schist, which are infolded with the lavas in this section, may be highly altered sediments. Thin, parallel beds of crystalline limestone and quartzite constitute a narrow zone flanked by lavas near the north shore of Samreid lake. The beds dip almost vertically and strike in a northwesterly direction approximately parallel to the lake shore. Thin horizons of boulder conglomerate, quartzite, and greywacke are associated with the basic lavas west of Samreid lake in township 157. In the southwestern part of this township Keewatin boulder conglomerates and greywackes are exposed at intervals along the north shore of Ten Mile lake. A small area of highly metamorphosed Keewatin rocks exposed about half a mile north of the east end of McElrea lake contains bands that resemble greatly altered greywacke.

Iron Formation

Remnants of banded iron formation, which in places attain a width of nearly a hundred feet, occur in the southeastern part of township 145. This iron formation is in contact with both lava flows and granites.

Algoman

The Algoman rocks consist principally of granites and granite gneisses. These types intrude the Keewatin rocks and lie below the Huronian sediments.

A large granite batholith occupies the northern parts of townships 1A, U, and Q. The south margin of this batholith is composed largely of pink granite gneiss. The gneisses are particularly evident in township 145, where the batholith is flanked by Keewatin rocks. They probably represent partially digested Keewatin greenstones and sediments. Sections of massive, coarse-textured pink granite also constitute parts of the batholith. They occur mostly in the areas remote from the contact. Massive pink granite containing abundant red orthoclase is exposed on the south boundary of township Q west of the 2-mile post. Coarse porphyritic pink granite is exposed at scattered places in the southeastern part of township 145. Scattered intrusions of massive pink granite occur throughout the Keewatin belt in the southern parts of townships 145, 151, and 157. The largest of these masses occurs in the southern part of township 157. Near Samreid lake this granite contains abundant quartz. Farther east it becomes distinctly gneissic.

Small pegmatite dikes and quartz veins and stringers cut the Algoman rocks at many places. In sections where the Huronian rocks are absent it is impossible to distinguish the Algoman quartz veins from those of the Keweenawan period.

Huronian

Sedimentary rocks of Huronian age are exposed in all the townships covered by this report and form the largest group of rocks in the area. They include members of both the Bruce and Cobalt series.

BRUCE SERIES

Exposures of Lower Huronian rocks are confined entirely to the southwestern part of township 157. They include conglomerates, greywackes, arkoses, and quartzites. Some of the exposures on the south boundary of township 157 extend into township 156. On Collins'[1] Blind River map, these outcrops are shown as various formations of the Bruce series. In township 157 similar types occur as isolated outcrops. It was not possible to separate all these outcrops into the various divisions of the Bruce series owing to the limited time at the writer's disposal. For this reason, therefore, the members of the Bruce series are shown in one colour on the map that accompanies this report.

COBALT SERIES

Sedimentary rocks of Upper Huronian age equivalent to the Cobalt series as described by Miller[2] are exposed in an oval-shaped belt, which extends from east to west for a distance of about 16 miles. This belt covers parts of all the six townships described in this report. Its eastern limits lie in townships Q and 145. To the west the belt extends beyond the limits of the mapped area into townships 1B and 163. In that direction, therefore, its boundaries were not delimited. The belt attains its maximum width in the eastern parts of townships 1A and 157, where it extends north and south for a distance of about 9 miles. In the latter part of the Huronian epoch this oval-shaped area was a shallow lacustrine basin lying in Keewatin and Algoman rocks. In this basin was deposited

[1]W. H. Collins, op. cit.
[2]Willet G. Miller, Ont. Bur. Mines, Vol. XIX, 1913, pt. 2, p. 75.

first Gowganda conglomerate, then Lorrain quartzite and pebble conglomerate, followed by beds of cherty quartzite. Above the cherty quartzite were deposited beds of massive white quartzite.

Gowganda

The Gowganda formation of the area consists almost entirely of boulder conglomerate. It forms the basal member of the Cobalt series and lies directly upon the folded pre-Huronian basement. Whether or not the Gowganda formation underlies the younger Huronian rocks everywhere throughout the area was not definitely established. The fact that it was not identified at many places around the margin of the basin suggests that it is absent in some sections.

The thickness of the formation varies considerably and is difficult to estimate. It probably has a maximum thickness in township 1A of less than 300 feet.



Lorrain quartzite, north shore of Rawhide lake.

Practically all the Gowganda formation identified in the area consists of coarse boulder conglomerate, which contains both rounded and angular fragments of red granite. Boulders of greenstone and lava and quartz pebbles are less abundant. At some places in townships 1A and U the amount of embedded red granite material is sufficient to impart a reddish colour to the conglomerate.

Lorrain

The Lorrain formation in the Blind River area was divided by Collins[1] into a lower feldspathic quartzite and an upper pure whitish quartzite, the latter containing numerous thin horizons of white quartz pebble conglomerate. These types also constitute the Lorrain formation of the Flack Lake area. The lower feldspathic quartzite lies directly above the Gowganda conglomerate. It is exposed at several places along the northern margin of the Huronian area in townships 1A, U, and Q. North and east of Rottier lake, however, the lower part of the Lorrain consists of banded thin layers of red and white fine-grained quartzite. Feldspathic quartzite exposed between Rawhide lake and Rosemarie lake contains sufficient red feldspar in some places to give the rock a definite pinkish

[1]W. H. Collins, op. cit., page 69.

colour. The feldspathic quartzite of the lower part of the Lorrain formation was not identified along the southern margin of the Huronian area.

The quartzite of the upper part of the Lorrain is a rather thick formation consisting of white quartzite, which in places contains numerous thin horizons of quartz pebble conglomerate. This formation is well exposed in numerous places in townships 1A, U, and Q, where it lies conformably above the feldspathic quartzite. The white quartzite is remarkably pure and has a very high silica content. The quartz pebble conglomerate is composed mostly of small rounded pebbles of pure white quartz cemented together with white quartzite. Some of the conglomerate horizons contain pebbles of bright red jasper along with the white quartz pebbles, making a very spectacular-looking rock. Conglomerates containing jasper pebbles occur at numerous places in townships 1A, U, and Q. Some good exposures occur in the vicinity of Mount lake in township 1A.



Ripple marks in Huronian sediments, Flack lake.

The Lorrain formation in townships 1A and U appears to have a maximum thickness of between 2,000 and 4,000 feet.

Cherty Quartzite

Thin beds of greenish-white and buff cherty quartzite alternate with thin beds of whitish quartzite in the middle of the Huronian belt. The exposures are confined mostly to an area about 10 miles long and 2 to 3 miles wide, which lies partly in township 1A and partly in township 157.

In many respects these cherty quartzites resemble the cherty quartzites examined by Collins[1] in the Bruce Mines area. The following parts of Collins' description apply to the cherty quartzites of the Flack Lake area:—

> The Lorrain quartzite passes gradationally up into several hundred feet of a thin-bedded formation which may be described as a banded cherty quartzite. It is made up of layers from one-fourth of an inch to 1 foot in thickness, which range in texture from a finely but perceptibly clastic quartzite to one so fine grained that it is outwardly indistinguishable from chert. The different layers range through light shades of grey, buff, and green, giving the formation a distinctly banded aspect. . . . Ripple marks are rather common in all parts of it.

Upper White Quartzite

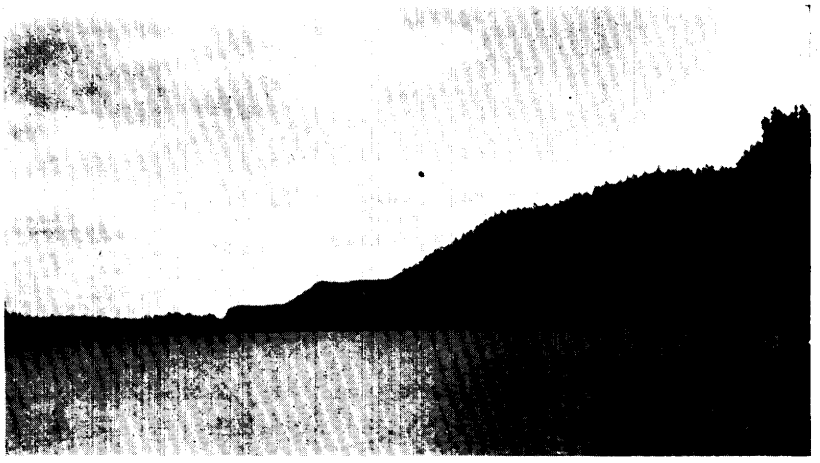
In townships 151 and 157 the banded cherty quartzite, which dips gently to the south, is overlain by massive white quartzite. This white quartzite is the

[1]W. H. Collins, op. cit., pp. 69, 70.

youngest Huronian rock identified in the area. It is best exposed in the section which extends from Flack lake to Semiwite lake. The rock is a very pure quartzite, indistinguishable in appearance from some phases of the Lorrain quartzite. It is mostly white in colour with a suggestion of pink in some localities. A contact exposed on the south shore of Flack lake shows that the upper white quartzite lies unconformably above the banded cherty quartzite.

Keweenawan

Keweenawan intrusives represented by dikes, sills, and irregular-shaped masses of diorite and diabase are scattered throughout the area. Exposures examined at scattered localities show that these intrusives cut all the older formations including the Huronian sediments. The largest intrusive mass of Keweena-



Keweenawan diorite, south shore of Greytrout lake.

wan age is a belt of diorite, either a dike or a sill, which strikes east-west through townships 1A, U, and Q. It forms part of the south shore of Rawhide lake and rises precipitously in some places to more than 400 feet above the lake. The Huronian sediments close to the diorite have been crumpled by the force of the intrusion. Other large masses of Keweenawan diorite are exposed between Cobre lake and Flack lake, in the central part of township 1A, and in the southern part of township 151.

DESCRIPTION OF PROPERTIES

New Sudbury Prospecting Syndicate

The New Sudbury Prospecting Syndicate holds a group of 28 claims in the vicinity of Samreid lake in township 157. The group was staked by Sam Reid and Sam Bobowash in October, 1936.

The rocks in the vicinity consist of steeply dipping, east-west striking Keewatin greenstones and sediments, which have been intruded by Algoman granite. Veins and lenses of quartz also cut the Keewatin rocks at scattered places. In several localities west of Samreid lake the Keewatin rocks have been replaced by massive sulphides consisting of pyrite, pyrrhotite, and a little chalcopyrite.

Another type of mineralization found in this vicinity consists of scattered sulphide-bearing quartz veins. Most of the veins lie parallel to the steeply dipping volcanics and sediments. Pyrite, chalcopyrite, pyrrhotite, galena, and zinc blende are associated with the vein material. Low gold and nickel values are reported to have been obtained from this group.

White Lake Mines, Limited

White Lake Mines, Limited, holds a group of 14 claims situated on the south shore of Cobre lake in township 1A. The rocks in the vicinity consist of gently dipping sediments of Upper Huronian age cut by Keweenawan diorite.



Adit, White Lake Mines, Limited, Cobre lake.

In 1929 underground development was undertaken on this group for the purpose of exploring two vertically dipping veins, which strike almost east-west from the south shore of Cobre lake. Surface sections of these veins showed abundant chalcopyrite. Work was carried out by means of two adits, which followed along the veins. One was driven west, the other east, from Cobre lake. By January 10, 1931, the west adit had been driven for a distance of 1,400 feet, and the east adit 1,040 feet from the shore. Some chalcopyrite was encountered, but no large body of copper ore was located. Gold values are said to have been obtained at some places. Development work was suspended in May, 1931, and practically no work has been done on the property since.

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PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. ROBERT LAURIER, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART XII, 1939

Geology of the Bigwater Lake Area

By

L. G. BERRY

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COLOURED GEOLOGICAL MAP

(In pocket at back of report)

Map No. 48n—Bigwater Lake Area, District of Cochrane, Ontario. Scale, 1 mile to the inch.

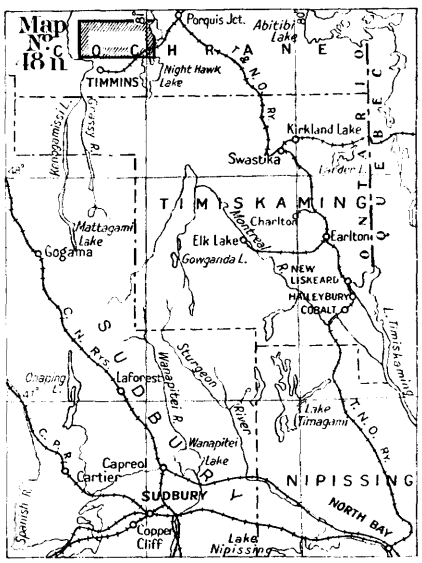
Geology of the Bigwater Lake Area

By L. G. Berry

Introduction

The Bigwater Lake area comprises the townships of Kidd, Wark, Gowan, Evelyn, Jessop, Murphy, Hoyle, and Matheson, located in the northern part of the Porcupine area, district of Cochrane. The south boundary of Murphy township is 5 miles north of Timmins. The area extends from Fredrick House lake and river on the east almost to the Mattagami river on the west. The north boundary of the area follows the north boundary of the Porcupine mining division.

All the townships in the area were surveyed and subdivided into lots between the years 1903 and 1907. Jessop township is open for the staking of mining claims. Nearly all the land in the other townships is patented, having been granted by



Key map showing the location of the Bigwater Lake area. Scale, 60 miles to the inch.

the crown to veterans of the South African war and the Fenian raids. For this reason prospecting activity has been very slight, although the area is quite near the Porcupine camp.

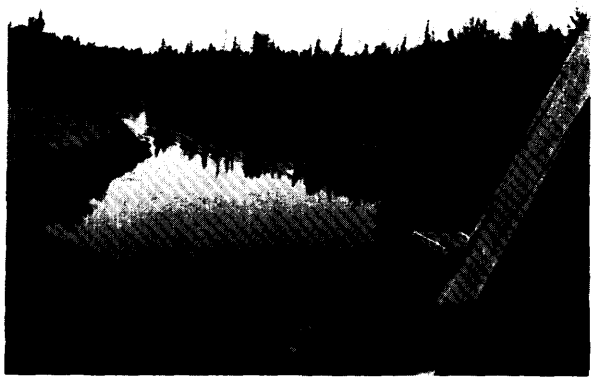
A geological examination of the area was made in the summer of 1938. The resulting information was recorded on a base map compiled from township plans and from an aerial survey of the area made by the Ontario Forestry Branch in 1937. The geology was plotted by means of pace-and-compass traverses. In Murphy, Hoyle, and Matheson townships traverses were arranged to avoid following surveyed lines, as most of the surveyed lines had been traversed by B. Rose[1] in 1923.

[1]B. Rose, "Murphy, Hoyle and Matheson townships," Ont. Dept. Mines, Vol. XXXIII, 1924, pt. 3, pp. 50-54.

Acknowledgments

During the field season the writer was ably assisted by A. C. Freeze, G. L. Colgrove, and D. Tuke. Mr. Freeze served as senior assistant and was responsible for part of the geological mapping.

It is impracticable to acknowledge individually the numerous courtesies and favours received by the writer and members of his party during the period of field work and during the preparation of the report. The information and hospitality extended by prospectors, settlers, and the staffs of the various mining, lumber, and hydro-electric power companies were greatly appreciated. The writer wishes especially to thank J. L. Regan and all the staff of the Timmins division of the Ontario Forestry Branch for their co-operation in providing helpful information and transportation.



The Porcupine river, looking upstream from the highway bridge at Hoyle, Matheson township.

Access

A motor road follows the power line of the Hydro-Electric Power Commission north from Timmins to Bigwater lake in Murphy township. Wark township and parts of Kidd and Jessop townships may be reached from this power line. The western parts of Jessop and Kidd townships may be reached from the power line of the Northern Ontario Power Company. This power line is one mile west of the west boundary of the area and cuts across the southwest corner of Jessop township. The southern part of Jessop township may be reached from a motor road in concession VI of Mountjoy township. The Porcupine river provides access by canoe to Hoyle and part of Gowan and Matheson townships. The main highway and the Temiskaming and Northern Ontario railway from Porquis Junction to Timmins traverse Matheson township from northeast to southwest. Evelyn township is easily reached from Frederick House lake. There are numerous winter logging roads in all the townships except Kidd.

Topography

The country is flat with very little relief except in the northern part of Evelyn township and the central part of Murphy township, where sand hills are numerous. The average elevation is less than 1,000 feet above sea-level. The sand ridges occasionally rise 50 to 100 feet above the general level. Hoyle, Matheson,

and adjoining parts of Murphy, Gowan, and Evelyn townships are chiefly clay flats with occasional boulder and gravel ridges. The Porcupine river has cut a meandering course in this clay, its banks being in places 20 to 30 feet high. The sand ridges in Murphy and Evelyn townships and the muskegs in Wark and Gowan townships form the height-of-land between the Mattagami and Fredrick House rivers. In Evelyn township there are several small lakes and ponds, surrounded by sand hills, with no visible outlet. In 1909 a natural dam on the Frederick House river in Mann township was opened by blasting, thus lowering appreciably the level of Frederick House lake. In 1938 a dam was constructed at this site and the lake restored to its former level.



Lizard lake, Evelyn township, from the sand ridge to the northeast. Several white pines can be seen in the younger growth south of the lake.

Natural Resources

There are a few small farms in Matheson township and in the adjoining parts of Hoyle and Evelyn townships. Most of Murphy, Hoyle, and Matheson townships and the southern part of Evelyn township have been logged or burned over. The northern part of Evelyn township is covered with young second-growth jackpine, poplar, and birch. There has been some logging in the southern parts of Wark and Gowan townships, the remaining timber being suitable only for pulpwood. A large amount of spruce and balsam has been cut in Jessop township for pulpwood within the last few years. No timber has been cut in Kidd township. The central part of Kidd township is mostly covered with alders, willow, young tamarac, and young spruce.

General Geology

The consolidated rocks of this area consist of early pre-Cambrian lavas and sediments, which have been tightly folded and intruded by granite and diabase. On account of the scarcity of outcrops it was impossible to work out the age

relations of the various rock types found in the area. The rocks were grouped into formations on the basis of lithological similarity to those found in the Porcupine camp.

Table of Formations

QUATERNARY	
PLEISTOCENE:	Clay, sand, gravel, boulders.
	Great unconformity
PRE-CAMBRIAN	
MATACHEWAN(?):	Diabase.
ALGOMAN:	Granite, porphyry.
TIMISKAMING(?):	Conglomerate, greywacke.
KEEWATIN:	Greywacke and slate. Breccia. Basic and acid lava flows.



Contact of two lava flows, north half of lot 5, concession III of Hoyle township.

KEEWATIN

Lavas

The commonest rocks found outcropping consist of altered basic lavas of the usual Keewatin types. Pillow structure occurs in the lavas in lot 1, concession III of Hoyle township; lots 1 and 2, concession I of Murphy township; and lot 2, concession VI of Kidd township. Fragmental tops are associated with the lavas in lot 11, concession I of Hoyle township, and lot 4, concession VI, Murphy township. Rhyolite occurs in lot 6, concession I of Wark township; lots 3 and 4, concession V of Kidd township; and lots 8 and 9, concession II of Prosser township. In Kidd township the rhyolite is brecciated. The lavas are highly carbonatized in lot 5, concession V of Matheson township; lots 1 and 2, concession III of Hoyle township; and lots 1 and 2, concession V of Jessop township.

Breccia

Numerous outcrops of breccia occur in lot 5, concession V, and lot 4, concession VI of Murphy township, and lots 4 and 5, concession I of Wark township. In this locality they occur between the lavas and the sediments. Some outcrops have the appearance of conglomerate, with fragments up to 1 foot in diameter.

Most of the fragments were of similar composition and appeared to be of volcanic origin. No fragments of sedimentary origin were found. One outcrop shows lava and breccia with no sharp contact. The contact of the breccia with the sediments was not observed.

Sediments

Scattered outcrops of greywacke occur in all the townships except Kidd. Some slate is interbedded with the greywacke in Murphy township. Under the microscope the greywacke is seen to be medium-grained and to consist of angular fragments of quartz, altered feldspar, calcite, chlorite, and sericite. Biotite is abundant in some outcrops. No conglomerate was found associated with these sediments. Similar sediments were located by drilling in concession I of Matheson township. The outcrop in the northwest corner of lot 2, concession II, Matheson township, shows neither sedimentary nor volcanic structures. Under



Breccia, south half of lot 5, concession V of Murphy township.

the microscope the rock shows similarities to the other greywackes but with less quartz. Microscopically it could be an altered volcanic rock.

TIMISKAMING(?)

Several outcrops of coarse greywacke and conglomerate occur in concession I of Matheson township. The greywacke is less altered and richer in quartz than that found in other parts of the area. These exposures represent the continuation of the main series of Timiskaming sediments found in the Porcupine camp. This has been confirmed by diamond-drilling west of these outcrops.

ALGOMAN

One outcrop of fine-grained pink granite occurs in lot 12, concession I of Prosser township. On the east bank of the Frederick House river in lot 1, concession V of Matheson township, there is a small outcrop of sheared quartz-feldspar porphyry, which may be of Algoman age.

MATACHEWAN(?)

A few small dikes of diabase were observed cutting the greenstones and sediments in Hoyle township.

PLEISTOCENE

The Pleistocene deposits of Murphy, Hoyle, and Matheson townships have been well described by B. Rose.[1] A large part of the remainder of the area is covered with swamp and muskeg. The clay flats and low gravel ridges of Matheson extend into Evelyn township. The sand deposits of the northern part of Evelyn township are like those in Murphy township. A few sand and gravel ridges project out of the swamp in Gowan, Wark, Kidd, and Jessop townships.

Structural Geology

The sediments in the northeast corner of Murphy township form the nose of a syncline plunging steeply east. Owing to the scarcity of outcrops, the extent of this syncline farther east is uncertain. The sediments in lot 2, con-



Timiskaming conglomerate, south half of lot 2, concession I, Matheson township.

cessions III and IV of Hoyle township, appear to be interbedded with the lavas, as the tops are to the south in these outcrops. There is no evidence to suggest that the sediments in Murphy township form a continuous band connecting with those in Mountjoy township. But they may occur as minor, canoe-like (pitching) synclines within a deeply eroded synclinorium. The large band of sediments, shown on the map as extending from Murphy and Wark townships in an easterly direction, may also consist of a number of closely spaced folds having the same general strike.

Economic Geology

Prospecting for gold has been carried out at several points in the area, and gold values have been reported from some of the prospects. No workable mineral deposits of any kind have yet been developed.

Several small gravel pits are in use in Matheson and Evelyn townships.

Future of the Area

Further prospecting in the area rests with the large mining companies who can afford to work in country deeply covered with drift. The ordinary prospector is able to work in Jessop township but is under a great handicap in the other

[1]B. Rose, op. cit., pp. 51, 52.

townships of the area. Further exploration of the carbonatized zone occurring in the lavas in concession III of Hoyle township might prove worth while.

Description of Properties

JESSOP TOWNSHIP

Dan Heard

Dan Heard, of Timmins, holds 8 claims in lots 1 and 2 of concessions IV and V. The rocks consist chiefly of carbonatized pillow lavas, striking about N. 75° E. Stripping and trenching have uncovered several east-west striking shear zones with a maximum width of 5 feet. Two small pits have been sunk. Veins of quartz and calcite carrying a little pyrite, galena, chalcopyrite, and pyrrhotite occur in the shear zones. There is some mineralization in the sheared wall rock. Grab samples of the vein material taken by the writer showed no gold values.

Ronald Kennedy

On two old patented claims, P. 6,534 and 6,535, in the north half of lot 5, concession III, held by Ronald Kennedy, there occurs a large outcrop of pillow lava. An east-west striking vein of quartz and calcite is exposed in several trenches dug many years ago. The lava is carbonatized near the vein, but very little sulphide mineralization was observed.

G. A. Lefebvre

G. A. Lefebvre holds 10 claims in lots 3, 4, and 5 of concessions II and III. In the northern half of lot 5, concession II, there is an outcrop of pillow lava and amygdaloidal lava. Stripping has uncovered many narrow quartz veins in the sheared lavas. The general strike of the veins is N. 80° E., and they dip steeply north. The veins contains tourmaline but not many sulphides.

Charles W. Pexton

Charles W. Pexton, of Timmins, holds a group of 15 claims in the western part of concession I. The rocks consist chiefly of altered basic lavas, striking N. 60° E. Stripping and trenching have uncovered two sets of veins. One 8-inch quartz vein, striking N. 72° E., has been traced for 20 feet; it is slightly brecciated, but contains no sulphides. Another set consists of narrow quartz veins with a maximum width of 3 inches and containing a little carbonate. The veins follow fractures cutting across the strike of the flows. Low gold values have been reported.

M. Bartnett

M. Bartnett holds 4 claims in concession I, adjoining the Pexton group to the east. Stripping and trenching have uncovered 3 east-west striking quartz veins up to 6 inches wide in carbonatized lava.

KIDD TOWNSHIP

E. Martin

Stripping and trenching by E. Martin on the south half of lot 4, concession V, has uncovered a sheared and brecciated band of rhyolite 4 feet wide, striking east-west in greenstone. The rhyolite is impregnated with pyrite, marcasite, and pyrrhotite. Small quartz veins are also found in cross-fractures but contain no sulphides. Assays of grab samples of the best-looking material taken by the writer, showed no values of gold or nickel.

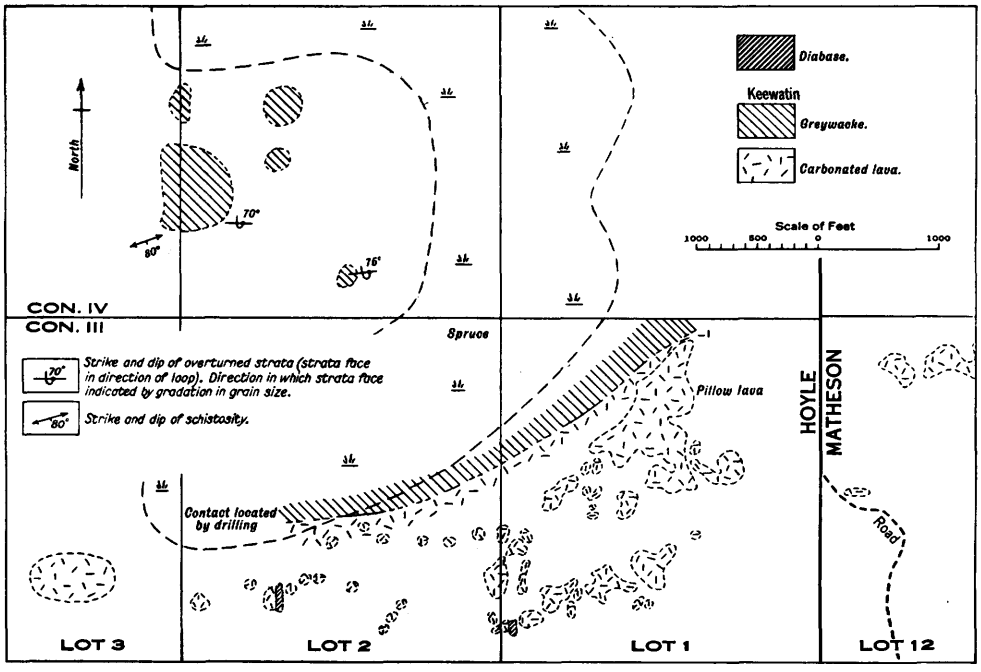
MURPHY TOWNSHIP

John Helmer

The rocks in the north half of lot 4, concession IV, held by John Helmer, consist of greywacke and slate. Stripping and trenching have uncovered an irregular quartz vein carrying carbonate and having a maximum width of one foot. The wall rock of the vein is highly contorted and sheared and carries a little sulphide.

North Half Lot 1, Concession I

Numerous quartz veins occur in pillow lavas in the north half of lot 1, concession I. The quartz contains fouqueite and chlorite. A few small stringers



Geological sketch map of the property of Hollinger Consolidated Gold Mines, Limited, and Noranda Mines, Limited, in Hoyle township, showing surface outcrops and results of drilling done in 1938.

carry some pyrite and chalcopyrite. There are coarse pyrite crystals in the sheared wall rock of the small veins. An assay of a picked sample of vein material and wall rock containing pyrite taken by the writer showed no gold values.

HOYLE TOWNSHIP

North Half Lot 12, Concession I

The rock outcropping on the north half of lot 12, concession I, consists of sheared pillow lavas striking east-west. Trenches and pits have uncovered several large masses of quartz up to 30 feet in width. The quartz is barren of ore minerals.

Lots 2 and 3, Concession III

The rocks on lots 2 and 3, concession III, consist of carbonatized lavas striking N. 75° E. Narrow irregular quartz stringers cut the lavas. Dis-

seminated sulphides are present in the carbonatized rock. Diamond-drilling, carried out in the summer of 1938 by Hollinger Consolidated Gold Mines, Limited, and Noranda Mines, Limited, located a contact with sediments to the north. The accompanying sketch map shows the contact as located by drilling. It probably dips north. According to information supplied by Hollinger Consolidated Gold Mines, Limited, gold values ranging from 0.02 to 0.10 ounces per ton were found associated with pyritized quartz stringers in the carbonatized lavas. The values are quite scattered.

Lots 9 and 10, Concession II

Several outcroppings of carbonatized Keewatin greenstones, striking N. 60° E., occur in the central parts of lots 9 and 10, concession II. A blue-grey quartz vein, striking N. 30° W., cuts the greenstones. It ranges in width from 3 inches to 3 feet and is exposed for 100 feet along the strike. Visible gold is reported to occur in this vein. In 1937, according to W. L. Edwards, 5 shallow diamond-drill holes were put down in the vicinity of the showing. This work failed to establish the continuity of the vein.

MATHESON TOWNSHIP

Claim P. 9,608

Claim P. 9,608 is a patented claim situated in the northwest corner of lot 2, concession II. The rock outcropping here consists of greywacke. A shaft was sunk to a depth of 50 feet about 25 years ago, and some diamond-drilling has been done since. Small quartz stringers containing disseminated pyrite occur in the rock. Picked samples taken by the writer from the vein and wall rock yielded no gold values when assayed.

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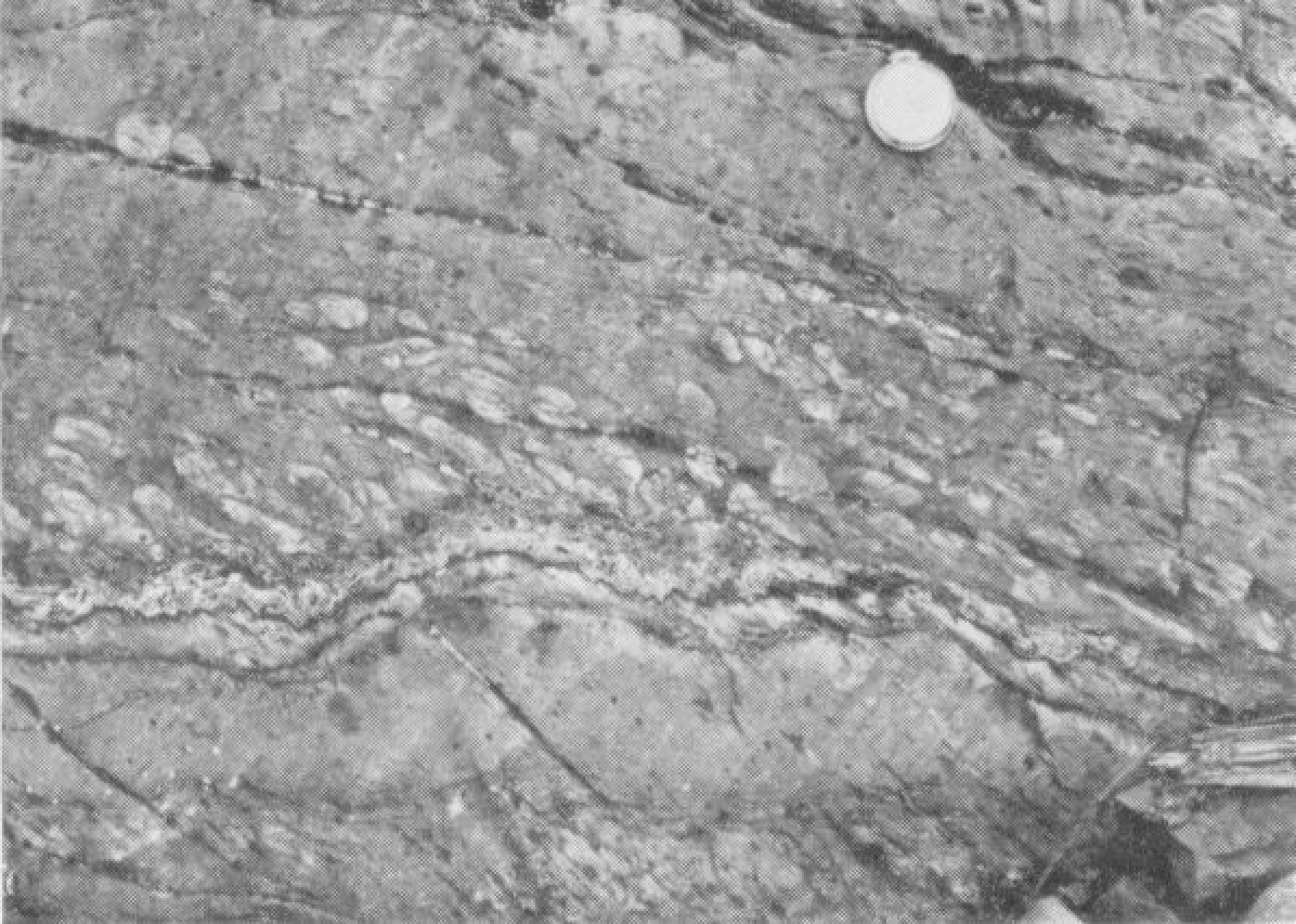
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HON. PAUL LEDUC, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

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COLOURED GEOLOGICAL MAPS

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Map No. 48a—Atikokan Area, District of Rainy River, Ontario. Scale, 1 mile to the inch
Map No. 48b—Steeprock Lake Area, District of Rainy River, Ontario. Scale, ¼ mile to the inch.

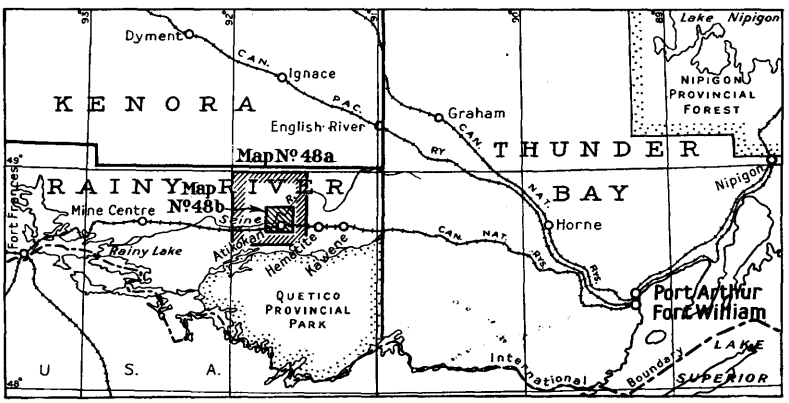
Geology and Ore Deposits of the Atikokan Area

By E. S. Moore

INTRODUCTION

Atikokan is situated in the Rainy River district, on the Canadian National railway between Port Arthur and Fort Frances, 141.4 miles west of Port Arthur. The Atikokan area, as described in this report, covers approximately 517 square miles and lies between north latitude 48° 40′ 40″ and 49° and west longitude 91° 28′ 40″ and 92°. The south boundary of the area lies close to the north boundary of Quetico park. The field work on which the report is based was done during the summer of 1937.

The village of Atikokan, the only one in the area, is located on the south side of the Atikokan river, which is navigable for small craft downstream to Steeprock lake. This lake is an unusually beautiful one because of its high rocky



Key map showing the locations of the Atikokan and Steeprock Lake areas. Scale, 60 miles to the inch.

shores, from which it got its name, and the steep red bluffs of oxidized carbonate so prominent around the north shore. There are a number of summer cottages on the lake belonging to the citizens of Atikokan, but the shores are for the most part so rugged that there are few camping sites.

The Seine river flows through Steeprock lake, and a power plant is situated at the point where the river enters the lake. Below the lake, the Seine is navigable for many miles, except for Tracy rapids, 2 miles downstream, where there is a portage of a quarter of a mile. The railroad and the Seine river offer excellent facilities for travel across the area and serve as bases from which canoe routes lead to the north and south through the numerous lakes.

During the summer of 1937 there was relatively little prospecting or development of mining claims in the area. Some work was done on the old Harold Lake property and on the Rebair, which is adjacent to the old Elizabeth mine on the east, but all work was discontinued before the end of the season. Practically the whole area was staked in former years for gold, iron, copper, or pyrites, all of which occur in at least small deposits. In the late nineties and early in this century, great interest was shown in the region. The Atikokan iron mine, situated near Iron Spur, 19 miles east of Atikokan, the Elizabeth, Harold Lake, Clearwater Lake, Sawbill, and Hammond Reef gold mines were all operating at

that time. There were also many other properties on which work was being done. The Sawbill (now the Upper Seine) mine and the Elizabeth were reopened in the spring of 1938.

The most interesting new development in the Atikokan area is the discovery in 1938, by drilling through the ice on Steeprock lake, of a considerable body of high-grade hematite. The discovery was made by Jules Cross, and the work is proceeding in the hope that a large quantity of this ore may be found. Since it is entirely beneath the water of the lake, it can be located only by drilling on the ice in winter, or by drilling long holes from the land during other seasons.

Acknowledgments

The writer wishes to acknowledge the very efficient service rendered by A. L. Prince, E. F. Hartwick, J. C. G. Moore, D. M. Bean, and N. L. Williamson, field assistants on his party. Mr. Prince is deserving of special praise for his conduct of the field work during the absence of the chief of the party on trips to other areas.

T. L. Tanton, who had previously done considerable work in this area and was again in the field in charge of a party from the Dominion Bureau of Geology and Topography, generously furnished information and exchanged views on the geology of the area, and to him the writer expresses his sincere appreciation.

Many persons in the area extended hospitality and aided the work of the party in various ways, and to all of them the writer takes this opportunity of extending his thanks.

Previous Work

The Atikokan area, because of its numerous interesting geological features, has been visited by many geologists. The Coutchiching problem, and the Steeprock and Seine series, have all led to a great deal of controversy, and there is an extensive literature dealing with the geology of the area. There are also a number of accounts of the mining properties worked many years ago in this and adjacent areas. Some reference will be made to the work of geologists and provincial mine inspectors in the detailed descriptions of certain formations and of some of the mining properties. A list of references to works bearing on the geology of the area follows:—

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Timber, Game, and Fish

The area at one time supported a good stand of pine, but this has been nearly all cut. In 1903 and 1904, large fires swept away most of the timber, but the northern part is now covered with second growth, which has reached sufficient size in many parts to provide some good stands of red pine, spruce, and jackpine. South of the railroad, most of the timber has been burned in recent years and, owing to the shallowness of the soil and its extensive destruction by fire, second growth is very slow in developing. Much of this section is desolate brulé.

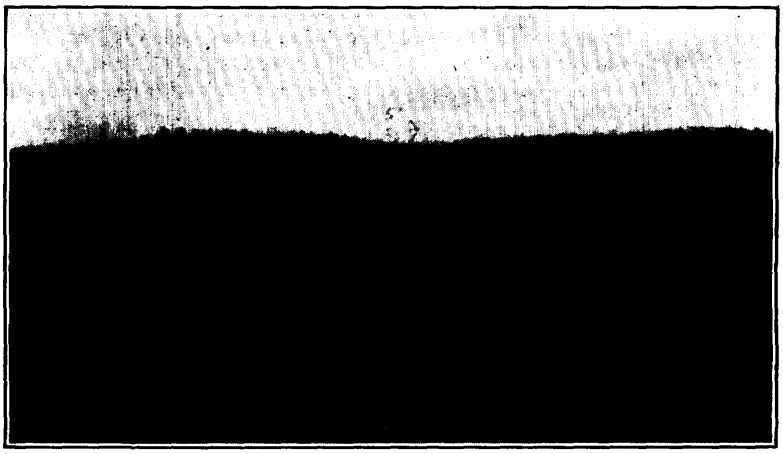
Moose and bears are fairly numerous in some parts of the area and a few deer were seen, but small game seems to be very scarce. There are some partridge, but very few rabbits or small fur-bearing animals. Some signs of beaver were found, but few of them were fresh.

Fish are abundant in some of the larger lakes removed from the railroad. Finlayson lake is noted for its very large lake trout, which reach over forty pounds in weight. A few lake trout also occur in Steeprock lake, and this species is found in a number of the other lakes in the area. Pike, some of large size, occur in most of the lakes and in the Seine river, and pickerel are common in a number of the lakes. Brook trout are reported from the stream flowing out of Miranda lake.

Topography

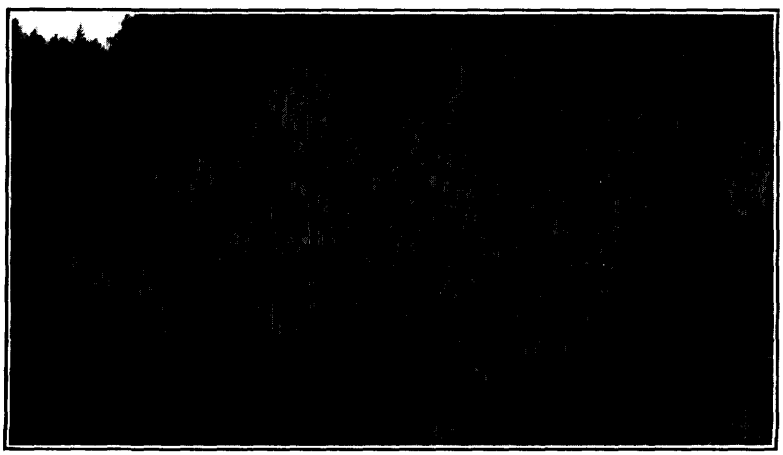
The village of Atikokan has an altitude of 1,284 feet, and there are few points in the surrounding area that rise more than 200 feet above this level. The Atikokan area as a whole, however, is very rugged and rocky. The basin of Steeprock lake is the most conspicuous topographic feature of the whole area. It is nearly surrounded by high hills, which are particularly prominent on the north side, and in sections of the shore vertical cliffs rise abruptly from the water. A large granite-greenstone hill at the north end of the Middle arm exposes a cliff that reaches 130 feet above the lake. The remnants of the Steeprock series, where they are exposed on the faces of the steep hills of granite and greenstone, also present many cliffs facing the lake and rising from 50 to 75 feet above the water. The rugged topography and variegated colours in the northern part of this lake make it one of the most beautiful in the province. Some of the hills of Keewatin greenstone rise to elevations of between 125 and 175 feet above

lake level. The lake is reported to have a maximum depth of 240 feet. Recent drilling for iron in the northern part of the Middle arm disclosed a depth of 150 feet of water, beneath which there is a layer of clay 150 feet thick. There is a difference of over 400 feet in altitude between the bottom of the lake and the



Keewatin lavas on the east side of the narrows,
West arm, Steeprock lake.

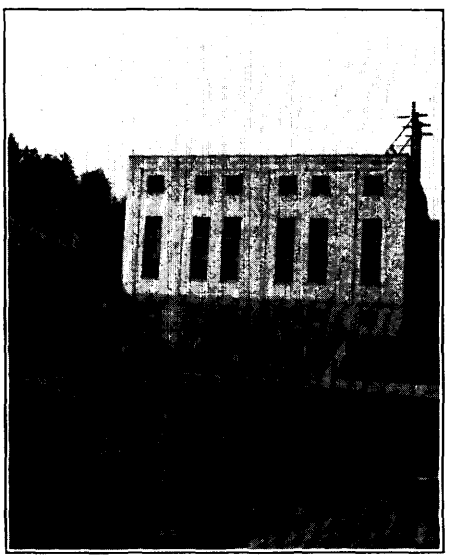
top of some of the hills near the shore. The basin has a marked sinuous outline due to its arms being underlain by sediments of the Steeprock series, which have eroded much more rapidly than the granite and greenstone that occupy the surrounding country.



Laurentian granite cliff, 130 feet high, north end of the
Middle arm, Steeprock lake.

The Seine river enters Falls bay on Steeprock lake at its northeast corner. The Ontario and Minnesota Power Company has a dam and power-house at a point where a deep channel has been cut through the rock to divert the water from its former course. At this plant there is a drop of 100 feet. During high

water a large quantity goes over a spillway and enters the lake by the old channel of the river, in which there is a fine falls of 45 feet. Marmion (Moose) lake has been raised by dams to 100 feet above the level of Steeprock, and at this elevation the relief becomes less. There are still prominent hills around Marmion and Finlayson lakes, but the topography is not so rugged as along the Seine River valley. The great areas of granite that occur in the northeast and northwest sections of the Atikokan map area present a more rolling surface than the areas in which greenstone is dominant, and rocky hills alternate with lakes and swamps. A general northeast-southwest trend in the direction of the lakes may be observed, as for example in Finlayson lake, where bands of schisted greenstone or sediments lie in the large granite areas. The action of glacial ice has also had an effect on the topography, as the glacier moved chiefly along a course S. 20° W.



Ontario and Minnesota Power Company's plant, head of Falls bay, Steeprock lake.

The valley of the Seine river is a major topographic feature, and at least parts of the valley show very youthful features. Its course is characterized by large and small lake expansions, separated by falls and rapids, and stretches of canyons. About two miles downstream from Steeprock lake the river drops over Tracy rapids through a narrow gorge. Between Tracy and Boyce rapids, greenstone hills rise to 75 feet or more above the river, and in places the stream flows between high cliffs. Below Boyce rapids, where the river runs over sedimentary formations, the shores are lower and have much gentler slopes.

The Atikokan river, in contrast to the Seine, has a fairly wide flood plain extending from its mouth to the falls at the first railway crossing east of the village. It is exceedingly crooked and meanders through an alluvial, swampy plain in which there are few exposures of bed rock.

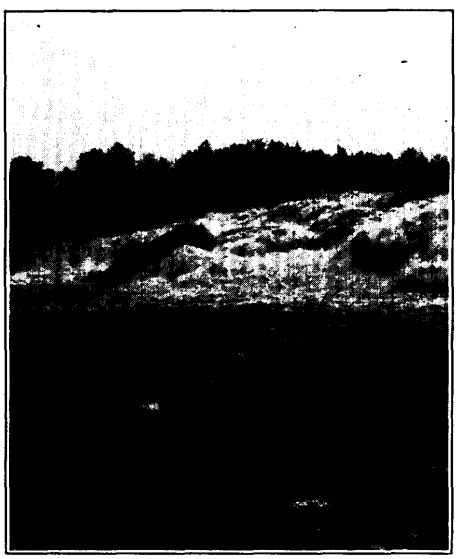
Near the west border of the area between Turtle and Niven lakes, a large area is rather flat, drift-covered, and swampy.

In the area south of the Canadian National railroad covered by the accompanying map, the topography is much less rugged than in the area north of the tracks. It is characterized by a series of rounded ridges, running nearly east-

west, with low cliffs in many places. There are no very prominent elevations, and on the whole the topography is much more monotonous than in the northern part of the area. There are numerous lakes and swamps, as there are in all parts of this section of Ontario. All the drainage in the northern part of the area is toward the Seine river, except that from Clearwater West lake, which flows to the north. In the southern part of the area, some of the lakes drain southwest into the Maligne and Quetico rivers.

Hydro-Electric Power

The Seine river provides a large supply of electric energy for use in this region. The Ontario and Minnesota Power Company has a series of power plants along this stream from Steeprock lake to Fort Frances. At the head of



Falls on the Seine river near Falls bay, showing excess water from Marmion lake during a period of high water.

Falls bay there is a power-house below a short dam 100 feet high. This dam crosses a channel blasted through solid rock and gives a head of 100 feet between Marmion and Steeprock lakes. The former lake furnishes a large reservoir, which has been greatly increased in size by placing another dam across its outlet a short distance north of the power-house. During periods of high water, over half of the water of the Seine goes over this dam. The timber was not cut from the shores of Marmion lake before the water was raised, and this reservoir is now a veritable maze of dead trees and islands and offers great difficulties in navigation to anyone who is not very familiar with the channels.

According to R. A. Mansfield, superintendent of the power plant on Steeprock lake, the plant furnishes about 15,000 horse-power when running at full capacity. It is connected with the plants at Crilly and others farther down the river by a power line that extends around the north end of Steeprock lake and down the Seine. This line has been connected with the Elizabeth mine, and sufficient electric power at reasonable rates seems to be available for any mining operations that may develop in the Atikokan area.

GENERAL GEOLOGY

There has been much controversy over a number of geological features of this area. The question of the presence of the Coutchiching and Seine series, the relations of the Seine and Steeprock, the position of the so-called Coutchiching with respect to the Keewatin lavas, and many other problems have arisen from time to time. The Steeprock is a unique series in many respects, and because of the lack of continuity of several of the formations for any great distance and the large amount of replacement and carbonatization that some of the rocks have undergone, it is very difficult to arrange its various formations in stratigraphical order.

On the Kenora sheet,[1] the sediments south of the Atikokan and Seine rivers are mapped as Coutchiching, whereas Lawson, Grout, and Hawley considered the northern part, which consists chiefly of quartz-sericite schists, as belonging to the Seine series. Lawson believed that the Seine series is younger than the Steeprock. Tanton has expressed the opinion that the Steeprock and Seine are contemporaneous, and in this conclusion the writer concurs, believing that they grade into one another. He agrees with Lawson and Hawley that the age of the quartz-sericite schists is the same as the Seine series.

Table of Formations

QUATERNARY	
RECENT:	Alluvial deposits in lakes and along rivers.
PLEISTOCENE:	Glacial drift, and fluvio-glacial deposits of gravel, sand, silt, and clay.
PRE-CAMBRIAN	
ALGOMAN:	Dikes and small bosses of gabbro, diabase, and diorite, some of which cut at least part of the Steeprock sediments. (They may be Algoman, since transitions between acid and basic dikes of the Algoman occur; some of them may be related to the igneous rocks of the Steeprock series; and a few may even be Keweenawan.)
	Hornblende syenite, granodiorite, monzonite, diorite, lamprophyre, and gabbro. Hornblende and biotite granite and gneiss, felsite, quartz and feldspar porphyries.
	Intrusive contact
TIMISKAMING: (Seine and Steeprock series)	Quartz-sericite schist, quartzite, arkosite, paragneiss, greywacke, and slate. (Seine and Coutchiching of Lawson, Coutchiching of McInnes and Tanton, and Seine of Grout and Hawley.)
	Ferruginous carbonate, replacing a number of older rocks and in places oxidized to iron ore.
	Dikes of felsite, diorite, and gabbro; intermediate to basic lavas, and agglomerate and tuff interbedded with sediments. (Some of the dikes may be Algoman in age.)
	Blue to grey limestone, partly crystalline.
	Conglomerate grading into quartzite, arkosite, greywacke, and quartz-sericite schist.
	Unconformity
LAURENTIAN:	Hornblende and biotite granite and gneiss with hybrid rocks, such as dioritic and chlorite-rich phases, along the contact with the greenstones.
	Intrusive contact
KEEWATIN:	Banded iron formation.
	Andesitic and basaltic flows in which pillows are common; basic intrusives; amphibolites; chlorite, hornblende, biotite, and sericite schists; agglomerate and tuff.

[1]Map 266A, Geol. Surv. Can., geology compiled by T. L. Tanton, 1933.

Keewatin

The Keewatin formations occur for the most part in an irregular band stretching across the area from east to west and lying north of the Atikokan and Seine rivers. There is a narrow zone running northeast along Finlayson lake, and several tongues extend northward from the main band north of Perch and Banning lakes. The rocks of this system are very similar to those of most other Keewatin areas. Andesitic lavas with pillow structure are the most abundant rocks, with some basalt and diabase, the latter forming the coarser, lower portions of the thick flows. While most of the greenstones show evidences of much alteration and some are changed to chlorite schists, some of the thick flows contain rather coarse diabase, which is relatively little altered, and the pyroxenes are quite fresh.

Cutting the lavas are dikes and other small intrusions of basic rock, whose relations to the lavas are such as to indicate that they are genetically related to



Keewatin agglomerate and tuff, north of Perch lake, Seine river.

them. These intrusions are generally diabase and gabbro, the gabbro being mostly changed to amphibolite. Rocks of this type are exposed on a lake lying between Eye and Righteye lakes.

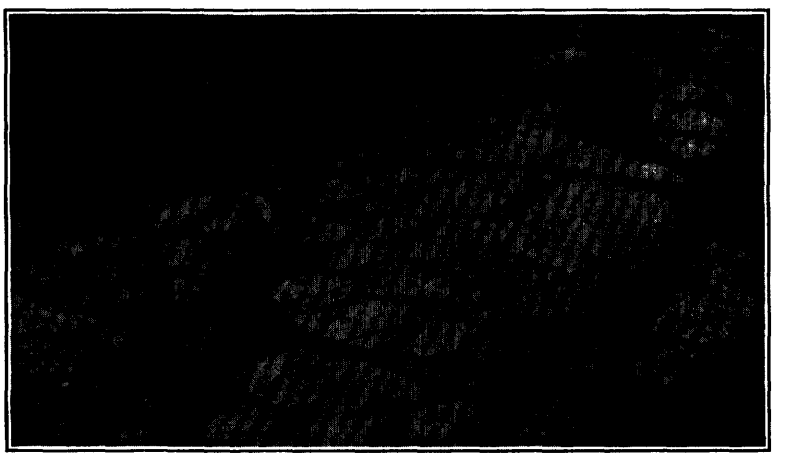
Very little rhyolite or other Keewatin acid rock is found in the area. A small body of rhyolite occurs on the south side of Dragon lake. In the upper part of the series of basic lavas there are alternating bands of sericite schist, chlorite schist, and greenstone. The sericite schists differ from the quartz-sericite schists of the sedimentary series south of the greenstone in the much smaller proportion of quartz that they contain. Their origin is uncertain, but it is believed that they are derived mostly from tuffs somewhat more acid than the typical greenstones, and possibly partly from lavas of similar composition. These rocks may be seen best along the Seine river at Tracy rapids and along the railroad track southeast of the rapids. They also occur southwest of Strawhat lake and in a number of other localities. Agglomerate and tuff are well exposed just north of Perch lake and southwest of Jackpine point on Steeprock lake. These rocks are interbedded with the Keewatin lavas in the upper part of the system.

Banded iron formation occurs in a number of localities, and most of it has been prospected. It is, however, a lean siliceous type and not of economic

importance. The largest body seen lies just south of the west end of Strawhat lake; and bands and lenses occur in the greenstone south and east of Atikokan and north of Perch lake.

Laurentian

The large mass of granite and granite gneiss lying north and east of Steeprock lake is considered as Laurentian. It is partly a biotite and partly a hornblende variety. Along the west border of the mass a zone of hybrid rocks, which is outlined on the accompanying map, contains a mixture of granite and Keewatin greenstone in which now one and then another of these rocks predominates, and there are dioritic intermediate phases. The granite is in many places highly chloritic and shows the effect of the inclusion of basic materials from the greenstone. The zone grades outward from the Keewatin-Laurentian contact into a body of granite with almost no remnants of greenstone.



Joints filled with silica in fine-grained Keewatin greenstone, half a mile north of Perch lake, Seine river.

The Laurentian granite is overlain unconformably by the basal conglomerate of the Seine and Steeprock series, as numerous boulders of Keewatin greenstone and Laurentian granite occur in this formation. The quartz and feldspar-rich phases of the granite constitute most of the boulders because of their greater resistance to weathering, but many boulders of the chloritic granite also occur.

Timiskaming (Seine and Steeprock Series)

The Steeprock and Seine series are placed in the Timiskaming system, since they lie between the Laurentian and Algoman in age. They have been highly deformed and show certain resemblances to the Timiskaming in other areas.

The name Steeprock has been applied since 1891 to a series of rocks found around the lake of that name.[1] In Smyth's original description, he had nine formations comprising the series. These were arranged in the following order, beginning at the base: conglomerate, lower limestone, ferruginous formation, interbedded crystalline traps, upper calcareous green schist, upper conglomerate, greenstone and greenstone schists, agglomerate, and dark-grey clay slate. He

[1]H. L. Smyth, "Structural Geology of Steeprock Lake, Ontario," Amer. Jour. Sci., 3rd Series, Vol. 42, 1891, pp. 317-331.

recognized that the basal conglomerate lay unconformably on the granite, which he designated as the "basement complex," in keeping with the use of this term at that time. He not only failed to recognize that the granite cut the Keewatin greenstone and that the Steeprock conglomerate was also unconformable upon it, but he included all the Keewatin around the lake in the Steeprock series. Two years later Smith recognized this unconformity,[1] but it was not until 1912 that a much more comprehensive account of the Steeprock series was published. Lawson[2] eliminated the Keewatin greenstone and schist from the series and reduced it to four formations: conglomerate, limestone, ferruginous formation, and interbedded crystalline traps. Tanton[3] later recognized that the ferruginous formation is a carbonate replacing other rocks and that it is not a fixed horizon.

The Steeprock is unique among the pre-Cambrian series, and it is very difficult to decipher its stratigraphy because some of the formations only occur in limited areas and the character of others changes rapidly from point to point

Conglomerate

A boulder conglomerate forms the basal formation of the Steeprock and also of the Seine in many places. It lies unconformably on the Laurentian granite and Keewatin greenstone. The unconformable relations are quite definite, because boulders of granite and greenstone occur in the conglomerate where it rests on these rocks in a few places. In the coarser phases of the conglomerate, boulders up to 2 feet in diameter and pebbles of the more quartose phases of the granite constitute the bulk of the formation. Where the rock consists of small pebbles, these are mostly quartz with some chert and granite. Pebbles of the chloritized granite are numerous in part of the conglomerate, and greenstone or chlorite schist in others. Few pebbles of porphyry and other rocks are found.

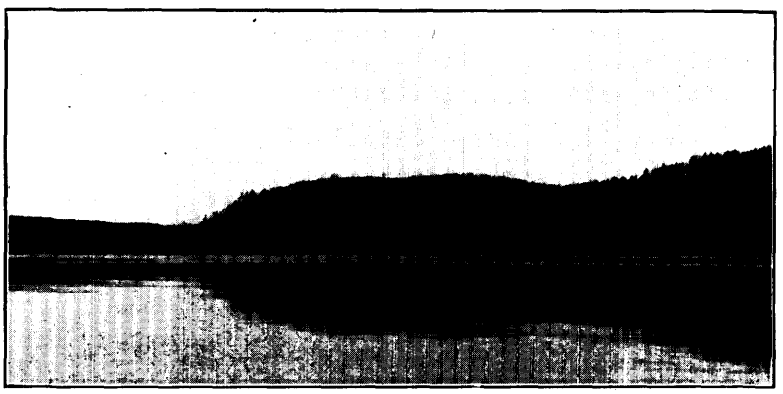
The conglomerate varies greatly in thickness. Smyth placed it at 100 feet, but he saw it only around the shores of Steeprock lake, where it is comparatively thin. The largest mass of this rock occurs about half a mile south of Strawhat lake in the form of a broad band, and the thickness of the formation is estimated at 1,000 feet. An accurate determination of the thickness in this outcrop is not possible because of cross-folding, and the rock stretches clear across a syncline, the depth of which is not known. The formation is practically restricted to the contact of the Steeprock series and the granite or greenstone, but a few lenses occur higher in the series, as for example, on the north side of the Atikokan river at points half a mile and one and a half miles west of the village. The two lenses lie in the greywacke and quartzite, but they are almost in line with a tongue of greenstone coming in from the east and seem to be on the crest of an anticline.

Patches of conglomerate of a similar character occur on the east and west shores of Finlayson lake, 2½ miles north of its south end, where it forms the basal member of a series of clastic sediments. A lens of this rock, one and a quarter miles long and 500 feet wide, lies wholly in the greenstone on the Rebair property northeast of Modred lake. Another band stretches for one and a quarter miles along the contact between the Keewatin greenstone and the quartz-sericite schist, where it crosses the narrows between Banning and Chub lakes. About 3,000 feet northwest of Jackfish lake there is still another lens of similar

[1]W. H. C. Smith, "The Archean Rocks West of Lake Superior," Bull. Geol. Soc. Amer., Vol. 4, 1893, pp. 333-348.
[2]A. C. Lawson, "The Geology of Steeprock Lake, Ontario," Geol. Surv. Can., Mem. 28, 1912.
[3]T. L. Tanton, "Mineral Deposits of Steeprock Lake Map-Area, Ontario," Geol. Surv. Can., Sum. Rept. 1925, pt. C, p. 3.

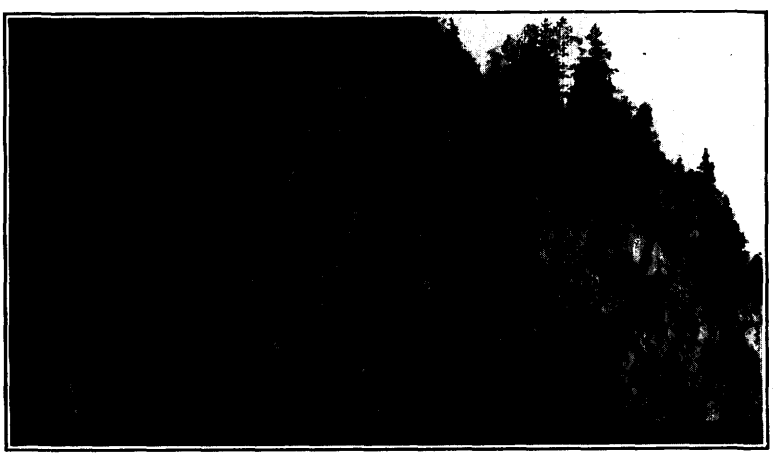
rock lying close to the contact of the quartz-sericite schist and the Keewatin greenstone.

In all of the large area of quartz-sericite schist and paragneiss covering the southern part of the map area, only three very small lenses of conglomerate were



Point of Steeprock sediments and breccia at entrance to Wagita bay, West arm, Steeprock lake. The depression in the foreground marks the contact between the Steeprock series and the Laurentian granite.

found. These lie south of Olympia lake. Two small patches of a coarse conglomerate were seen on Miranda lake, one on a small island and the other on the west shore. They are surrounded by granite, and their relations to this rock could not be definitely determined. They may be remnants of a much larger



Cliff of the Steeprock series, near the north end of the Middle arm, Steeprock lake.

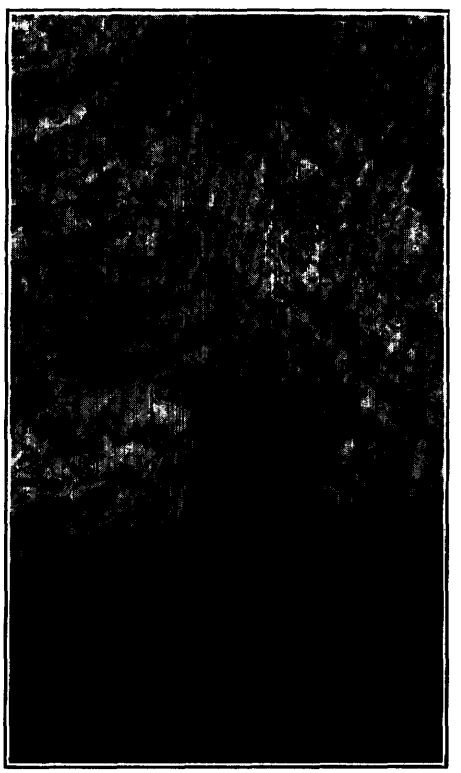
body of conglomerate intruded by the granite. A little conglomerate intruded by granitic rock was seen near the cook camp on the Rebair property.

The conglomerate gives place rapidly along the strike of the formations to arkosite, quartzite, or greywacke and grades upward stratigraphically into these

rocks. The arkosite and impure quartzite where sheared are changed to quartz-sericite schist.

Limestone

Most of the real limestone is easily recognized in the field by its bluish colour. The blue rock grades to grey, and in some of the weathered outcrops it is nearly white. This rock is readily distinguished from the ferruginous formation, which invariably weathers to yellow, brown, or red tints, but the two grade into one another in many places, as the calcium carbonate has been extensively replaced by the ferruginous carbonate. The blue limestone is largely crystallized and



Banded blue limestone, north end of the Middle arm, Steeprock lake.

highly deformed, and part of it is silicified. Numerous stringers of silica traverse the beds and laminate the formation, and very intricate structural patterns may be observed. A careful search was made for fossils, and while there are numerous structures that strongly resemble some of those due to organisms, no definite fossils could be found. Lawson[1] found what he regarded as fossils, and these were identified for him by Walcott, one of the foremost authorities on early forms of life, and given the generic name *Atikokania*. One species was called *A. lawsonii* after its discoverer. These organisms were regarded as possessing some of the characters of both the *Archaeocyanthinae* and the sponges. At least one of

[1]A. C. Lawson, op. cit.

Walcott's figures shows what appears to be a definite fossil, and the writer believes that low forms of life existed at the time these rocks were formed but he did not succeed in finding any structures that he felt sure were fossils.

Part of the blue limestone is quite pure, but the formation grades into quartzite and ferruginous carbonate in many places. An analysis of the purer rock from the outcrops on the north shore of the Middle arm of Steeprock lake showed the following composition:—

	Per cent.
Insoluble	1.40
Iron oxide and alumina	.40
Lime	53.70
Magnesia	.80
Carbon dioxide and water	43.41
Manganese	trace
Total	99.71

Analysis by A. T. Prince, University of Toronto.

This analysis shows that the purer limestone is sufficiently free from impurities to be burned for lime or used for blast-furnace flux. The quantity of such rock is, however, not large. The formation has been found in limited areas around Steeprock and Strawhat lakes, but it is believed to exist in much larger volume beneath the waters of Steeprock lake, where it has been cut by the drill near the north end of the Middle arm, and probably beneath drift north of Strawhat lake. A little of this rock lies along the greenstone contact south of Atikokan, but there is none of it with the sediments around Finlayson lake or south of the Seine river. It must have been formed in the deeper portions of the basin in which the Steeprock series was deposited, where clearer waters prevailed. It is believed that the Steeprock series was deposited on the eroded Keewatin-Laurentian surface, in which there was marked relief.

The thickness of the limestone beneath Steeprock lake is not known, but it reaches approximately 500 feet on a point in the East arm and about 300 feet in the Middle arm. In the Middle arm most of the rock is not pure limestone but is mixed with quartzite and partly replaced by silica and ferruginous carbonate. Large blocks of blue limestone occur in the breccia around the north end of the Middle arm.

Lavas, Dikes, and Pyroclastic Rocks

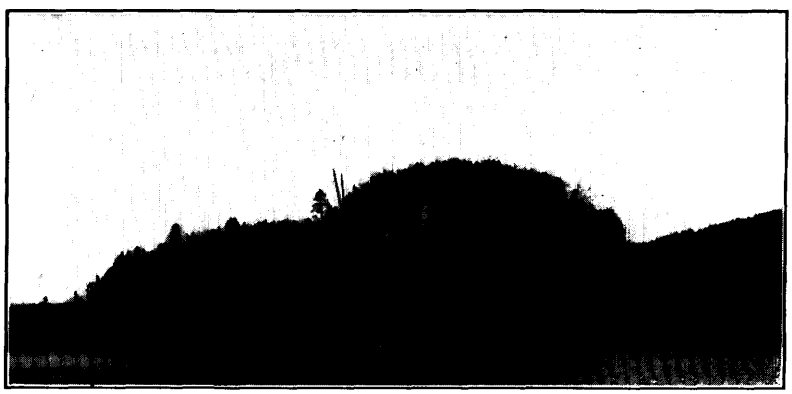
The igneous formations associated with the Steeprock sediments comprise lavas and dikes and the pyroclastics, agglomerates and tuffs. Some of the previous writers on the Steeprock included in this series large bodies of lava that are here assigned to the Keewatin. These are located west of the East arm of Steeprock lake and north of Strawhat lake. It is often very difficult in the field to distinguish some of the sheared greywacke containing quartz grains from the sheared Keewatin greenstones that lie near the Laurentian granite and have been somewhat silicified. In the areas mentioned, however, tongues of Keewatin can be followed from the main body northward between bands of Steeprock sediments that lie in narrow synclines in the greenstone. Some of these tongues contain pillows, a feature very characteristic of the Keewatin flows but not found in any of the Steeprock lavas. There is a relatively small amount of lava in the Steeprock series, but it is believed that some of it has been replaced by ferruginous carbonate.

On the east side of Wagita bay, Steeprock lake, a large number of fragments of lava are found in the breccia forming the high red cliff. The rock is too highly altered to permit an accurate petrographic description, but several specimens

containing orthoclase, quartz, sericite, and carbonate can be recognized as igneous in character and of acid to intermediate composition.

The area around Strawhat lake is the best for the study of the Steeprock lavas. On the small island in this lake, on the mainland opposite, and in the northwest corner of the lake, distinct lava flows are exposed. A band of basaltic tuff on the south side of the island is followed by fine-grained, amygdaloidal basalt containing epidote and zoisite as alteration products. North of the basalt is a coarse-grained rock consisting of oligoclase, augite, and hornblende, with chlorite, kaolin, and leucoxene as alteration products. The composition is that of a basic diorite.

Half a mile north and one mile northwest of Atikokan, basic lavas are interbedded with tuff and agglomerate, and in some outcrops the pyroclastics are cut by gabbro dikes, which are believed to be genetically related to the lava flows. There are other basic dikes in the vicinity of Steeprock lake that may be related to these intrusions.



Steeprock limestone and quartzite on a point in the East arm, Steeprock lake.

On the south side of the Atikokan river, one-eighth of a mile above its mouth, a small outcrop of carbonated igneous rock is exposed in a clay bank. In the field it strongly resembles a dark-grey, carbonated sedimentary rock, but in thin section it is distinctly igneous and low in ferromagnesian minerals and consists chiefly of plagioclase in a much less altered condition than that in the Keewatin greenstone. It contains some introduced magnetite and has the composition of an andesitic lava.

Tuff and agglomerate outcrop on the southeast corner of Strawhat lake, on the island in the lake, just north of the lake, and north and northwest of Atikokan. A long diamond-drill hole bored by Jules Cross from the west shore of the Middle arm of Steeprock lake cut a wide band of tuff beneath the lake. The tuff and agglomerate in the Atikokan area consist chiefly of fragments of the lavas of the Steeprock series and range from basic to intermediate in composition. Specimens examined in thin section contained some magnetite, and this seems to explain the magnetic deflections obtained by Mr. Cross when prospecting for iron ore over the Middle arm of Steeprock lake. Tuff, not the iron ore, was found beneath the area where the deflections were observed.

The lavas and pyroclastics are found interbedded with clastic sediments, including arkosite, quartzite, greywacke, and slate, and cutting all these rocks

are a few dikes of gabbro, diorite, and felsite. At the north end of the Middle arm of Steeprock lake a dike of felsite 16 inches wide cuts the impure limestone near the water's edge. East of the large cliff near which the above dike occurs is another dike 25 feet wide, running N. 50° E. from the shore. It is a fine-grained diorite containing andesine, a little orthoclase, abundant hornblende, and a few grains of zircon and magnetite. Beside the creek at a point five-eighths of a mile west of the northwest corner of Margaret lake, there are two felsite dikes cutting the Steeprock conglomerate. One of these is 4 feet in width and the other 3 inches. Gabbro dikes cut the tuff and agglomerate, and a few occur out in the Keewatin greenstone in areas west of Margaret lake and east of Dismal lake.

Some of the basic dikes described seem to be related to the Steeprock lavas, but the more acid dikes may be Algoman in age.

Ferruginous Carbonate Formation

Owing to the fact that the rock composing the ferruginous carbonate formation originated by replacement of other formations, its position in the Steeprock series varies from place to place. It appears to have formed through the action of hot waters and possibly gases escaping from the magma, and by ground waters heated by the magma that supplied the igneous rocks of the Steeprock series and caused the occurrence of the tuff and agglomerate. The ferruginous carbonate replaces and veins the limestone, and it has replaced tuff, breccia, and igneous rocks. It is found in many places around Steeprock lake and along the Seine river as far downstream as Tracy rapids. Its distribution is somewhat similar to that of the igneous rocks, and it does not occur with the sediments regarded as Steeprock in age on Finlayson lake, where igneous rocks of this series are not present.

The following analyses show that the carbonate does not conform in composition to that of any standard mineral. It approaches more nearly to ankerite than any of the other carbonates, since it contains both iron and manganese in addition to lime and magnesia. It is not a pure carbonate, but contains considerable silica, in the form of chert, jasper, and quartz, which varies for different specimens, owing to the varying degree of replacement of different rocks and the introduction of silica into the formation in different proportions at different points.

Analyses of Ferruginous Carbonate from Steeprock Lake

	No. 1	No. 2	No. 3	No. 4
	per cent.	per cent.	per cent.	per cent.
Insoluble	11.08	7.76	7.44	[1]26.46
Iron oxide and alumina	3.72	10.22	5.84	8.04
Lime	27.74	30.82	27.24	20.34
Magnesia	16.62	11.60	16.87	9.63
Carbon dioxide and water	40.36	39.52	41.84	26.32
Manganese (not quantitatively determined)	present	present	present	present
Total	99.52	99.92	99.23	90.79

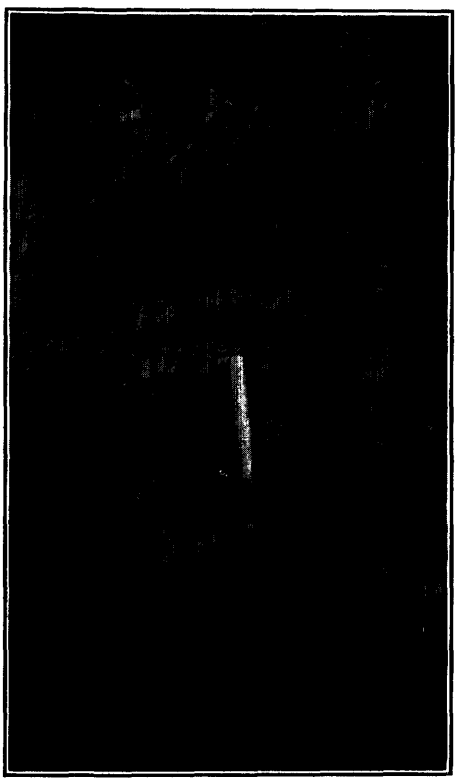
Analyses of specimens Nos. 1, 2, and 3 by A. T. Prince, University of Toronto.

Specimen No. 1—From the west shore of Wagita bay, West arm, Steeprock lake.
Specimen No. 2—From the east side of an island in Wagita bay.
Specimen No. 3—From the north end of the Middle arm, Steeprock lake.
Specimen No. 4—From Elbow point, Steeprock lake. Analysis by A. G. Burrows, reported by W. G. Miller.[2]

[1]Silica.
[2]W. G. Miller, "Iron Ranges of Northern Ontario," Ont. Bur. Mines, Vol. XII, 1903, p. 307.

Another analysis by Burrows of a specimen from a pit on Elbow point and quoted by Miller,[1] showed 3.00 per cent. metallic iron and 12.32 per cent. manganese.

The ferruginous carbonate has been extensively oxidized, and red, brown, or yellow outcrops mark practically all exposures of the formation. Cliffs of this formation are striking features of the shores of Steeprock lake. Oxidation has given rise to bodies of hematite and limonite, the former of considerable size.



Breccia on a point near the north end of the Middle arm, Steeprock lake.

The nature and occurrence of the hematite deposits will be discussed under "Iron Deposits" in the section of this report dealing with Economic Geology.

Metamorphic Sediments South of the Atikokan River

There is a broad band of metamorphic sediments lying south of the Atikokan and Seine rivers, which have been classified in different ways by several of the geologists who have previously worked in this area. Lawson considered the northern part, consisting chiefly of quartz-sericite schist with a few bands of conglomerate, as Seine in age and the southern part, which consists chiefly of paragneiss, as Coutchiching. Tanton and Grout have regarded these formations as part of the same series; while Tanton classifies them as Coutchiching, Grout

[1]W. G. Miller, op. cit., p. 306.

places them in the Seine. McInnes also called them Coutchiching, but Hawley regarded them as Seine. Tanton and the writer agree that the Seine and Steeprock are contemporaneous; and the writer believes that the Steeprock sediments north of the Atikokan river grade into the mica schists to the south and, therefore, that there is no Coutchiching in the area. Some of the arkoses around Steeprock lake where highly schisted are almost identical with the mica schists along the south side of the river, and there are gradations between the so-called Steeprock and Seine sediments. Further, there are bands of conglomerate at the base of the mica schists at a point half a mile northwest of Jackfish lake and around the east end of Banning lake in which the rock, which is similar to the conglomerate of the Steeprock series, grades upward into the mica schist and is part of the same series. In no place was the granite that is considered as Laurentian found cutting either the Steeprock or Seine formations, but these are cut by the later Algoman[1] granite.

The tongue of Keewatin greenstone and banded iron formation coming in from the east and ending half a mile southeast of Atikokan is cut by Laurentian granite and has Steeprock sediments surrounding its west end. It is unquestionably due to an anticline that brings to the surface the Keewatin greenstones lying beneath the mica schists.

This broad band of metamorphosed sediments lying south of the Atikokan river is very monotonous in character. The chief rock is arkose, metamorphosed in the northern part to quartz-mica schist and in the southern to paragneiss. The two types of rock grade into one another. The schist shows evidence of more shearing and this is due to the thrusting of the series against the more resistant mass of Keewatin greenstone and granite lying to the north. The schist gradually gives place southward to the hard, more massive paragneiss, which exhibits the influence of the large intrusions of Algoman granite that are shown in the southern part of the map-sheet. In some places, the paragneiss is metamorphosed to special types of rock, as for example cyanite schist and staurolite-garnet gneiss at the northeast end of Abbess lake. The paragneiss in some places where there is less shearing is found as far north as the Seine river. Hawley[2] has produced evidence of a large fault marking the schist contact with the Keewatin greenstone in the Sapawe Lake area. Along the railroad, just east of Atikokan, the rocks are greatly sheared and disturbed, indicating that in this section the fault is passing to the west into a shear zone, which dies out in the Atikokan area. There is no definite evidence of an important contact fault west of the village of Atikokan.

The paragneiss is distinctly banded in many places, the bands in some cases showing a coarser and a finer grained division. Attempts were made to distinguish the top from the bottom of the beds by observing the relations between the coarser and finer layers in the bands, but the results were not sufficiently regular to be of much value in working out structure. There are zones of quartzite and a few small lenses of conglomerate in the paragneiss; the rock is otherwise remarkably uniform in appearance. It weathers grey to brown, and in most places very little soil is found on its surface. On account of its shallowness,

[1]If it be admitted that the Seine and Steeprock series are contemporaneous, it would seem wise to drop one of the terms from the time scale. The term Steeprock has priority in use, but it applies to a series much more restricted in distribution, although a much more varied and unusual group of formations. Probably, all things considered, the term Seine would be the more suitable one to apply to the two series formerly known as Seine and Steeprock. They are regarded as equivalent to the Timiskaming in age.

[2]J. E. Hawley, "Geology of the Sapawe Lake Area, with Notes on Some Iron and Gold Deposits of Rainy River District," Ont. Dept. Mines, Vol. XXXVIII, 1929, pt. 6, pp. 16, 17.

nearly all the soil was removed from the surface by severe forest fires, and it is difficult for the forest to re-establish itself on the knolls and ridges.

Algoman

It is difficult to decide how much of the granite and granite gneiss in the Atikokan area should be classed as Algoman and how much as Laurentian. It has been accepted by several geologists working in this region that the large area of granite and gneiss in the northeastern part of the map-sheet is Laurentian and that to the south of the Atikokan river is later and probably Algoman. These granite masses are separated by large bodies of greenstone and sediments.

There is a third large area of granite in the northwestern part of the area, which is separated from the other two and which is regarded by the writer as Algoman. This granite intrudes the Keewatin greenstone and, in two places only, sediments of the Seine-Steeprock series. On the northwest side of Finlayson lake, 3½ miles north of its south end, a tongue of these sediments appears to be cut off by the granite; and on the Rebair property, northeast of Modred lake, a small body of conglomerate is cut by granite.

Associated with the Algoman granite along the south border of the map and with the mass in the northwestern part of the area, large numbers of acid, intermediate, and basic dikes occur. It seems probable that the granite underlies, at no great depth, large areas where it is not exposed at the surface, and these dikes are offshoots from a mass of this rock. It may be observed that near the south border of the area, granite is exposed in a number of the larger lake basins, but not in the higher lands around them. Bewag, Abbess, Jim, and Nym lakes are good illustrations of this feature. The proportion of acid dikes increases greatly in the vicinity of the large areas of granite, and it is worthy of notice that the quartz porphyry dikes cutting the Keewatin area, mapped as Laurentian by Hawley in the Sapawe Lake area, are most numerous in the one area where the Algoman granite occurs. This raises a question as to whether these dikes are not also Algoman.

There is in the area, a great variety of igneous rocks so intimately related to one another that they must all be classed as Algoman. There seem to be all gradations from such acid rocks as aplite and granite to gabbro and lamprophyre, through such intermediate types as syenite, granodiorite, and diorite. The granite is mostly the biotite type, but there are areas in which hornblende is dominant, and the syenite is the hornblende type.

Near the south border of the area dikes of the following varieties have been recognized: pegmatite, aplite, felsite, granite, syenite, monzonite, kersantite, granodiorite, diorite, lamprophyre, and diabase. These are interrelated in such a way that it is very difficult to separate them into intrusions of different geological periods. For example, on the east side of Bewag lake a granite dike distinctly cuts a biotite-hornblende lamprophyre dike, and on the north side of Abbess lake diorite dikes cut felsite dikes. The small bosses and stocks of gabbro, which in many cases are now altered to amphibolite and which cut the paragneiss, may be later than the Algoman; but in some places, these bodies show differentiation into a granodiorite phase. Two of these stocks occur just south of Plateau lake, and one of them contains a little nickel and platinum.

A similar series of dike rocks occur in the area north of Banning, Chub, Perch, and Modred lakes and south of the main granite mass in the northwestern part of the map-sheet. In this area there are granite, felsite, quartz and feldspar porphyry, hornblende syenite, dacite porphyry, camptonite(?), lamprophyre, diabase, and gabbro dikes. The gabbro and hornblende syenite occur mostly in

stocks or bosses, as they do in the southern part of the area, and they seem to bear much the same relations to the granite that they do there. There is no way of deciding definitely whether they belong to the Algoman period of igneous activity or to a later period. On the property of the Elizabeth mine, a lamprophyre dike cuts a quartz vein and quartz veins cut the granite and porphyry dikes.

Several dikes of felsite and at least one of diorite that cut the Steeprock sediments occur around Steeprock lake. These are probably of Algoman age. The gabbro dikes that cut some of these sediments may also belong to the series of gabbro intrusives associated with the Algoman dikes, or they may be related to the Steeprock igneous formation.

Keweenawan(?)

As indicated above, there are certain intrusions of gabbro and diabase that may be Keweenawan, but their close petrographical and geographical relations suggest that they may be phases of the Algoman magma. They are not typical of either the quartz diabase or the olivine diabases so characteristic of the Keweenawan formations in other areas.

Pleistocene

The area has been extensively glaciated, but there is less than the average cover of drift over its surface. Rock outcrops are unusually abundant and, except in the large granite area in the northwestern part, there are no large sections heavily covered with drift or sand plains. The striations indicate that the ice moved in most sections of the area from south to S. 20°W. In some places, two sets of striations may be seen. These are quite distinct on the south shore of Steeprock lake, about half a mile east of Overflow on the railway. Here the older striations strike S. 20° W., and the younger S. 40° W. The direction of movement of the ice is of some importance in this area because the finding of glacial boulders of good hematite ore led to the search for the ore in place. It was finally located beneath the water in the Middle arm of Steeprock lake.

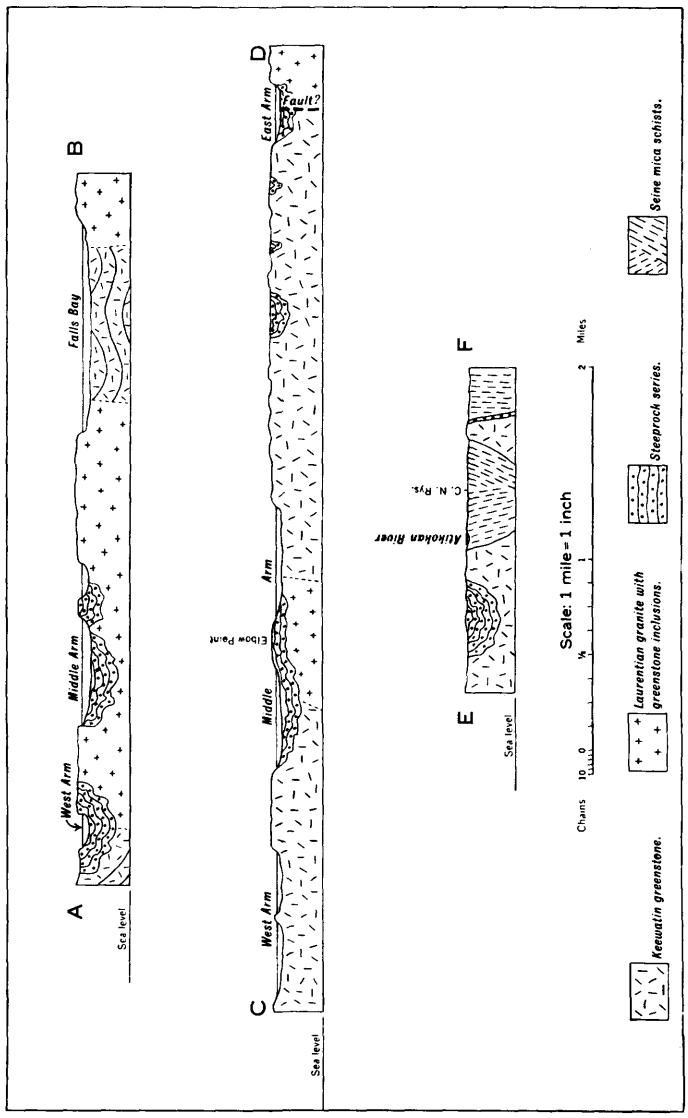
STRUCTURAL GEOLOGY

The presence of the three major granitic masses in this area has greatly affected the structure. They have served to some extent as the more competent masses, and the greenstones and sediments have been compressed between them and now occupy large troughs between the bodies of granite. The intrusion of the Laurentian batholith is believed to have been accompanied by compression and folding of the Keewatin greenstone, but this disturbance has been largely masked by the later disturbances that accompanied the great igneous activity of the Algoman. All the sediments in the area were greatly affected by this orogeny, and practically all the beds dip at high angles.

Folding

The sediments around Steeprock lake have been affected by at least two disturbances, one due to compression in a direction between northeast-southwest and east-west. The resulting movement was the chief cause of the folding of the Steeprock series; after erosion removed the anticlines the synclines remained in the bottom of the arms of Steeprock lake. The evidence of the presence of these synclines is found in the remnants of the sediments scattered along the

shores of the three arms and in drilling in the bottom of the lake. It is believed that the sediments were deposited on an irregular Keewatin-Laurentian erosion surface and that the depressions in this surface were deepened as a result of the folding. The arms of the lake follow the direction of strike of the major folds, superimposed on which were many minor anticlines and synclines; the remnants of some of the former remain in the Keewatin greenstone west of the East arm



Sections showing interpretation of the structure around Steeprock lake and near Atikokan, along lines A-B, C-D, and E-F on map No. 48a accompanying this report.

(see photographs on page 4). The cleavage in the schisted greenstones tends to parallel the rim of the lake in most places, but it is greatly disturbed around the narrows between the West arm and the Middle arm and shows a roughly east-west trend.

A second movement, which was due to a thrust from the south, which was stronger in the eastern than in the western part of the area, caused cross-folding

along the East arm of Steeprock lake, faulting along the Keewatin-Seine contact east of Atikokan, and shearing and schisting in a large area south of the Atikokan river. Evidence of this cross-folding is seen in the sharp changes in the strike of the sediments along the East arm, from nearly northwest through north to almost northeast, and in the large number of small drag folds overturned to the north. A marked jointing and schisting runs through the rocks in the vicinity of the East arm, trending northeast to N. 60° E.

Several attempts have been made by various geologists to settle the Coutchiching problem by a study of the dip of the pillows in the Keewatin greenstone and the dip of the cleavage in the mica schists, on the opposite sides of the contact between these rocks. The results of the study of grain size and the strike and dip of the cleavage in the sediments has been fully discussed by Hawley.[1] The schists and paragneisses lying between the contact with the greenstone to the north and the Algoman granite to the south all stand practically vertical, the dip seldom departing more than 15 to 20 degrees from this position, which indicates that the beds are isoclinally folded. When the dip departs from the vertical, it may be north or south, and in some places both north and south dips were found within a few feet of one another. Northerly dips are a little more numerous than southerly, especially where shearing is most intense. In a long stretch of the contact between Tracy rapids and Perch lake, where there is a very uniform contact running regularly about N. 85° E., the dip rarely varies from vertical. It is in the section farther east where the strike, which is dominantly about N. 85° E., departs from this direction locally that the greatest changes in dip occur. South of Atikokan, there are many small drag folds in the mica schists and paragneisses that might be expected to furnish a key to the direction of the major thrust. The strike of their axes, however, is nearly vertical, and some of them are overturned to the northwest and others to the northeast. There is not sufficient regularity in their attitudes to furnish definite evidence regarding the direction of the major movement, beyond the fact that it has been northward.

Careful attention was paid to the dip of the pillows in the Keewatin greenstone, especially near its contact with the mica schists, to determine if possible the prevailing direction of the dip of the lavas. The direction was found to vary considerably, and although in a few places it was to the north, suggesting that the lavas lay on top of the sediments, it was not sufficiently regular to settle the relative age of lavas and sediments.

Faulting

Faulting on a small scale is fairly widespread, and a few major faults have been recognized. The fault described by Hawley in the Sapawe Lake area to the east seems to extend into the Atikokan area and die out in extensive shearing just east of Atikokan. Apparently the thrust was greater towards the east than towards the west end of the faulted zone, and a differential throw resulted.

Several geologists have indicated a large fault running northeastward from a point near Atikokan and passing between Margaret lake and the East arm of Steeprock lake. The writer could find no definite evidence of the presence of this fault. Some evidence against such a fault is found in the presence of a small body of sediments, which are believed to be Steeprock in age, on what would be the upthrow side of the fault as indicated.

Faulting is suggested by the prominent cliffs around the north end of the Middle arm and the northeastern part of the West arm of Steeprock lake. The field observations rule out faults, unless of pre-Steeprock age, in the West arm,

[1]J. E. Hawley, op. cit., p. 15.

and there is no evidence of the fault on Birch point that was indicated by Smyth.[1] There is evidence, however, of the existence of one or more faults in the bottom of the Middle arm near the northwest end. This evidence has been furnished by recent drilling beneath the lake. The granite cliffs along the shore strongly suggest faulting in this area, but the relations of the Steeprock sediments on the land did not seem to the writer, at the time his field work was done, to permit the presence of faults on the land.

It is probable that the East arm is situated along a fault, judging by the regularity in its form and direction and the disturbed condition of the strata along its shores. It lies between high hills, some with steep cliffs facing the lake, and it also has the appearance of a former river channel, which might have been occupied by a stream in pre-Pleistocene time.

From the topographical features of several sections of this area, it is probable that a number of other faults of considerable magnitude exist in the Keewatin greenstone, but there are no key horizons that can be utilized to determine the size and nature of these faults. There is much evidence in the topography just northeast of Dismal lake that a north-south fault cuts the greenstones in this area.

A number of prominent bodies of breccia occur on the shores of Steeprock lake. These are well exposed at the north end of Falls bay, around the north end of the Middle arm, and on the east side of Wagita bay. This material is a crush breccia, due apparently to folding of the sediments over resistant ridges of Laurentian granite and to a mashing of the sediments against these granite masses by a thrust from the south. The breccia in nearly all cases occurs where the sediments abut against prominent outcrops of granite. Faulting, now concealed by the waters of the lake, may also have played a part in the origin of some of this rock.

The breccia consists of fragments, some of them several feet in diameter, of blue limestone, quartzite, igneous rocks of the Steeprock series, Laurentian granite, Keewatin greenstone, and other rocks. It is cemented with silica, ferruginous carbonate, and calcite. The ferruginous carbonate is nearly everywhere partly oxidized, and remnants of breccia, where exposed on the faces of granite hills, forms striking topographic and scenic features. Many solution caverns occur in this material, and a large cave may be seen on the prominent point near the northeast corner of the Middle arm.

ECONOMIC GEOLOGY

This area has almost continuously attracted the attention of prospectors since about 1890, and several discoveries were made and shafts sunk before the close of the century. These properties were all worked for gold. The Atikokan iron deposits, situated about 22 miles east of Atikokan, were apparently known from 1882; and when development work began to be actively carried on in 1900, with production commencing a few years later, great interest was shown in the search for iron and iron pyrites. The building of the main line of the Canadian Northern railway between Port Arthur and Winnipeg, through Atikokan, opened up a large area and stimulated further prospecting.

Such properties as the Elizabeth and Harold Lake produced gold for a few years, but have been idle until recently. The Sawbill and other properties just outside of the northeast corner of the map-area were active during the latter part of last century, and the Sawbill has recently been reopened. During the

[1]H. L. Smyth, op. cit.

summer of 1937 the Rebair property was under development, and a considerable amount of prospecting was being done on the old Harold Lake property. Some prospecting for gold was also going on in a few other sections of the area. Practically the whole of the area north of the railroad, except the large granite sections, has at some time been staked. The larger greenstone areas hold out no promise to the prospector. On the other hand, the presence of large intrusions of Algoman granite, with which are associated numerous dikes of porphyry, syenite, lamprophyre, and other rocks, as well as quartz veins, suggest that this area has many geological features favourable for the occurrence of gold deposits. In the metamorphosed sediments south of the railroad, small quartz veins and stringers are very numerous, but their small size and generally barren nature make them unpromising to the prospector. The majority of the deposits that have been developed occur in the Keewatin greenstone or in granite, either where small bodies of greenstone have been included in this rock or near the contact of the granite with the main bodies of greenstone. Where the deposits are out in the greenstone, they are usually associated with porphyry, felsite, lamprophyre, or other dikes. A little nickel-platinum ore has been found in gabbro south of Plateau lake.

Iron Deposits

A body of hematite has recently been discovered beneath the water near the north end of the Middle Arm of Steeprock lake. The presence of boulders of good-grade hematite on the south shore of the Middle arm and also on the south side of the Seine river between Steeprock lake and Tracy rapids was the cause of an extensive search for their source. Jules Cross was largely responsible for the initiation of a campaign of diamond-drilling in the lake bottom after the discovery of marked magnetic deflections obtained on the ice of the Middle Arm. The Steerola Exploration Company was organized, and a number of holes were drilled during the autumn of 1937 and throughout 1938. In winter the drilling was done on the ice, and in the summer from the shores of the lake. The first hole was started on the west side of the Middle arm just south of the channel between this and the West arm. This hole indicated, according to Mr. Cross, that there was a body of tuff beneath the lake that contained sufficient magnetite to cause the magnetic deflections observed, and that these were not due to the hematite deposit. Some evidence of faulting in the bed of the lake was also found. Later drilling on the ice in winter disclosed the presence of a body of hematite at least 700 feet long by 500 feet wide. The thickness of this deposit was at least 30 feet, but drilling was not extended to the bottom because of the great difficulty in handling the sludge beneath the clay and water. It was found that the water was 150 feet deep over the ore and that there was 150 feet of clay in the bottom of the lake.

That this body of good hematite was formed by the leaching and oxidation of the ferruginous carbonate, limestone, and breccia during pre-Pleistocene time, there seems to be no doubt. The iron oxide was deposited in the deep depression between the high granite hills, which furnished a head for descending meteoric waters, and faulting in the lake bottom no doubt played a rôle in the deep oxidation. Following glaciation, which must have removed a considerable quantity of ore, stratified clay was laid down in the basin that is now occupied by Steeprock lake. A layer of black mud, which is said to contain some manganese, lies on top of the clay. This could have been formed from manganese set free through leaching of the ferruginous carbonate, since this rock contains an appreciable quantity of it.

It is of interest to note in connection with this discovery, that the late W. G. Miller, for many years Provincial Geologist of Ontario, visited Steeprock lake and suggested in 1903 that large bodies of iron ore were likely to be found in the vicinity of Steeprock lake from leaching of the limestone.

During the summer of 1938, the Ontario Department of Mines had a party on Steeprock lake. M. W. Bartley was in charge of geological work and A. A. Brant was working with the magnetometer. Detailed geological work was done in the light of the results of diamond-drilling, and magnetic surveys were made in the hope of finding other favourable locations for drilling. A report on the results of their investigations of this hematite deposit will be found in this volume.

About half a mile north of Tracy rapids, there is a band of ferruginous carbonate nearly a mile long in the Keewatin greenstone. The occurrence of some limonite at the surface, resulting from oxidation of the iron in the carbonate, led Thomas Rawn and associates some years ago to drill this rock to a depth of 400 feet. Except for the thin oxide capping, nothing but carbonate was found in the band, which is a replacement of greenstone.

Pyrites

Several bodies of pyrites have been prospected in this area. The Oliver Iron Mining Company in 1902–1903 and 1909 stripped, trenched, and drilled a body of pyrite in ferruginous carbonate near the east end of Strawhat lake. A ridge of this rock rising 25 to 30 feet above the lake is highly impregnated with pyrite for several hundred feet in length and for a width of over 200 feet. Apparently no work has been done on this deposit since 1909, as the trenches are partly filled in.

On the west side of Steeprock lake, behind Birch point, three patented mining claims, Nos. 460, 461, and 462, were prospected for pyrites by Mackenzie and Mann in 1903. According to Tanton[1] a vein of pyrite, 600 feet long, was drilled to depths of 95 to 167 feet in five holes and showed widths of 6 to 21 feet. Samples of the pyrites gave: sulphur, 43.8 to 48.8 per cent.; iron, 38.4 to 43.2 per cent.; and traces of phosphorus.

As to the origin of these pyrite deposits, there are two possibilities. They may have come from the magma that provided the lavas and tuffs of the Steeprock series, or they may be genetically related to the Algoman granite. Pyrite is rather widely associated with the ferruginous carbonate, but only in a few places in considerable quantities, and the geographical distribution of the two minerals is much the same. Their relations favour the assumption that they are both genetically related to the magma of Steeprock age.

Gold Deposits

Elizabeth Mine

The Elizabeth mine is situated about half a mile northeast of Modred (Rice) lake and about 2½ miles directly north of mile 5 on the Canadian National railroad, where it passes close to the Seine river. A canoe route leads from the Seine, through the small creek flowing out of Modred lake, to the head of this lake, from which a wagon and tractor road runs through the Elizabeth camp to the Rebair property. A winter road starts at a point west of the 4-mile post and runs from the railroad across a bridge over the Seine river at Tracy rapids and on to the Elizabeth mine.

The Elizabeth property formerly consisted of two patented claims, F.M. 171

[1]T. L. Tanton, op. cit., p. 6.

and 172, comprising 373 acres. Twelve additional claims, F.F. 2,626–2,631 and 2,838–2,843, containing about 480 acres, have been added, making a total of about 853 acres.

Gold was discovered on claim F.M. 171 in 1900, and development work started by the Anglo-Canadian Gold Estates, Limited, of London, England. In 1902 a 10-stamp mill was constructed at the foot of the hill just south of the mine, and it is reported that before the end of 1903 twelve diamond-drill holes had been bored for a total of 1,800 feet, two shafts 500 feet apart had been sunk, and 20,000 tons of ore blocked out. It is reported from several sources that the ore averaged about $10 a ton. The mine was again worked in 1912–14 and has not been operated since. It is stated that No. 1 shaft is 110 feet deep with 115 feet of lateral work and No. 2 is 270 feet deep with levels at 65, 120, and 235 feet, and a total of 1,200 feet of lateral work.[1] The production in 1912 is recorded as



No. 2 shaft, Elizabeth mine, in 1937.

50 tons of ore worth $400.[2] The ore body in No. 2 shaft is said to have been 75 feet long and to have been mined from the surface to a depth of 150 feet. There was apparently a high-grade shoot within the ore body.[3] All ore above the 120-foot level has been removed.

In 1923 the Goldex Mining Corporation of Montreal bought the property, but did not operate it. The mine has been dewatered and examined several times in recent years. The Elizabeth Gold Syndicate took up the property, and in February, 1936, the Elizabeth Gold Mining Company, Limited, was incorporated and is now reviving operations. This company has the same management as the Upper Seine Gold Mines, Limited, which has taken up the old Sawbill mine on Sawbill lake. In 1936, poles for a 13,200-volt transmission line were planted between the main line of the Seine River Improvement Company, near the Seine river at Tracy rapids, and the mine, and a contract for power arranged. Some machinery has been taken in, and a 25-ton mill was under construction in the summer of 1938. The buildings on the property at the time of the writer's visit were of temporary construction, and the workings were full of water.

[1]Ont. Dept. Mines, Vol. XLVI, 1937, pt. 1, p. 132.
[2]Ibid, p. 25.
[3]T. L. Tanton, op. cit., p. 8.

A recent report of W. N. McClintock, mining engineer of the Elizabeth company, states that veins in a sheared zone at No. 1 shaft gave the following assays:[1] 3 samples taken in the shaft averaged $11.90 over 47 inches; samples from the surface of one band averaged $15.60 over 38 inches for 70 feet; and those from another band $22.60 over 56 inches for 20 feet. A 35-foot section of another vein, 130 feet east of No. 2 shaft, gave an average of $20.60 over 30 inches.

Geology of the Property.—The contact between the main body of Algoman granite in the northwestern section of the map-sheet and the main body of greenstone passes through the mine. The granite is coarse-grained, pink to red in colour, rich in quartz, and deficient in ferromagnesian constituents. A specimen taken 650 feet from the contact shows a quartz-rich, microcline granite with a little titanite and apatite and streaks consisting of hornblende. The latter are probably due to inclusions of the greenstone engulfed in the granite. Such inclusions, some of considerable size, may be seen at several places.

At No. 2 shaft and close to the granite-greenstone contact, the granite is much altered. It is greenish-yellow in colour and consists chiefly of quartz, sericite, and muscovite, the muscovite in flakes of considerable size. The microcline is all altered and mostly replaced by sericite, quartz, and a little albite. It appears that some albitization has occurred during the alteration of the granite.

Several dikes may be seen near the mine. Some of these cut both greenstone and granite, and at least two cut quartz veins. Just east of the dining hall, a small sheared dike, which has a maximum width of 8 feet and is slightly reddish to grey in colour, cuts granite and a quartz vein. Under the microscope this proves to be a peculiar rock. It is probably a lamprophyre, which has been highly altered to sericite and serpentine. In a fine-grained groundmass there are dark patches of considerable size, consisting almost entirely of serpentine in an indefinite colourless material. These patches resemble inclusions, and if the rock were not in a distinct dike, it might easily be mistaken for a tuff. What appears as a similar rock forms a dikelet near the southwest corner of the office building. Another dike, found 800 feet down the trail from the mine to Modred lake, consists of a massive, fine-grained rock with many small grains of pyrite. It lies parallel to a quartz vein and between it and greenstone. In thin section, this rock is seen to be made up of a network of interlocking, small, lath-shaped crystals of plagioclase with many crystals of hornblende partly replaced by carbonate and chlorite. What appear to have been plates of biotite, now green in colour but lacking pleochroism, are present. The rock originally was probably a lamprophyre or camptonite.

In addition to the rather basic dikes described, there are several acid dikes in the vicinity of the mine. One-eighth of a mile south of No. 1 shaft there is a complex of porphyry dikelets intruding greenstone. This body is 200 feet long by 65 feet wide. South of shaft No. 2 are two small dikes, one a quartz-orthoclase porphyry and the other an orthoclase porphyry. The feldspars are highly sericitized and kaolinized. Another quartz-orthoclase porphyry dike was seen near the road from the Elizabeth mine to the Rebair camp. This dike contains many flakes of biotite as well as quartz and feldspar phenocrysts, which form white spots on a dark-grey, brown-weathering surface.

Quartz Veins.—The veins occur in fractures in the granite, in short shear zones in the greenstone, and along the contact between these two formations. They do not show evidence of being related to major structures and they are, therefore, mostly short and vary greatly in width within short distances. When

[1]Gold at $35.00 per ton.

they occur in granite, they are usually along zones with chlorite and amphibole, which indicate inclusions of greenstone that have been highly altered. Ferriferous carbonate, probably ankerite, is present in many of the veins and in the wall rocks. The veins represent a late phase of the Algoman igneous activity and came from the same magma as the granite and dikes in the vicinity of the mine. The quartz-feldspar dikes preceded the veins in formation, and at least some of the basic dikes are later than the quartz.

There are two types of quartz in the veins, a normal solid type and a granular, sugary type, the latter probably representing quartz that originally contained ankerite and pyrite, which have been partly removed in solution. The sulphides present are pyrite and chalcopyrite with a little pyrrhotite and galena. The quartz in most places is not highly mineralized. A number of veins have been uncovered on the property. These vary in width from a foot to about 20 feet and



Camp on the Rebair property.

they can, in a few cases, be followed continuously for more than 100 feet along the strike. The main vein in No. 2 shaft is reported to be from 1 to 14 feet wide, and it was mined for about 75 feet along the strike. A map by Bruce[1] showing the main geological features of this camp was published several years ago.

Rebair

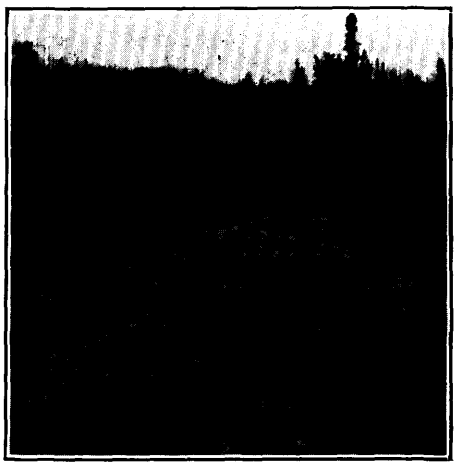
The Rebair property lies next to the Elizabeth on the east and comprises 15 claims. In 1937 camps were constructed, and a large amount of stripping and rock-trenching and some diamond-drilling were done. Four drill-holes were put down with a light drill along what is known as the Dome vein at about 60 degrees to a maximum depth of 125 feet. Late in the summer a shaft was started on this vein, and when work was abandoned in the autumn it was said to be about 15 feet deep. Gold values were reported as being low.

The Rebair camp is situated on the main body of greenstone where it is cut up by a great many small intrusions of granite and porphyry. A band of Steep-rock conglomerate, lying in a small syncline in the greenstone, cuts across the south end of the property, and small patches of conglomerate, cut by granite, may be seen near the west side of the camp. The greenstone at many places is cut by irregular dikes and small stocks of porphyry. The strike of the country

[1]E. L. Bruce, Ont. Dept. Mines, Vol. XXXIV, 1925, pt. 6, p. 30.

rock is generally northeast-southwest, and in some places the dikes follow the strike of the schistose greenstone but in many places disregard the major trend of the country rock. The porphyry ranges from distinct orthoclase porphyry to a fine-grained granite or to a rock approaching a dacite porphyry. In some cases the phenocrysts have been crushed and drawn out, indicating that the intrusions were squeezed after cooling. The feldspars are sericitized. Quartz stringers and small veins form a network in some of the porphyry bodies, and carbonate is scattered through much of the quartz. These intrusions are mineralized with disseminated pyrite, and chalcopyrite occurs in small quantity in some of them.

A rock trench, 40 by 8 feet in area and 4 feet deep, runs northwest from the middle of the south boundary of claim F.F. 2,614. In this trench three dikes of feldspar porphyry, ranging from 2 to 10 feet in width, intrude the greenstone.



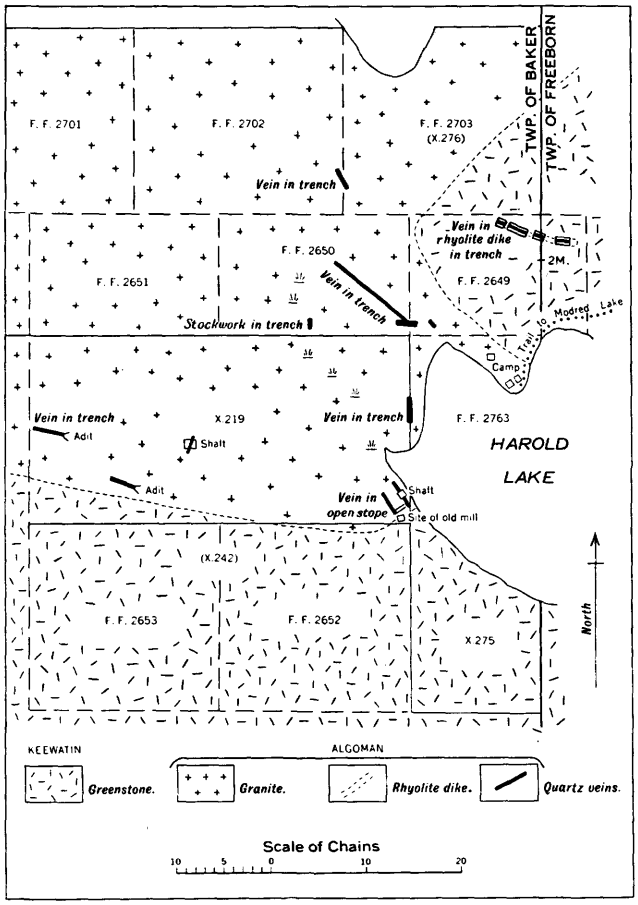
"Dome vein" (porphyry dike cut by quartz veins), Rebair property.

The porphyry contains pyrite, disseminated and in streaks and blotches, and the rock is cut by stringers of quartz with carbonate. Some 45 feet northeast of this trench is another trench 95 feet long, running parallel to the schistosity in the greenstone. Scattered along the trench for about 40 feet are lenses and streaks of quartz, up to 20 inches in width, in the schist. In one section, small quartz veins occur across 3½ feet. Across a small swamp to the northeast of the last trench, the so-called Dome vein begins. This is a long, irregular intrusion of porphyry containing stringers, small veins, and irregular masses of quartz. The vein, on which drilling and test-pitting has been done, ranges in width from 2 inches to 6 feet.

Harold Lake Mine

The Harold Lake mine is situated on Harold lake, a small lake west of Modred, from which it is reached by a trail 50 chains long. It is 1½ miles southwest of the Elizabeth mine. The property comprises two patented claims, X.219 and X.275, and 22 claims that have been recently added. There are on the property two shafts, two adits, and several pits and rock trenches. The mine was in operation in 1895 and 1896, and it is reported that during these years

1,131 tons of ore were milled in a 5-stamp mill for a return of $11,236. The mine has been idle since and the original buildings have disappeared, but in 1937 Canadian Longyear, Limited, took an option on the property and after doing over 17,000 square feet of stipping and trenching of veins on several claims, sampling exposures, dewatering a shaft, and putting new timbers in the old stopes, gave up the option. The writer is greatly indebted to R. D. Longyear, president of E. J. Longyear Company of Minneapolis, for permission to make use of the report of their engineer, H. M. Whimster, in the description of the property.



Geological sketch map showing part of the Harold Lake property.

The geology of the property is somewhat similar to that of the Elizabeth. The veins are along the contact of the Algoman granite and Keewatin greenstone, in the granite, generally along inclusions of greenstone, and in the greenstone in association with dikes emanating from the granite magma. Altogether Longyear performed work on 18 different veins. These are mostly short and rarely can be followed for 100 feet along the strike. Many of them carry little or nothing in gold values.

On the west shore of the lake, in the southeast corner of claim X.219, is a shaft 30 feet from the water, which is reported to be 37 feet deep. A trench runs

100 feet north and 65 feet south from the shaft. Some recent work had been done on this trench, and streaks of quartz from 12 to 15 inches wide occur at intervals along the trench in sericitized granite. This is known as vein No. 1. The vein runs N. 30° W. and dips 65° S.W. The shaft has a lower dip, 15 to 20 degrees. Some of the quartz carries much chalcopyrite and some galena. Fragments of quartz near the shaft contain visible gold, chalcopyrite, pyrite, galena, sphalerite, and carbonate. A sample taken by Longyear from the quartz, well-mineralized with sulphides, gave 1.67 ounces of gold to the ton. Other samples gave low values. These minerals extend into the hanging wall, and the quartz lies in a rusty band about 6 feet in width. On a hill of granite rising 40 feet above the lake, southwest of the shaft and at 100 feet from it, there is a stope open to the surface for a length of 75 feet. The vein, No. 2, which seems to have had quite distinct walls and to have been 3 to 5 feet wide, has been stoped out to an apparent depth of 35 to 40 feet. The vein makes a sharp turn to the east and pinches out at the south end, and the north end is concealed. The mill, which has been burned, leaving five stamps as a relic, was situated at the foot of the hill near the southeast end of this vein.

Near the west end of claim X.219, there is an adit driven into a hill of granite, which is partly sheared and altered to sericite schist. The adit is 135 feet long, 4 feet wide, and 5 to 6 feet high, and is driven along a vein that ranges from stringers a few inches wide to a vein 2½ feet wide. The adit has not been driven on a horizontal line. At 40 feet from the entrance there is a winze full of water and a little stoping has been done in the adit. The quartz carries pyrite, chalcopyrite, and galena. Samples taken by Longyear at various points along this adit showed values from 0.03 to 0.83 ounces of gold to the ton of quartz.

There is another adit 500 feet southeast of the one described. The vein lies partly in granite and partly along the contact of granite and an inclusion of greenstone. Values obtained by Longyear were 0.10 ounces over 0.4 feet and nil in two other samples.

Directly east of the first adit and 900 feet from it is an old shaft on a small vein. No information is available concerning the depth of this shaft or what was encountered in it.

Near the middle of the east boundary of claim X.219, there is a stripping exposing two nearly parallel veins about 1 and 2 feet wide. These veins can be followed for 150 feet, and they run along an inclusion of greenstone in coarse granite. They are weakly mineralized with pyrite, and assays showed that appreciable values were lacking.

In the southeast corner of claim F.F. 2,650, there are two trenches. One of these runs nearly east-west and is 120 feet long. It is on a slightly mineralized quartz vein, which has a maximum width of 4 feet near the centre and pinches out at the ends. The vein runs along inclusions of schisted and carbonated greenstone. Another trench runs northwest from this one for 700 feet. The first 200 feet show a vein, seldom more than a foot wide, and for the remainder of the distance there is no regular vein, only stringers and small lenses of quartz. The country rock varies from a coarse red granite to a sheared sericitized granite containing streaks of schistose and carbonated greenstone. Values up to 1.20 ounces to the ton across 0.4 feet were obtained from the latter trench by Longyear, but they were low across a mining width. In the same claim and 650 feet west of the first trench described, there is a small stockwork on the west side of a hill of granite. A stripping 50 feet along the foot of the hill, and for 30 feet up the face, exposes a network of stringers and lenses of quartz in a body of squeezed

and contorted granite containing inclusions of greenstone. No values were found in this quartz.

On the east boundary of claim F.F. 2,649 and 650 feet north of Harold lake, there is a large stripping on greenstone cut by several irregular intrusions of rhyolite, varying from dikelets a few inches wide to one body 25 feet wide. Associated with these intrusions are numerous stringers and short, irregular bodies of quartz up to 8 feet wide. Stringers of quartz extend across a zone that is 20 feet wide in one section, and in this zone a band of greenstone 10 feet wide is impregnated with ferriferous carbonate and chrome mica. This mica is believed to be mariposite. A small quantity of pyrite is disseminated in the quartz veins and country rock. Longyear found very little gold in these veins, practically none in the west exposure and, except for one sample that yielded 0.47 ounces to the ton across 1.1 feet, nothing of any interest in the east.



Quartz vein in a zone of carbonated Keewatin greenstone with chrome mica, Harold Lake property.

The large amount of sampling done on the whole property failed to disclose new ore bodies of commercial importance.

In the area in which the Elizabeth, Harold Lake, and Rebair properties occur, the veins are usually found in or near granite where it has been sheared and chemically altered. They are not far from the greenstone contact and are frequently associated with remnants of greenstone inclusions that have been highly altered. This seems to account to some extent for the small size of the veins. In the greenstone the veins are all associated with intrusions, and their extent is usually limited by the extent of these intrusions. The veins so far found are not in major shear zones or faults, but owe their origin largely to contact conditions resulting from the intrusion of the acid magma into the greenstone. The presence of chalcopyrite is regarded by those who have worked in this section of the Atikokan area as the most favourable indicator for the occurrence of gold.

Law Syndicate

The Law Syndicate property is situated on the north side of Banning lake near the west end and between Banning and Niven lakes along a chain of small lakes, which includes Anderson, Law, and Wright. It comprises 13 claims and has been

well prospected by stripping, trenching, and test-pitting. The geology is rather complex, as the country rock, which consists of chloritic, hornblendic, sericitic, and carbonated Keewatin schists, has been intruded by felsite, quartz porphyry, feldspar porphyry, and hornblende gabbro, which occur as dikes, lenses, and irregular injections. The main granite contact lies about three-quarters of a mile to the northwest. There are many showings of quartz in the form of stringers, short veins, and lenses, but they are for the most part small, although often well mineralized with pyrite and chalcopyrite. The quartz occurs in many places in rusty schists. High values in gold and copper have been reported, but Hawley[1] found quite low values in gold in samples assayed, and the copper values were not sufficiently important to make a copper mine. A detailed description and a map of the property may be found in Hawley's report.

Miranda Lake

Cutting across an island, near the centre of Miranda (Beaver) lake, there is a quartz vein about 25 feet wide, which is exposed for 500 feet along the strike. It stands about 20 feet above lake-level and is cut by a dark dike, apparently lamprophyre. The vein cuts granite and contains inclusions of chloritic and hornblendic schist. The vein for the most part shows little or no mineralization, but there are patches of the white quartz carrying pyrite and chalcopyrite. Prospectors informed the writer that they had failed to obtain any appreciable gold values from this vein, and a sample submitted to the Provincial Assayer gave only 70 cents to the ton.[2] On the other hand, Tanton[3] records the following assay from this vein: gold, 2.10 ounces; silver, 3.52 ounces to the ton.

Northeast of this island, a large bay extends to the east and a small lake lies to the north of the end of the bay. On the northwest side of this lake, between it and a smaller lake to the north, there is a zone of schist about 60 feet wide containing stringers and veins of quartz and much disseminated pyrite. This shear zone appeared to be favourable for the occurrence of gold, but four samples of the pyritiferous schist taken at intervals along the strike and assayed by the Provincial Assayer gave no trace of the metal.

Righteye Lake

At the southeast end of Righteye lake a large body of quartz carrying a little pyrite occurs in a mass of granite and schists. It is located on claim A.L. 195. The quartz exposed is on the whole too barren in appearance to carry gold in commercial quantities, and no assays have been made for this report.

On a point on the north side of Little Dragon lake, which lies northwest of Lefteye lake, a considerable amount of work has been done on the Johnson claim on a rusty shear zone, which is about 20 feet wide and is traversed by a felsite dike about 6 feet in width. Narrow quartz veins, up to one foot wide, run through the schist. Three pits from 6 to 12 feet deep, one being 15 feet long, have been sunk in the rusty zone.

Finlayson Lake

Several old properties on Finlayson (Clearwater) lake and between it and Eye lake were quite extensively developed near the close of the last century. The exact location of some of these properties could not be fixed. Carter[4] describes the Clear Lake mine of the Clearwater Gold Mining Company as being

[1]J. E. Hawley, op. cit., pp. 50, 51.
[2]Gold at $35.00 per ton.
[3]T. L. Tanton, op. cit., p. 9.
[4]W. E. H. Carter, "Mines of Northwestern Ontario," Ont. Bur. Mines, Vol. X, 1901, p. 105.

located on claim X.785, "on Clear lake, one mile north of Jack lake and 12 miles south of Sawbill" and the property as containing 187 acres and consisting of claims B.J.115 and 116 and X.785, 786, and 796. At the time his report was made, No. 1 shaft was down 144 feet, and at 82 feet the first level had a drift 63 feet to the southwest with a crosscut 12 feet to the southeast and another 9 feet northwest. The drift to the north was 56 feet long. No. 2 shaft, which was inclined and located 150 feet east of No. 1, was 185 feet deep with no lateral workings. At a point 90 feet southwest of No. 1 shaft, a pit 12 feet in diameter and 20 feet deep had been sunk on a body of quartz, and an adit had been driven 20 feet north into the hill, 60 feet south of No. 1 shaft. The shafts are apparently on two separate veins. No. 1 was sunk on a gneissoid zone containing numerous quartz stringers, and there was considerable quartz in the southwest drift. In No. 2 shaft a wavy quartz vein ranged in width from a few inches to 2 feet. The quartz showed little or no sulphides, and the writer could find no records of assays. The mine was apparently closed in 1901.

On the northwest shore of Finlayson lake, about 5 miles from the south end, there are two old shafts on claim X.327, but no definite information could be obtained regarding the workings at these shafts. They are located on a quartz vein running northeast-southwest across a point of Keewatin greenstone. A felsite dike cuts the greenstone in the vicinity of the vein.

Marmion Lake

On a small island just off the southwest side of the large island lying across the entrance to the northwest bay of Marmion lake, there is a small mine. This is often spoken of as the Connolly property. Dr. MacKenzie, of Fort Frances, James MacGregor, of Atikokan, and the late Peter Connolly were said to control it. The vein has been traced for 1,450 feet, although in considerable stretches only stringers of quartz are visible. It strikes N. 20° E. and runs into the lake at the north end. The vein, which consists of quartz and carbonate, lies in granite along streaks of sericite and chlorite schist, the latter indicating remnants of greenstone inclusions. The quartz, where solid, has a maximum width of 3 feet, but in one place stringers of quartz make up a zone 8 to 10 feet wide. It is mineralized with pyrite, and one sample picked from the ore contained a speck of visible gold. Ore has been removed from a pit 27 feet long, 5 feet wide, and a few feet deep and transported by tram to a little mill on the shore, 200 feet distant. The machinery consisted of a compressor, a small crusher, and a little ball mill, in which 3-inch steel balls were rotated in a circular, horizontal pan. The mine was not in operation at the time of the writer's visit.

Other Quartz Veins

A sample was taken from the west shore of the small lake one mile north and half a mile east of Olcott siding. Another was collected from a vein cutting the granite intrusion in the paragneiss, half a mile northwest of Nym lake. These samples were submitted to the Provincial Assayer for tests and found to contain no gold.

Lead and Zinc

Nearly half a mile east of the falls on the Seine river, near Falls bay, Steeprock lake, a vein occurs on the northwest shore of a little lake. This lake is reached by a trail 70 chains long from a small bay on the east side of Steeprock lake, just south of the mouth of the Seine. The vein strikes northeast-southwest and dips 75° to 80° S.E. It has been exposed with pits and trenches for 185 feet from a pit on the lake shore, where it disappears beneath the lake, and it ranges from

a series of stringers in schisted greenstone to a vein nearly 12 feet in width, at a point 50 feet from the shore. The gangue is mostly crystalline quartz with a small amount of brownish-weathering carbonate. The metallic minerals are amber-coloured sphalerite, galena, pyrite, and chalcopyrite, the last two in small quantities. The sphalerite and galena carry enough metal at some places to make up 6 to 7 per cent. of the vein, but the mineralization is far from uniform and is so distributed in patches that there is not enough of the base metals in a vein of this size to make a mine. A sample taken by the writer and assayed by the Provincial Assayer gave no gold and only a trace of silver.

This vein occurs in bands of slightly sheared greenstone along the southwest side of an intrusion of sericitized granite. It contains more lead and zinc than any other vein seen in the Atikokan area. These minerals are rather widely distributed, but in most veins they occur in very small quantities.

Nickel and Platinum

Six miles southeast of Atikokan and 700 feet south of the southwest bay of Plateau lake, there is an intrusion of gabbro in which a little nickel and platinum occur. This body of gabbro is oval in shape, about 800 by 400 feet in size. The rock is very coarse grained and shows large bronzy cleavage faces of pyroxene. It contains pyrrhotite and chalcopyrite, disseminated, in blotches, and in tiny veinlets. On weathering, it turns brown to red and leaves a porous, sinter-like rock. At the west shaft the rock has a fragmental appearance, as if somewhat brecciated, and this portion of the intrusion is highly weathered and leached.

The property on which the nickel showing is located consists of 4 claims, R.760 and 761, both of which are patented, and A.L.491 and 492. On claim R.760, there are three shafts, two of them only a few feet apart. They were full of water when visited, but the rock dump indicated that they had been sunk to a considerable depth. A short distance to the west and a little north of these shafts, is another, only about 12 feet deep, and near it there are two pits.

The gabbro is not highly mineralized on the whole. A sample carrying pyrrhotite and chalcopyrite was tested by the Provincial Assayer. It gave 0.14 per cent. nickel and 0.01 ounces of platinum to the ton.

Talc and Soapstone

At the southwest end of Milk lake, 3 miles northeast of Banning, there is a small body of soapstone about 25 feet wide and nearly 100 feet long. This rock lies in a highly contorted, dark-green to rusty chlorite schist, which appears to be an altered basic tuff cut by a number of small felsite dikes and a quartz vein with a maximum width of 3 feet. The green, flaky talc lies adjacent to the vein and along the dikes. No work has been done on this outcrop, which lies along a ridge running in a northwesterly direction between Milk lake and a small lake to the west of it.

Other quite small bodies of soapstone occur in this section of the Atikokan area, but they do not appear to be of any economic importance.

Beryl

Small crystals of beryl were seen in a pegmatite dike cutting granite on a small island in Turtle lake. This island lies near the north shore about half a mile south-southeast of the point where the portage to Clearwater West lake leaves Turtle lake.

Iron Deposits of the Steeprock Lake Area

By M. W. Bartley

INTRODUCTION

Interest in the iron ore possibilities of Steeprock lake was stimulated by the discovery of massive hematite by diamond-drilling beneath the lake during the winter of 1937.

The Ontario Department of Mines assigned a combined geological and geophysical survey party to investigate the locality, genesis, structural relationships, and economic possibilities of the deposits during the field season of 1938. The investigation was carried out by detailed mapping of the rock exposures and a magnetometric survey of the drift-covered parts of the area. A. Brant was in charge of the geophysical work, and the writer supervised the geological examination.

In this report, the writer presents a description of the geology in the vicinity of the deposits and a summary of the development work to March, 1939.

Acknowledgments

The field work was greatly facilitated by the generous co-operation and assistance rendered by M. S. Fotheringham and W. D. Neeland, of the Steerola Exploration Company, Limited. Subsequent data furnished by the company cleared up many difficulties and added important information to this report. Information and suggestions advanced by E. S. Moore were of great assistance and formed a basis for the plan of investigation. A. A. Brant, M. C. Gardiner, and T. L. Boyle acted as assistants and rendered efficient service in the field. A great deal of credit is due Mr. Brant for his comprehensive determinations of structure and geology in the drift-covered areas.

Position and Means of Access

The principle deposit is situated 4 miles north of the village of Atikokan, on the southern line of the Canadian National Railways, 135 miles west of Port Arthur. Good water transportation is available from the railroad to the site of operations. To supplement this, a motor road has been constructed from Atikokan to the lake, thus providing year-round transportation.

Power

Hydro-electric power is available from a plant situated at the head of the lake and operated by the Seine River Development Company. The plant is capable of developing 12,000 horse-power, and under an agreement with the Provincial Government power is to be supplied when needed at a reasonable rate.

Previous Geological Work and Early History

H. L. Smyth[1] first recognized the possibilities of iron ore at Steeprock lake in 1891, when he studied the geology there. Wm. McInnes,[2] in 1897 corroborated Smyth's observations and went further by indicating that the position

[1]H. L. Smyth, "Structural Geology of Steeprock Lake," Am. Jour. Sci., 3rd series, Vol. 41, 1891, pp. 317-331.

[2]Wm. McInnes, "On the Geology of the Area Covered by the Seine River and Lake Shebandowan Map-Sheets," Geol. Surv. Can., Vol. X, 1897, pt. H, p. 57.

of the ore body should be under the lake, as evidenced by the existence of hematite float on the southwest shores but not on the northeast. W. G. Miller stated in a report of the Ontario Bureau of Mines that "pits have been sunk here [Elbow point] and some of the material taken from them, which appears to have been found in small quantity, has the following percentage composition: metallic iron 3.00, manganese 12.32."[1] Speaking of the boulders found on Floatore island, he says: "They consist of what may be called hard ore, and appear to be different in character from most of the ore met with in the material thrown out from the pits."[2] He recommended that the lake bottom be investigated to determine if the large fragments of float came from there, as they obviously did not originate on the shores. Subsequently, diamond-drill holes were put down, three of which were seen during the present examination. The first, on Elbow point, was reported[3] to have encountered hematite under the lake. The other two, located on the west shore behind Floatore island were directed inland, away from the possible ore zone.

Reference was made to the possiblity of an iron ore deposit at the bottom of the lake by T. L. Tanton[4] in 1925. He also mentioned the occurrence of limonite in the vicinity of the Southeast arm, but the quality and quantity were not commercial.

At least two dip-needle surveys were made by private interests, the first by J. E. Marks previous to 1930 and the second by Jules G. Cross in 1930.

E. S. Moore conducted a survey of the Atikokan area during the summer of 1937, and his report, which is contained in this volume, is used as a basis for the regional geology.

GENERAL GEOLOGY

All the consolidated rocks of the Steeprock area are pre-Cambrian in age and are classified as follows:—

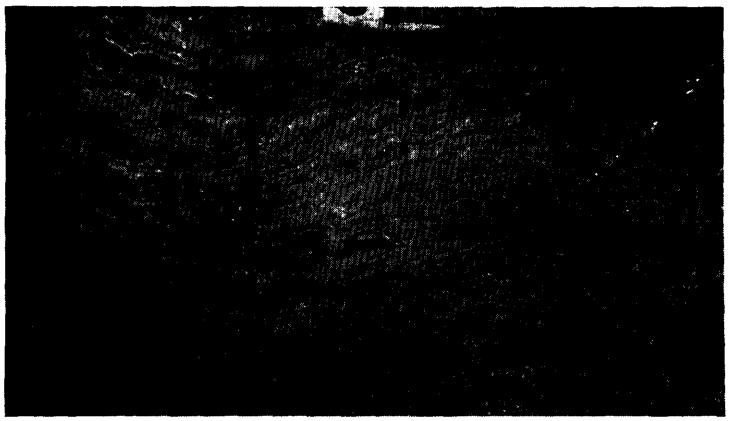
QUATERNARY	
RECENT:	Soil and alluvium.
PLEISTOCENE:	Drift, soil, and gravel.
	Erosion interval
PRE-PLEISTOCENE:	Hematite.
PRE-CAMBRIAN	
ALGOMAN(?):	Breccia cemented by ferrodolomite. Diorite and gabbro.
	Intrusive contact (?)
TIMISKAMING TYPE (including the Seine and Steeprock series):	Conglomerate, greywacke, and arkosite. Lavas, dikes, and related pyroclastics. Pyritiferous ash horizon. Iron formation. Limestone. Conglomerate, greywacke, and arkose.
	Unconformity (?)
LAURENTIAN(?):	Granite and granite gneiss (may be Algoman in part[5]).
	Intrusive contact
KEEWATIN:	Iron formation. Basic to intermediate lavas, dacite, pyroclastics and derived schists.

[1]W. G. Miller, "Iron Ranges of Northern Ontario," Ont. Bur. Mines, Vol. XII, 1903, p. 306.
[2]Ibid., p. 307.
[3]Personal communication with Hugh Boyle.
[4]T. L. Tanton, "Mineral Deposits of Steeprock Lake Map-Area, Ontario," Geol. Surv. Can., Sum. Rept. 1925, pt. C, p. 3.
[5]See page 38.

Keewatin

The oldest formation in the area mapped consists of basic to intermediate lavas and pyroclastics with lenses of dacitic material and scattered bands of iron formation, all of which are regarded as Keewatin in age.

The lavas shown on the west side of the map-sheet, west of the lake, are similar to those of other pre-Cambrian localities. They consist essentially of fine- to medium-grained flows and chloritic and hornblendic schists. Pillow structures are abundant and usually distorted by elongation. Bands and zones of medium- and coarse-grained andesitic material, which may either be intrusive or represent the coarse portions of thick flows, are present in many places. Metamorphism has so altered these rocks that their true character cannot be definitely established. In this region there is a conspicuous absence of acid flows and pyroclastics.



Keewatin acid and intermediate tuffs along the south shore of Steeprock lake.

On the south side of the lake, between the West arm and the Southeast arm, the volcanics change lithologically. These rocks appear fresher and more massive and are characterized by an abundance of pyroclastic material. Stock-like masses and tabular bodies of coarse-grained diorite and gabbro appear to intrude them. In many places the contacts are transitional. Where such is the case, the dioritic rock may represent the central part of a thick flow or possibly the filling of volcanic vents. The sequence outward from the coarse igneous rocks is medium to fine acid and intermediate lavas, agglomerates, and then tuffs of like composition. A band of well-bedded acid to intermediate tuff, up to 200 feet in thickness, follows the shore line on the south side of the lake.

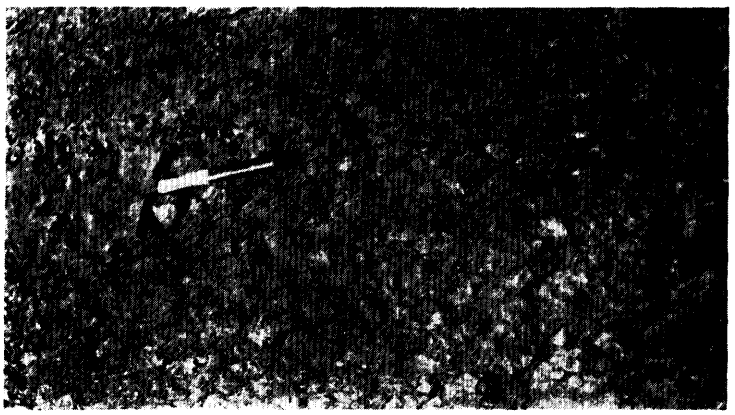
Laurentian(?)

On the northeast side of the Southeast arm, the Steeprock sedimentary series is in contact with a highly sheared, grey hornblende-biotite granite classed as Laurentian by previous writers. It is correlated with the Laurentian granite of the Sapawe Lake area[1] to the east. The position of the Steeprock sediments in relation to the granite is based upon two facts: (1) The basal conglomerate of

[1]J. E. Hawley, "Geology of the Sapawe Lake Area, with Notes on Some Iron and Gold Deposits of Rainy River District," Ont. Dept. Mines, Vol. XXXVIII, 1929, pt. 6, p. 11.

the sedimentary series contains granite boulders of a composition similar to the so-called Laurentian; and (2) the granite displays two directions of shearing, one parallel to that in the clastics and the second tangential to the first. This conglomerate, however, is more highly sheared than the other clastics and appears to have been granitized. The granite is highly sheared and granulated for a few feet from the contact, but very abruptly gives way to massive, relatively fresh material. This contact effect may be due either to differential shearing along the contact or to the intrusion of the granite if it is younger than the sediment.

The grey granite extends northward to and beyond Falls bay, and close to the west shore of the bay it changes to a red, hornblende-rich granite and granodiorite. There is a marked lithological dissimilarity between the two phases, and it has been suggested that the latter is younger, probably Algoman in age. On Elbow point, Tanton[1] found the red granite intruding the limestone. This



Steeprock conglomerate, Southeast arm.

condition was not observed by the writer. On the north side of the Middle arm and Wagita bay, the red granite appears in many places to intrude the Steeprock clastics, the latter displaying a metamorphosed character. This, however, may well be the result of shearing of the incompetent sedimentary beds during folding. The contacts are neither sharp nor definite, but rather appear to be transitional. In a few isolated spots, what are considered to be inclusions of conglomerate were found in the granite.

The question of the age of the granite or granites at Steeprock is still unanswered. All the writer can do at present is to state the facts and present the evidence for both sides of the argument so that readers may form their own conclusions.

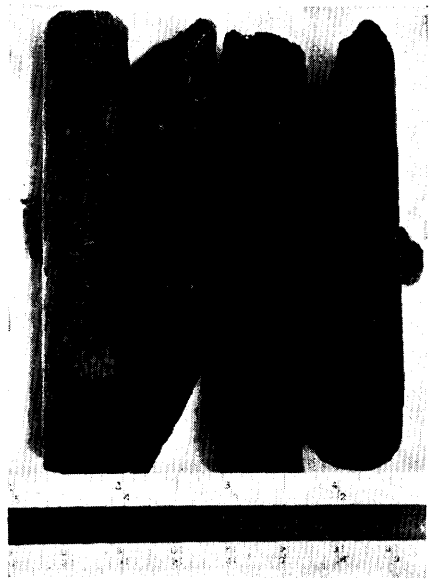
Timiskaming

Apparently overlying the Keewatin and the grey granite is a series of clastic sediments, limestone, and pyritiferous ash rock. These are in turn covered in part by lavas and related pyroclastics. Remnants of this series are seen now as isolated patches and hummocks confined principally to the north shore of the lake. Exceptions are the occurrences of ash rock along the southwest shore of the Southeast arm and occasional exposures of late Steeprock sediments and lavas around Strawhat lake and along the creek flowing out of Pete lake.

[1]T. L. Tanton, personal communication.

It would appear that the sediments were laid down in depressions on the irregular Keewatin terrain and that erosion removed the greater part of the material, leaving only that which occupied the deeper basins. The direction of glaciation is northeast-southwest, and it is significant that the above-mentioned remnants occupy positions on the south and southwest, or lee side of the hills and ridges of resistant granite and greenstone. It is thought that the ice, when moving over the area, gouged out the greater part of the softer Timiskaming rock, such as limestone and ash, and that only the protected portions were left.

The discontinuity of the formations, with the substitution of one type of rock for another within short distances, makes any satisfactory determination of the stratigraphic relations of the various members of the series difficult.



Diamond-drill cores of typical ash rock.
Note the sulphide concentrations.

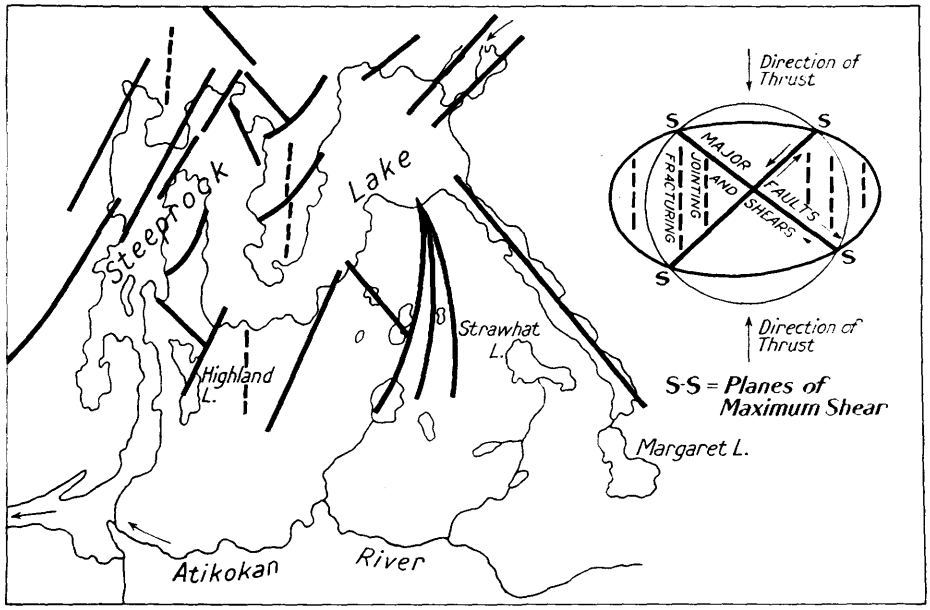
Moore has presented a complete description of the limestone, clastics, and lavas so that any further discussion is unnecessary. Reference must be made, however, to the ash rock, which is so persistent under the lake, especially in the vicinity of the hematite.

It is a pyritiferous, tuffaceous agglomerate of basic composition containing an abundance of iron sulphide nodules and andesitic bombs and a heterogeneous mixture of limestone, clastics, and magnetic material. Distinct bedding can be observed in places, but usually all trace of structure is masked by intense shearing. From thin sections, it was found to contain many magnetite crystals throughout the chloritic groundmass. The presence of fragments of previously deposited rocks in the ash bed would suggest an interval of time between the consolidation of the limestone and the deposition of the ash, in which the sea subsided sufficiently to allow a certain amount of erosion to go on during the deposition of the ash. Corroboration of this is noted in the fact that the ash fills the shallow depressions on the limestone as well as forming the bed of much of the lake. Magnetometric surveys and diamond-drilling have indicated that the ash now occupies the floor of Southeast bay, the Middle arm from the southeast corner of

Elbow point to Conglomerate bay, and the West arm as far south as Birch point. Added to this, drill-hole No. 23, at the outlet of Steeprock lake, cut a band of graphitic material similar in appearance to the typical ash. Magnetometric surveys across the drift-covered valleys east and west of Wagita bay indicate that ash rock is the underlying formation.

STRUCTURAL GEOLOGY

The Steeprock series has been compressed into a series of tightly folded anticlines and synclines, the latter forming the depression now occupied by the lake. Subsequent erosion removed the anticlines and exposed the underlying granite and greenstone. Following this disturbance, the direction of compression shifted and cross-folding and faulting occurred to further complicate the structure.



Sketch of the fault pattern in the Steeprock Lake area and its relation to the strain ellipsoid.

Folding

The first compressional force was in an east-west direction; probably the thrust originating in the west pushed the beds against a buttress just east of Southeast bay, forming the aforementioned synclines and anticlines. The folds plunge steeply south. On the limbs of the synclines are minor drag folds. The second movement was in a north-south direction, producing cross-folding and slight overturning to the north. This deformation may be related to the Algoman intrusive period. No doubt some of the minor plications on the major folds are due in part to this later movement.

Faulting and Shearing

During both periods of folding, and especially during the second, faults were produced along the limbs of the synclines. In addition, the northeast-southwest regional shearing, accompanied by distinct faults trending in the same

direction, and the complementary northwest-southeast faults assume the positions of maximum shearing in a strain ellipsoid pattern produced by either or both compressions. There appears to be a fault striking through the Southeast arm, displacing the west side north. Other northwest-southeast trending faults were noted on Mosher peninsula and in the region of Pete lake. Northeast-southwest faults were found traversing Midas peninsula, Mosher peninsula, and the west side of the lake. One fault in particular, which cuts across Midas peninsula, striking N. 30° E., has displaced the west limb of the Middle arm syncline south for a horizontal distance of 3,000 feet. Extensive brecciation has been indicated on the east side, and it appears to be the most westerly boundary of the zone of concentration. The lack of marker horizons on the other faults prevented any estimate of the amount of their relative movements.



Diamond-drill cores of ferrodolomite breccia. Note the unreplaced edges of fragments and the hematite stain on the one fragment of basic dike material.

Brecciation

On parts of the north shore of the lake, there are several points flanked by a very striking breccia consisting of large and small fragments of all the neighbouring rocks except granite. The matrix of a part of the breccia is a crystalline ferrodolomite, which also appears as fillings in cracks outside the breccia, usually displaying no sign of replacement of the fragments or the walls of the fractures. The other part of the breccia has an amorphous ferruginous carbonate of similar composition. In the case of the amorphous type of cement, replacement of the limestone, greenstone, and other rocks is quite evident. Both phases weather brown. The ferrodolomite seems to have been formed by hot waters related to igneous activity. Thus the ferrodolomite is not a stratigraphic horizon and cannot be assigned to any particular period of deposition, but rather it is thought to be connected with either late Timiskaming vulcanism or the Algoman intrusives. The origin of the breccia is ascribed to two main causes: (1) the thrust from

the south, which mashed the rocks against buttresses of granite and greenstone, forming a crush breccia, and (2) in part to faulting along the limbs of the synclines. The extent of the breccia zones can be quite closely defined from their limits in the shore outcrops.

It is significant that there is evidence of intense faulting and shearing in the northern part of the Middle arm and not in Wagita bay and that the ferrodolomite cement in the former case is distinctly coarsely crystalline, but not so in the latter. Where the ferrodolomite is coarsely crystalline, very little replacement occurred, and conversely the amorphous carbonate has completely impregnated the fragments and the country rock. Hard iron oxide is found in the vicinity of the fracture zones, but to date there is little evidence of dense hematite where extensive replacement by amorphous ferrodolomite has occurred.

Analyses of the carbonate are as follows:—



Ferrodolomite breccia, showing unreplaced blocks of limestone, lava, and dike material. Fracture-filling can be seen on the right side.

	No. 1	No. 2	No. 3
	Per cent.	Per cent.	Per cent.
SiO_2	0.25	0.40	0.37
Fe_2O_3	3.10	3.24	2.59
FeO	6.14	6.16	6.22
CaO	31.22	31.12	30.86
MgO	15.14	16.46	16.01
TiO_2	.001	.002	.001
MnO	1.40	1.05	1.34
H_2O	.26	.25	.15
CO_2	42.72	41.66	42.63
Total	100.231	100.342	100.171
Specific gravity	2.998	2.991	2.987

Sample No. 1—Analysis made by the Provincial Assayer, Ontario Department of Mines.
Sample No. 2—Analysis made by writer at the University of Toronto.
Sample No. 3—Analysis made by writer at the University of Toronto.

ECONOMIC GEOLOGY

Description of the Deposits

The hematite deposits found to date lie beneath the Middle arm of Steeprock lake. They are overlain by 75 to 150 feet of grey clay and 100 to 200 feet of water.

The Steerola Exploration Company, organized in 1938 to develop the deposits, proceeded to explore them by means of diamond-drilling and geophysical surveying.

Geophysical determinations and diamond-drilling have indicated that one deposit, having a possible length of 3,300 feet, exists at the north end of the Middle arm. The width and vertical extent of this body are at present indefinite, since none of the drill-holes have passed completely through the zone and only one hole, at the extreme west end, has been put down to depth. The calculated vertical depth reached in this hole, below the lake surface, is 1,350 feet.



Ferrodolomite breccia, showing crystalline ferrodolomite surrounding the fragments but not replacing them. This is typical of the ore zone.

The main body is believed to be tabular. It strikes north from Cave point for 2,000 feet and then swings sharply west for 1,300 feet. A second small body was discovered off Elbow point, where two diamond-drill holes encountered hard and soft hematite, but the geophysical survey did not indicate a large quantity.

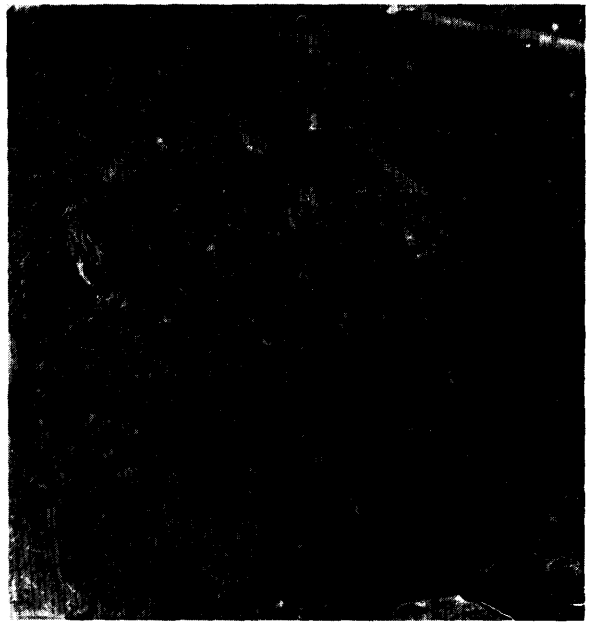
Development

During the winter of 1937–38, on the basis of the results of Cross's dip-needle survey, 12 holes were drilled from the ice, 2 off Elbow point and 10 at the north end of the Middle arm. The two at Elbow point and three at the north end struck ash rock. These results proved conclusively that the ash was the source of the magnetic attraction that Cross had attributed to iron oxide concentrations. The remaining holes encountered hard hematite and indicated a possible length of 700 feet for the deposit but yielded no information as to its width or vertical extent. The hard hematite yielded an average iron content of 58 per cent. natural iron.[1]

During the summer of 1938, two holes, Nos. 25 and 27, were put down to cut the westerly extension of the deposit. Hole No. 25 struck hard hematite at

[1]Computation of the Steerola Exploration Company.

a vertical depth of 400 feet, below the lake surface, and continued to cut sections of hard and soft hematite to 500 feet. It is believed that this hole just passed along the north side of the zone, alternately encountering iron oxide and wall rock, since the core showed short sections of hematite separated by sections of andesite and limestone. Two sections of No. 25, namely 540 to 580 feet and 644 to 706 feet, contained the following percentage compositions, respectively:—



Ferrodolomite breccia, showing amorphous type of cement, which contains altered fragments.

	Section 540 to 580 feet	Section 644 to 706 feet
	per cent.	per cent.
Iron	56.70	55.00
Manganese	.11	.09
Silica	6.14	8.00
Phosphorus	.02	.01
Sulphur	.27	.02
Lime	.53	.55

These analyses were obtained from the Steerola Exploration Company.

Hole No. 27, directed deeper into the deposit, struck good hematite first at 1,130 feet vertically, and from there to 1,350 feet the intersections were alternately hematite and unaltered or partially altered rock, indicating either that the deposit is spotty or that there are fragments of country rock separated by hematite. The latter is a reasonable explanation, since the zone is in a region of fracture.

During the winter months of 1938–39, Brant conducted a geophysical survey on the ice in an endeavour to trace the outline of the deposits.[1]

[1]A. Brant, "Geophysical Work at Steep Rock Lake," pages 48 to 50 of this volume.

On the strength of Brant's recommendations, the company commenced drilling on the ice again, following the trend of the geophysically defined zone of concentration. Up to March 15, 1939, 20 vertical holes had encountered hard hematite and 5 holes were in soft hematite and limonite. An additional 32 holes failed to reach bed rock on account of the coarse debris overlying the lake bottom. The surface of the deposit appears to be very irregular, ranging from 150 to 418 feet below the lake surface.

Composition and Grade of the Material

The Steeprock hematite, judging by the analyses obtained from the company of core and sludge samples and those made at the Provincial Assay Office, compares favourably with other iron ore deposits in North America. The silica, phosphorus, manganese, and sulphur contents are within commercial requirements. The following table is a summary of the available analyses of the Steeprock hematite, the first two being obtained from the Steerola Exploration Company and the last two made by the Provincial Assayer, Ontario Department of Mines.

	No. 1	No. 2	No. 3	No. 4
	per cent.	per cent.	per cent.	per cent.
Iron	56.70	55.00	65.17	62.84
Silica	6.14	8.00	1.07	.56
Phosphorus	.02	.01	nil	.01
Sulphur	.27	.02	.19	.13
Manganese	.11	.09	nil	nil

Sample No. 1—Drill-core sample, hole No. 25, intersection 540 to 580 feet.
Sample No. 2—Drill-core sample, hole No. 25, intersection 644 to 706 feet.
Sample No. 3—Hematite float, Floatore island.
Sample No. 4—Drill-core sample, hole No. 27.

Age and Origin of the Deposits

The iron deposit is believed to be related to fracturing and to the presence of the ferrodolomite and the pyritiferous ash rock. When folding took place, the ash sheared easily, but the more brittle limestone, greenstone, and clastics were fractured and brecciated. This disturbance (late Timiskaming or Algoman) produced channelways and allowed solutions or emanations containing ferruginous carbonate to travel upward and cement the rubble.

The abundance of ferrodolomite in the breccia, and the fact that hematite and limonite occur in the breccia zone, suggests that the iron oxide is largely the result of the oxidation and leaching of the carbonate supplemented by the oxidation to hematite of pyrite from the ash horizon. Although the carbonate forming the cement of the breccia contains only between 8.8 and 9.4 per cent. mixed iron oxides, given time enough and sufficient concentration, a material containing 50 to 60 per cent. metallic iron could be formed. In addition, the original ferruginous carbonate which entered the channelways may have been relatively richer in iron and comparable to a siderite. The ferrodolomite cement now seen in the breccia could be the sideritic material contaminated by magnesia from the limestone and basic country rock, the result being a carbonate with the over-all composition of the ferrodolomite. This supposition would account for the concentration of higher metallic iron content in the zones adjacent to the faults.

The relief, calculated from the difference between the average elevation along the shore on the east side of the zone of concentration and the depth at

which the top of the hematite is encountered, ranges from 250 to 500 feet. The alteration of the ferruginous carbonate to iron oxide, with the accompanying reduction in volume, can better explain this depression than either glaciation or normal rock weathering.

The explanation advanced by the writer for the origin of the ore involves the oxidation of the ferrodolomite in the breccia and the siderite(?) in the fractures by solutions, with the concentration of the resulting iron oxide in its present position. The oxidation of the carbonate was accompanied and aided by the oxidation of the pyrite in the ash rock.

The chemical reactions involved in the oxidation of the pyrite, according to experiments performed in the laboratory by Gottschalk and Buehler,[1] are as follows:—

$$FeS_2+7O+H_2O=FeSO_4+H_2SO_4$$

The ferrous sulphate ($FeSO_4$) oxidizes to ferric sulphate ($Fe_2(SO_4)_3$) according to the following reaction:—

$$2FeSO_4+O+H_2SO_4=Fe_2(SO_4)_3+H_2O$$

Hydrolysis converts the sulphate to iron oxide, probably hematite, as:—

$$Fe_2(SO_4)_3+3H_2O=Fe_2O_3+3H_2SO_4$$

Thus we have iron oxide (hematite) formed from the pyrite and also free sulphuric acid, which is available for the breakdown of carbonate. The alteration of the carbonate (ferrodolomite and siderite(?)) would take place as:—

$$(CaCO_3+MgCO_3+FeCO_3)+3H_2O=Ca(OH)_2+Mg(OH)_2+Fe(OH)_2+3CO_2$$

and

$$FeCO_3+H_2O=Fe(OH)_2+CO_2$$

Ferrous hydroxide ($Fe(OH)_2$) is not stable and rapidly oxidizes to hematite in the presence of oxygen-bearing waters according to the following equation:—

$$2Fe(OH)_2+O=Fe_2O_3+2H_2O$$

Theoretically the pyrite from the ash horizon and the ferruginous carbonate from the breccia zone might both contribute to the formation of hematite. The quantity of iron oxide formed would be dependant on the amounts of sulphide and carbonate present, on the extent of the brecciation, and on the amount of oxygen carried by the circulating waters.

Diamond-drilling has indicated that the ash rock is extensively altered and leached for a distance of 200 feet away from the hematite zone and that the sulphide content varies inversely as the alteration. The ash rock side of the deposit contains visible sulphides as skeleton crystals. The sulphide-bearing hematite gives way abruptly to hard, massive hematite, some of which displays botryoidal structure. Correspondingly, the material on the breccia side is higher in carbonate, which passes outward into a zone of alteration characterized by hematite stain extending far into the limestone.

It was mentioned above[2] that there appears to be two types of cement around the breccia fragments. Where the cement is coarsely crystalline, fracturing has been most pronounced and massive hematite is present. Where the cement is finer grained, indications of severe disturbances are lacking and to date deposits of hematite have not been encountered. The writer believes that this relationship is strong evidence to support the hypothesis that fracturing is an important factor in the formation of these deposits.

[1]V. H. Gottschalk and H. A. Buehler, "Oxidation of Sulphides," Econ. Geol., Vol. 7, No. 1, 1912, p. 16.

[2]Page 42.

If the hematite was due, as has been suggested, to the alteration and leaching of a banded iron formation, similar to the iron deposits of Minnesota and Michigan, it would appear as a stratigraphic horizon, following the bedding. This, however, does not seem to be the case, since the walls are alternately ash rock and limestone, ash rock and andesite, andesite and limestone, and andesite alone. In only a few holes has banded chert and siderite been encountered, and in these massive hematite is absent. The banded material is relatively unaltered and appears to be present in irregular, narrow, lenticular patches.

CONCLUSIONS

It appears that the iron deposits are closely related to zones of fracture which have been filled with ferrodolomite. These are usually close to ash rock and limestone, but not necessarily so in all cases. The ash rock is quite fissile and weathers easily, with the result that it forms depressions. Hence conditions favourable for the formation of hematite deposits similar to those at Steeprock lake are most likely to be found in depressions underlain by ferrodolomite breccia and ash rock.

Geophysical Work at Steeprock Lake, 1938-39

By A. Brant

Introduction

During the summer of 1938 the author was assigned to the Steeprock Lake survey party of the Ontario Department of Mines under M. W. Bartley for the purpose of carrying out magnetometer measurements to assist in the determination of structure and in the tracing beneath overburden of certain of the rock types encountered.

During the winter of 1938–39, electrical and magnetic surveys, attempted as research work by the Physics Department, University of Toronto, succeeded in indicating hematite bodies beneath the waters of the Middle arm and the rock contacts in the West arm.

The summer magnetometer work was done by T. Boyle, of Queen's University, and A. Brant, of the University of Toronto.

The winter magnetic and electrical measurements were carried out by R. Clark, J. Britton, H. Banting, F. McDonald, and A. Brant, of the University of Toronto, and T. Boyle, of Queen's University, assisted by W. Gemmell, J. Leonard, and L. Pattyson, of the Steerola Exploration Company, Limited.

Acknowledgments

Invaluable assistance in the geological interpretation of both the summer's and winter's geophysical results was received from W. Neeland, geologist of the Steerola Exploration Company, and M. W. Bartley. Thanks in great measure is also due M. S. Fotheringham, chief engineer of the Steerola Company, for his continued co-operation throughout the work.

Results of Magnetometer Work, Summer of 1938

The following interpreted results, shown on the geological map (No. 48b) of the area, were derived from observations with an Askania vertical magnetometer of sensitivity[1] 20 γ per scale division.

In the northwestern part of the West arm to the north and east of Cedar Springs, a lime[2]-andesite contact was traced northward to a point where the limestone meets the ash rock and the andesite meets the granite. Rock types here were chiefly indicated by outcrops. From the drag-folded lime contact outlined just east of Cedar Springs, the faulting was shown to have caused a relative northward movement of the east side.

A magnetic traverse eastward from the narrow part of the West arm over the breccia and the limestone, across a deep valley and up the hill of granite beyond, indicated higher magnetic intensities in the valley, which from the winter's work were subsequently inferred to be due to ash rock.

At Birch point andesite tuff and flow formations, identifiable by outcrops, and dolomitic fragments of several hundred square feet in area surrounded by the flow, were delineated. Assuming the formula expressing the magnetic anomaly for a body of rectangular cross-section to be applicable here, and making allowance for topography, the values of vertical magnetic intensity obtained across

[1]The sensitivity of a dip needle by contrast is about 300 γ per degree dip. A magnetometer, however, can be read quite accurately to one-fifth of a scale division, i.e. to about 4 γ, a dip needle to half a degree, i.e. 150 γ, where a γ is a small unit of magnetic intensity $= 10^{-5}$ Gauss.

[2]The word "lime" is used for convenience, throughout this report, to include the blue limestone, the ferrodolomite, and the ferrodolomite breccia.

the dolomite seem to indicate that the dolomite extends to no great depth. A drill-hole, off shore, about 200 feet south of the outcropping dolomite, failed to intersect it at a depth of a few hundred feet.

A cherty breccia horizon and ash rock of widely varying magnetic permeability was traced along the west shore of the East arm northwestward from Greenstone point, and the geologically inferred folding thereby substantiated.

To the west of Greenstone point a permanently magnetic chert and magnetite iron formation was outlined and the contacting ash rock followed to the southeast and west, where it was met by a diorite ridge.

At the north end of Strawhat lake the juxtaposition of the limestone, ash rock, and andesite formations delineated might be explained by the remnants of two minor anticlines separated by the intermediate exposed portions of the underlying older flow rock.

Results of Magnetic and Electrical Work in the Middle Arm, December, 1938, and January, 1939

The geological map[1] illustrates the results of the magnetic and electrical measurements in the Middle arm. Note that at the ash-lime contact room has been left to indicate the presence of the electrically inferred hematite body.

From observations with an Askania vertical magnetometer the ash-lime (inclusive of possible hematite) contact was readily found, for the ash rock was magnetic, the lime non-magnetic.

Electrical measurements, of the difference in electrical resistance of geometrically equal earth sections, served to indicate the presence of possible hematite; for dense hematite, such as that encountered in drill-holes put down during the winter of 1937–38, was found to be more electrically resistant than either ash or lime. Moreover, the electrical results at the northeast corner of the Middle arm seemed to indicate that here the hematite body extended downwards for at least several hundreds of feet.

In addition the magnetic results also evidenced, in the east middle part of the Middle arm, the presence of a body of unknown rock material, of low permeability and (from the electrical work) of good conductivity, which subsequent drilling showed to be reddish, altered greywacke-like sediments. In the northwest corner of the Middle arm to the north of the electrically delineated hematite, the magnetic results were incompatible with the presence of lime. Drilling in this vicinity indicated a reddish sheared lava.

Results of Magnetic and Electrical Work in the West Arm, February and March, 1939

From magnetic observations with an Askania vertical magnetometer evidence was found of ash and lime rock in the relative locations shown on Bartley's geological map. Note the ash rock lying in a shallow trough of lime at and north of the narrow part of the West arm north of the narrows. Calculations from the variation of vertical magnetic intensity across the trough at the narrow part of the West arm showed the water to be about 75 feet deep above a basin-like depression filled with not more than 100 feet of ash rock. Other calculations, from vertical intensity profiles, of the dips of formations and the depths to bed rock were in agreement with the known geological conditions.

The electrical measurements substantiated the presence of the trough and the magnetically established rock contacts and types.

[1]No. 48b accompanying this volume.

Conclusions from the Magnetic and Electrical Work at Steeprock Lake

1. It is apparent that where suitable differences in electrical properties exist, rock formations beneath lakes may be delineated by electrical resistance measurements. Waters of most lakes, owing to dissolved sulphides, carbonates, etc., will be sufficiently conducting to carry the currents well down into the underlying rock materials as desired.

2. From the magnetic work it is apparent that lime-lava contacts, for example, can be traced and faults indicated if they are marked by less magnetic, leached, gouge material.

3. When the magnetic rock formations are roughly rectangular in cross-section approximate calculations of their dip, and depth below the surface, may be made from a vertical intensity profile curve.

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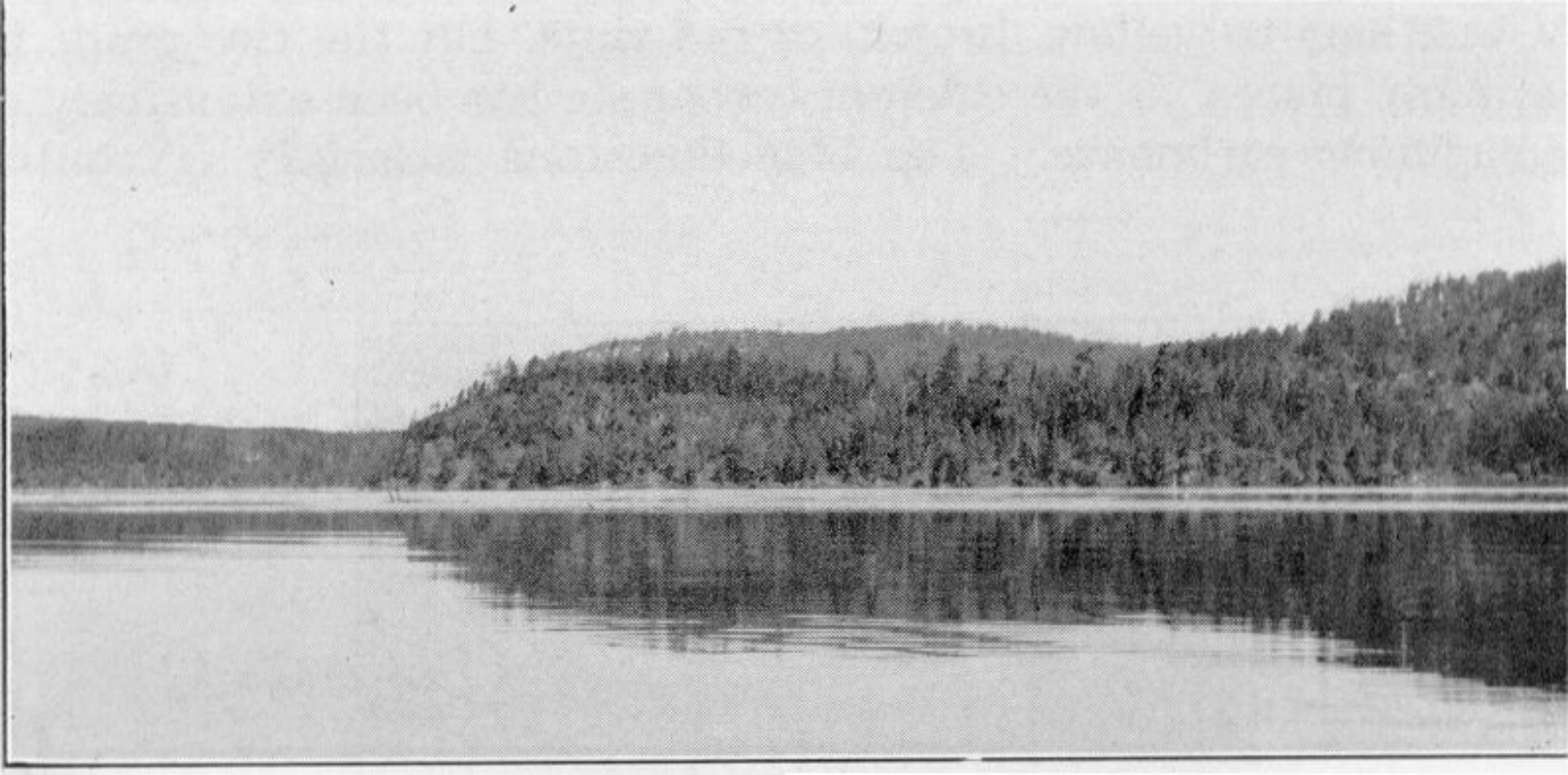
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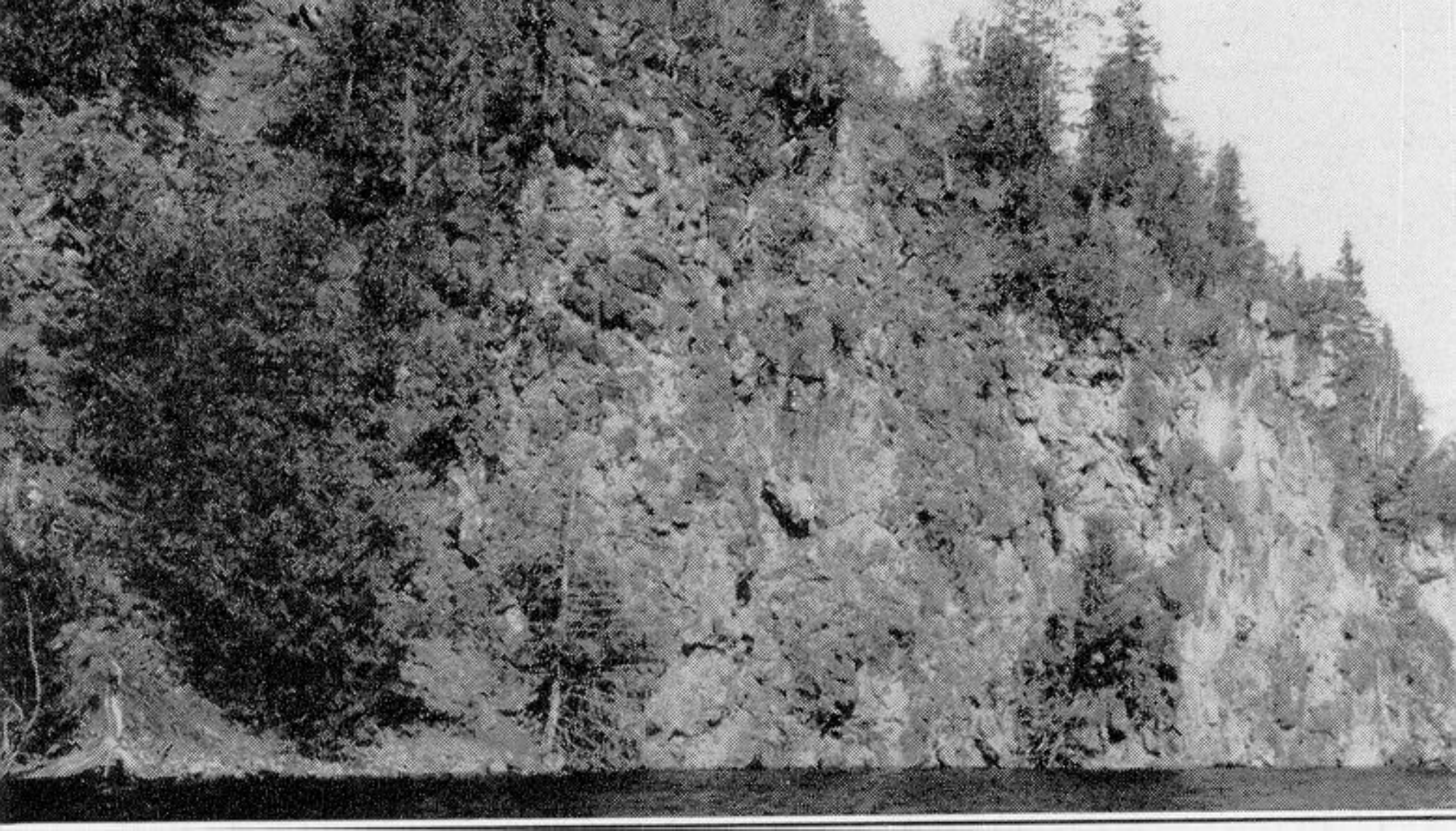
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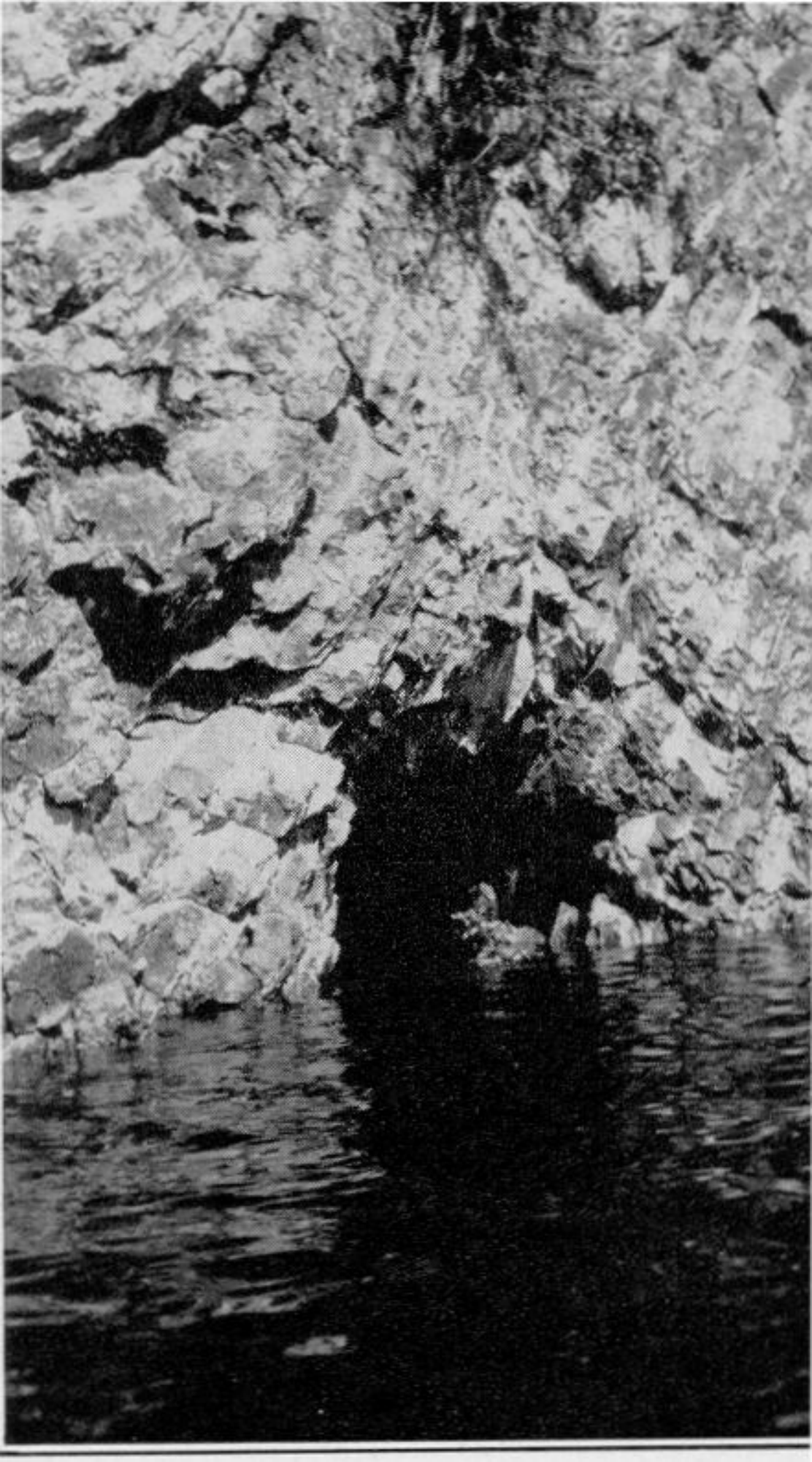
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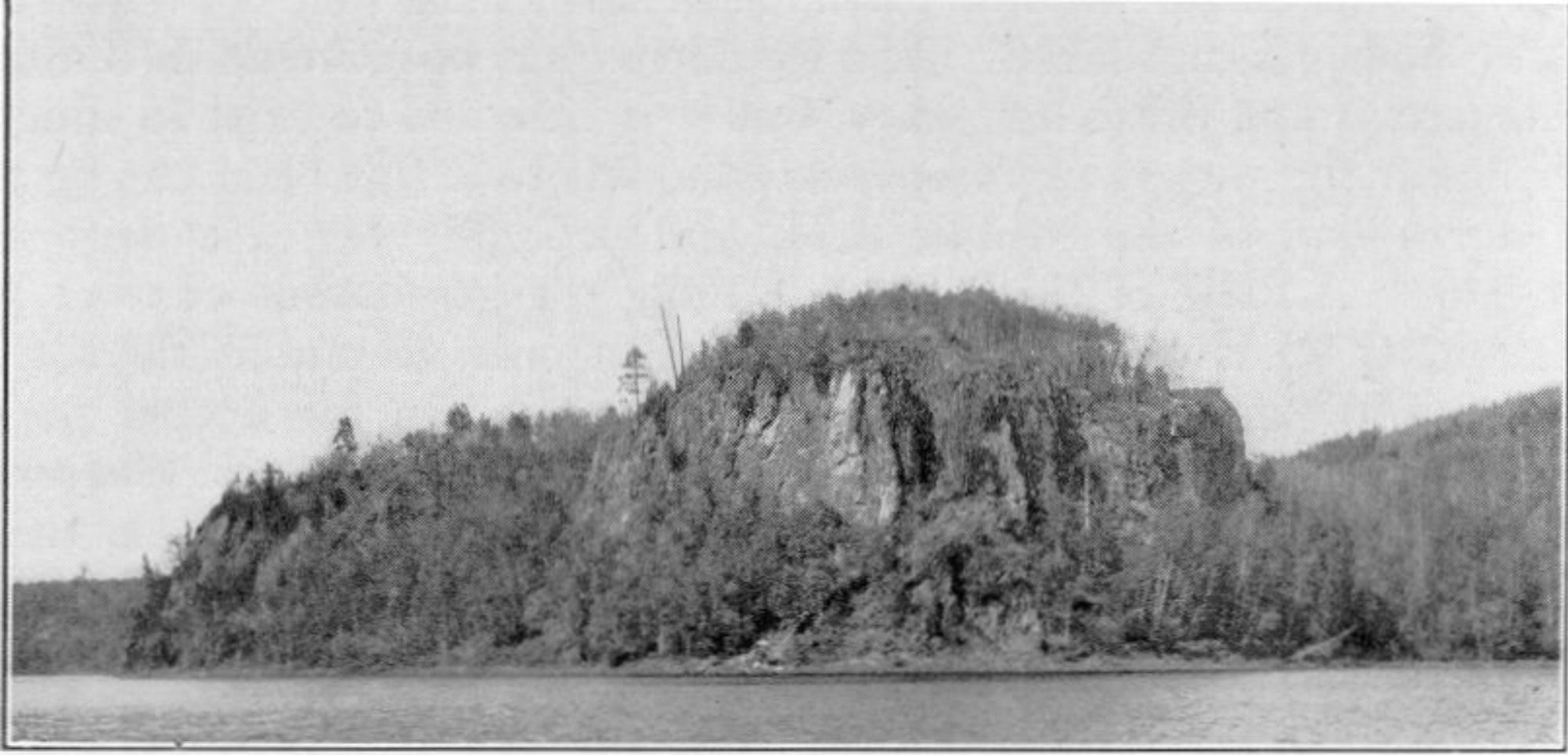
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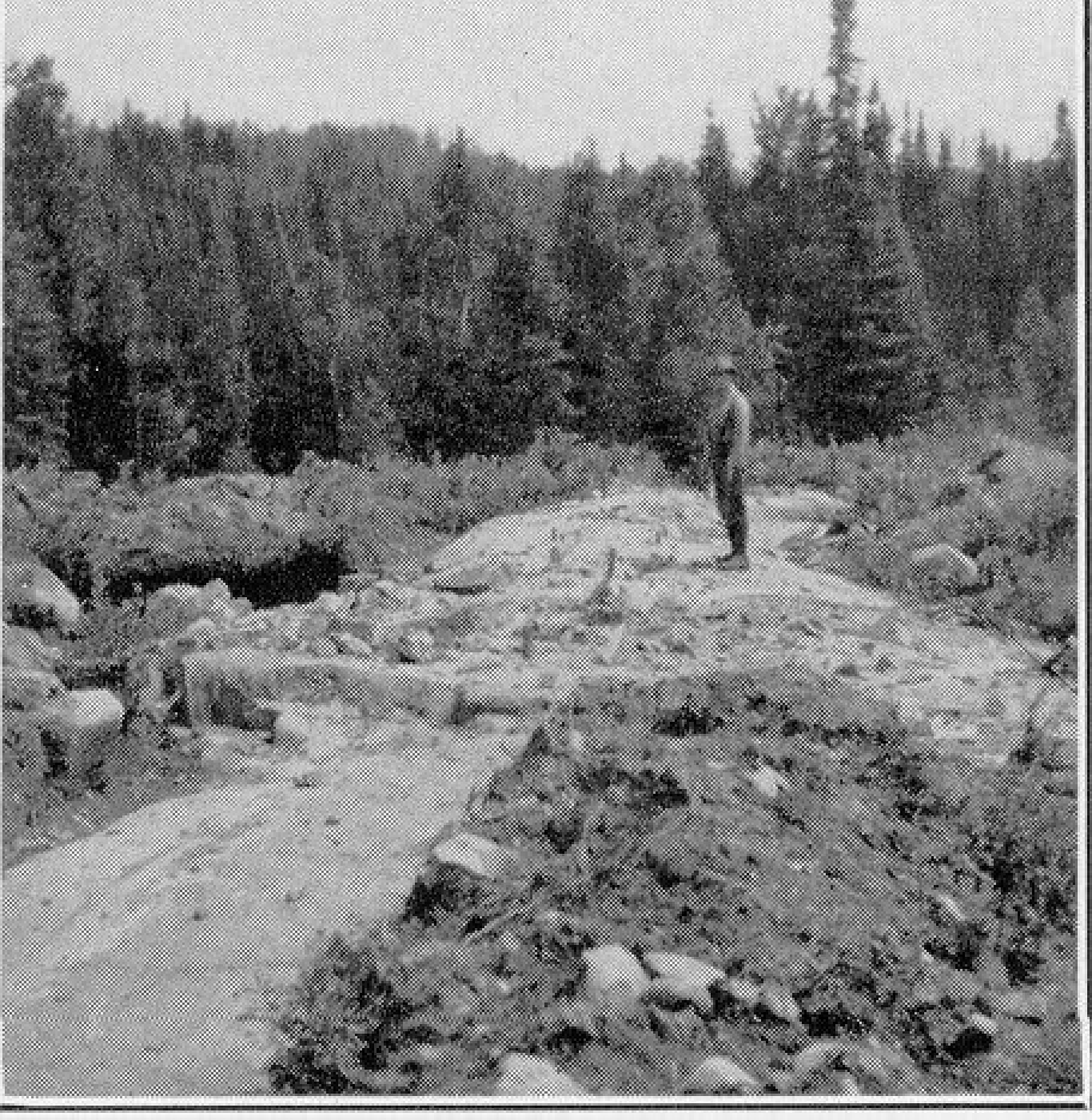




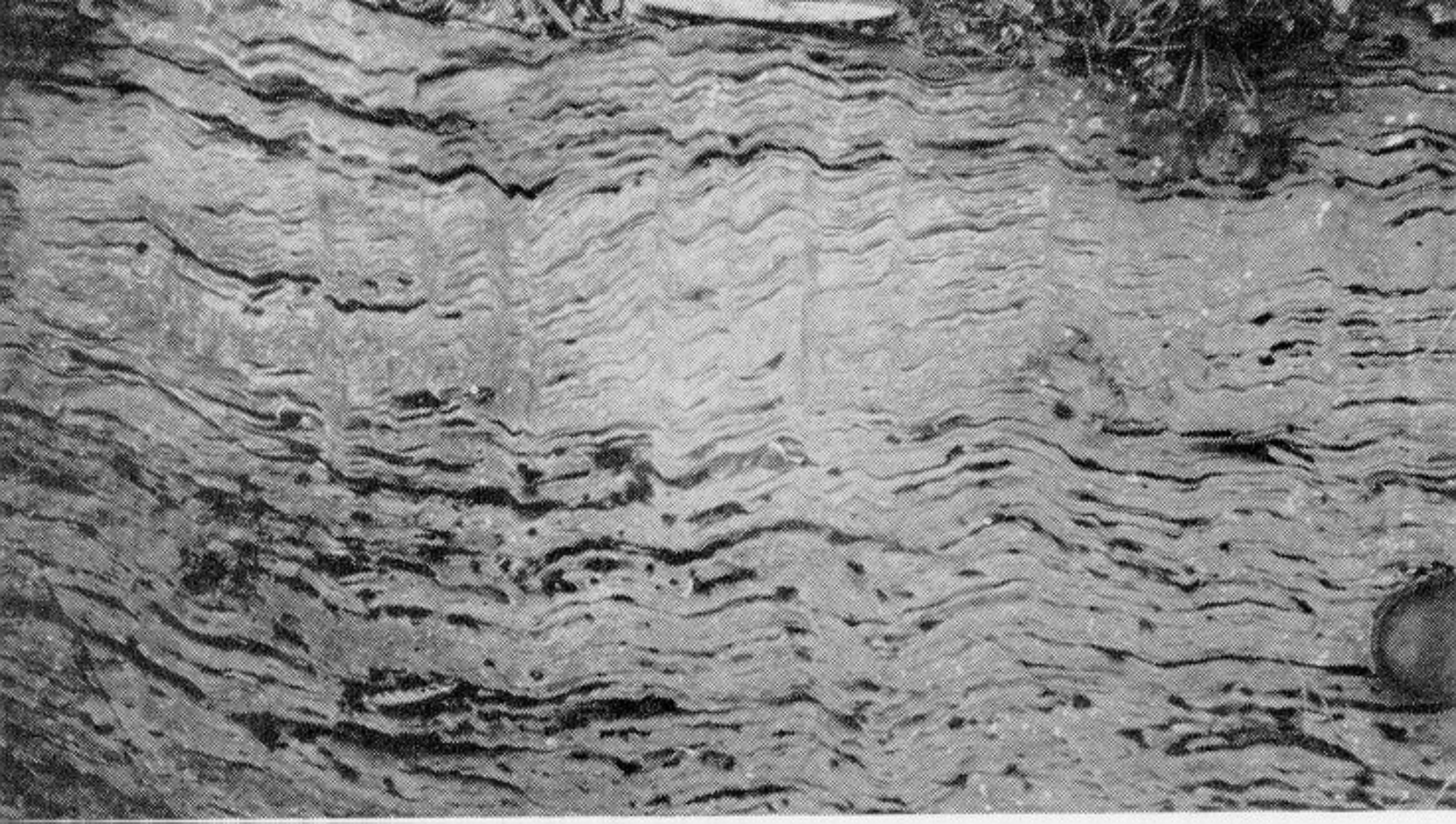












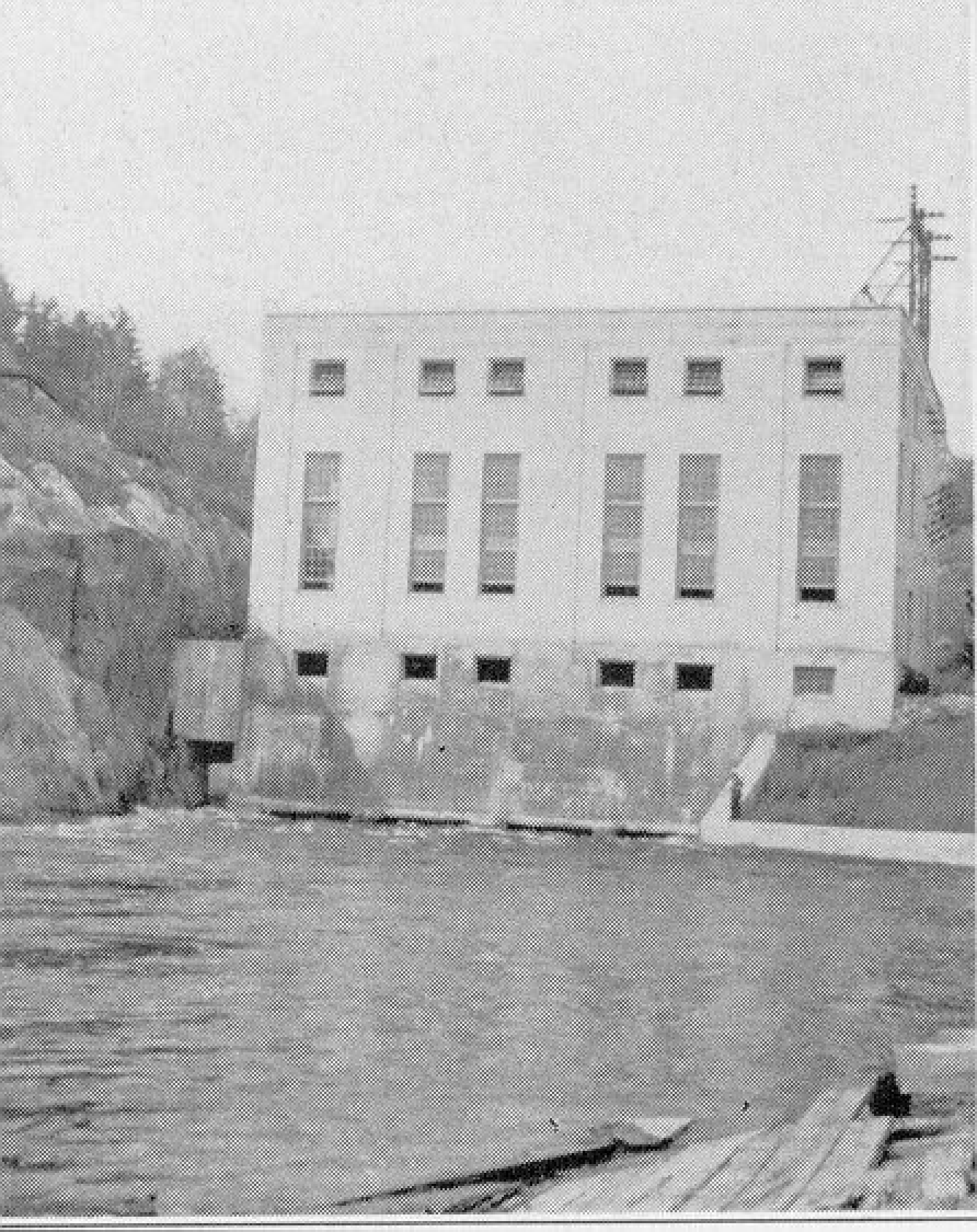


















PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. ROBERT LAURIER, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART III, 1939

Geology of Gorham Township and Vicinity

By

R. D. MACDONALD

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COLOURED GEOLOGICAL MAP

(In pocket at back of report)

Map No. 48c—Gorham Township and Vicinity, District of Thunder Bay, Ontario. Scale, 1 mile to the inch.

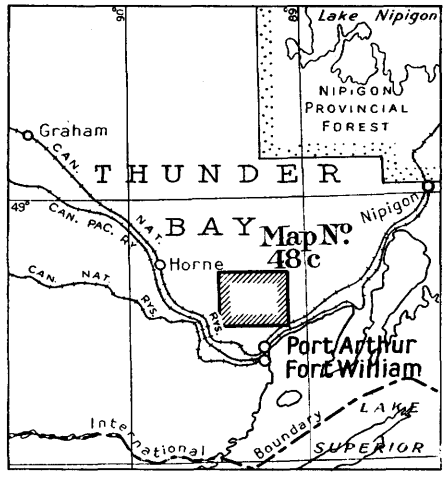
Geology of Gorham Township and Vicinity

By R. D. Macdonald

INTRODUCTION

The map area designated as "Gorham Township and Vicinity" lies a short distance north of Port Arthur in the district of Thunder Bay. It includes the townships of Gorham and Jacques, the eastern parts of Ware and Fowler, the western part of MacGregor, and an area surrounding Onion lake.

Prospecting in the area was originally carried out in the search for iron ore, but no commercial deposits were found. Present activities are concerned with the search for gold. Gold has been found in quartz veins and stringers in sheared volcanics. Pyrite is the chief metallic mineral associated with the gold.



Key map showing the location of the Gorham Township area. Scale, 50 miles to the inch.

The field work in connection with this report was done during the summer of 1938. The geology was mapped by means of pace-and-compass traverses, the resulting information being recorded on a base map supplied by the Air Surveys Branch, Department of the Interior, Ottawa.

Acknowledgments

The field mapping was greatly facilitated by the co-operation of the residents of the area and the men interested in its mineral development. The writer wishes to express his appreciation and thanks to J. D. Wright, W. W. Beaton, and G. Papineau for the information they supplied in connection with the properties of Gorham Gold Mines, Limited, and Lake Head Gold Mines, Limited. Able assistance was rendered in the field mapping by J. E. S. Milne, A. M. Burslem, and A. Johnson.

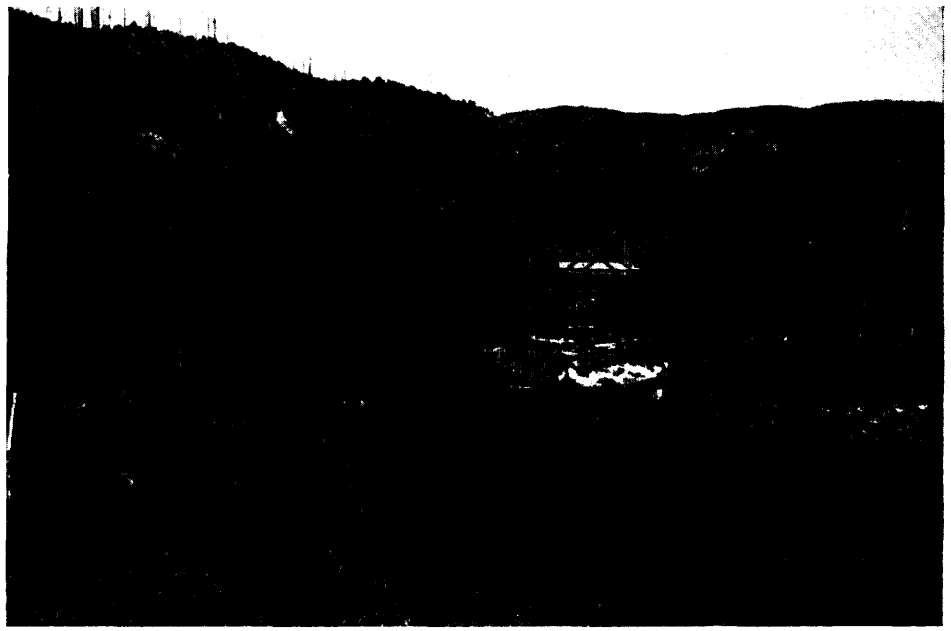
Means of Access

Most of the area is accessible by gravel roads. The roads in the western part connect with the highway running from Port Arthur to Winnipeg; those in the eastern part lead directly to Port Arthur. The northern parts of Jacques and

Fowler townships can be reached by a canoe route that connects with the road to Dog lake just east of Paul lake. The route leads westward through Paul, Spike, and Hawkeye lakes and eastward through Missing and Mary lakes. Onion lake forms a means of access to the northeastern part of the area. Current river, the only sizable river in the area, is unsuitable for navigation by canoe over most of its length.

Previous Geological Work

A compilation of previous geological work done in the Gorham area appears on map No. 308A, "The Lake Nipigon Sheet," published in 1935 by the Geological Survey of Canada. The compilation is based on mapping done by Wm. McInnes[1] and L. P. Silver.[2] Modifications and additions to this work were supplied by T. L. Tanton[3] in the years 1919, 1921, and 1924.



View of the Current River valley looking north from a point one and a half miles south of Onion lake.

An excellent bibliography of publications on the area is included by Tanton in Memoir 167 of the Geological Survey of Canada.

Topography

The area lies in a range of rocky hills to the north of the Kaministikwia valley. In some places the elevations are from 600 to 700 feet above the level of Lake Superior. The direction of drainage is southward. The Current and

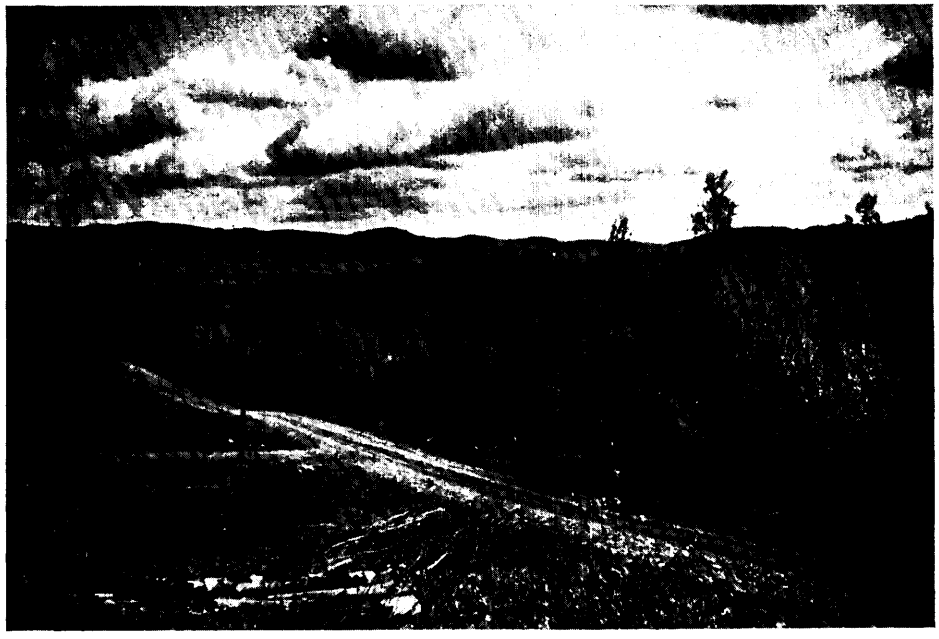
[1]Wm. McInnes, "Report on the Geology of the Area Covered by the Seine River and Lake Shebandowan Map-Sheets, Comprising Portions of Rainy River and Thunder Bay Districts, Ontario," Geol. Surv. Can., Vol. X, 1897, pt. H, pp. 13-51.

[2]L. P. Silver, "The Animikie Iron Range," Ont. Bur. Mines, Vol. XV, 1906, pt. 1, pp. 156-172.

[3]T. L. Tanton, Geol. Surv. Can., Sum. Rept. 1919, pt. E, pp. 1-7; Sum. Rept. 1921, pt. D, pp. 1-6; Sum. Rept. 1924, pt. C, pp. 1-27.

North Current rivers empty into Lake Superior within the city limits of Port Arthur. McIntyre creek, which drains the western part of Gorham township, empties into Lake Superior between Port Arthur and Fort William. The northern parts of Jacques and Fowler townships are drained by way of Hawkeye lake to Dog lake and thence southward to the Kaministikwia river. The large north-south drainage channels are probably pre-glacial and show little relation to the structure of the underlying rocks.

Rock outcrops are abundant in most parts of the area. Glacial deposits are usually thin but are known to have local thicknesses of at least 50 feet. The southern part of Ware township and the southwestern part of Gorham township



View looking north from the southeast corner of lot 7, concession III, Gorham township, showing the typical topography of the township.

are extensively covered by glacial deposits and drift. Since the topography of the area shows a moderate relief, drainage is quite effective and very few muskegs are found.

Natural Resources

The commodity of greatest economic importance in the area has been pulpwood timber. Logging has been carried on by large timbering concerns and by individual farmers in the area. Much of the better timber has been removed by cutting or destroyed by fire, and at the present time only a relatively small amount of timber is being taken out.

Mixed farming is carried on in the southern part of the area. Owing to the relatively rugged and rocky nature of the area, however, it is not good farming land and only small fields have been cleared.

Hydro-electric power is developed on the Current river at Port Arthur. A control dam, which forms part of the power development, is situated at the south end of Onion lake.

GENERAL GEOLOGY

The consolidated rocks of the area are pre-Cambrian in age. They are overlain by gravel, sand, clay, and drift of glacial and post-glacial origin. The pre-Cambrian rocks include intrusive, extrusive, and sedimentary types. The extrusive rocks, consisting of altered lavas and pyroclastics, are classed as Keewatin because of their lithological similarity to the type Keewatin rocks. These rocks have a general east-west trend across the southern parts of Ware, Gorham, and MacGregor townships.

Two lithologically distinct groups of sediments occur in the area. The more widespread group occurs mainly to the north of the Keewatin rocks in a belt of variable width. The sediments of this group are provisionally classed as Coutchiching in age. The other, less extensive, group of sediments lies within the belt of Keewatin rocks and is considered to be post-Keewatin in age. It corresponds to Tanton's Windigokan series.[1]

The large granitic bodies of the area intrude Keewatin and Coutchiching formations. Diabase occurs as the youngest of the pre-Cambrian rocks and intrudes all other formations.

The various formations are tabulated with respect to age as follows:—

Table of Formations

QUATERNARY	
PLEISTOCENE and RECENT:	Till, gravel, sand, clay, and muskeg accumulations.
PRE-CAMBRIAN	
KEWEENAWAN:	Diabase. Olivine gabbro.
POST-KEEWATIN:	BATHOLITHIC INTRUSIVES: Biotite and hornblende granite, porphyritic granite, grey biotite granite and granite gneiss, pegmatite and diorite. SEDIMENTS: Conglomerate, arkose, greywacke and fine siliceous sediment, iron formation.
KEEWATIN:	ACID VOLCANICS: Rhyolite and rhyolite porphyry, dacite, sericite schist. VOLCANIC FRAGMENTALS: Agglomerate, tuff, sediments, iron formation. BASIC VOLCANICS: Andesite, basalt, pillow lava, hornblende schist and gneiss, chlorite schist.
COUTCHICHING:	Banded mica schist and gneiss. Stratified sediments. Massive siliceous sediments.

Coutchiching

The Coutchiching rocks consist of a sedimentary series occupying a belt to the south of the northern granite mass. The belt extends across the area with an average trend of N. 65° E. and ranges in width from 2 to 6 miles. In Ware township the width is narrow, since the belt is there intruded by a mass of porphyritic granite. Volcanic rocks lie within the sedimentary series in the central part of Ware township. A group of sediments surrounding the granite mass in the northern part of MacGregor township is lithologically like the sediments in the vicinity of Onion lake but is separated from them by a belt of basic volcanics. In general, the formation is characterized by a uniformity of bedded structures and steep dips.

[1]T. L. Tanton, Geol. Surv. Can., Sum. Rept. 1924, pt. C, pp. 11-17.

The sediments are separated into three main groups. The group that is the most widespread consists of stratified brownish-grey, medium- to fine-grained sediments, composed mainly of quartz and feldspar. Biotite forms an average of 5 to 10 per cent. of the rock. The bands, many of which show a gradation of grain size, range in width from a few inches up to 6 feet. The schistosity, as produced by the alignment of the biotite, appears to be parallel to the bedding. The degree of schistosity varies within the formation, but is usually more strongly developed towards the north. In the central part of Ware township some of the stratified sediments are slightly chloritic.

A second group, which is of local occurrence, consists of unstratified, fine-grained, highly siliceous rocks. Their biotite content is low, and schistosity is poorly developed. They may be of clastic or pyroclastic origin.

In the vicinity of the northern granite mass the sedimentary rocks are characteristically banded biotite schists and gneisses. Garnetiferous phases are locally present. These rocks are considered to be more highly metamorphosed phases of the previously described sediments. The contact between the Coutchiching sediments and the northern granite usually constitutes a zone of intrusion. Dike-like bodies of granite intrude the northern schists, and many schistose inclusions occur in the granite along its southern border.

The Coutchiching rocks are cut by numerous veins of white quartz. Many of the veins run parallel to the strike of the bedding or schistosity; others are irregular and show crosscutting relations. The rocks are also intruded by pegmatitic and dioritic bodies.

Keewatin

The Keewatin consists predominantly of acid and basic lavas and pyroclastics. The boundaries between the various groups are not sharply defined, and in the accompanying map the rocks have been grouped according to the predominant rock type.

Basic Volcanics

The basic lavas range in composition from dacite to basalt, andesite being the most common type. They are characteristically dark-green in colour, but the grain size varies from fine to coarse. The rocks are typically sheared and chloritized.

Poorly formed pillow structures occur in association with basic lavas in a few places. The best examples occur in the northern part of lot 2, concession II, Ware township, and lot 16, concession A, MacGregor township. The pillows are too poorly formed in most cases to afford a means of structural determination.

A coarse, dioritic-textured rock occurs in association with some of the basic lavas. No intrusive relations with the lava were seen; and since the rock shows an apparent gradation in many places to typical andesite, it is considered to represent a coarse-textured lava developed by recrystallization or by slow cooling of some of the thicker andesite flows. Examples of this type occur in lot 10, concession III, and lot 7, concession V, Gorham township. Examination of a thin section shows the rock to be distinctly altered with the development of chlorite and kaolin.

Metamorphism of the basic lavas has resulted in the production of hornblende and chlorite schists. The degree of schistosity varies throughout the volcanic belt. Chlorite schists are more commonly associated with the fine-grained andesites. Hornblende schists are common in the northern volcanic belt, which extends from Hazelwood lake to Beaverlodge lake. Where intruded by granite, the basic lavas have in many places been changed to a coarse-grained hornblendic rock.

Volcanic Fragmentals and Sediments

A considerable part of the Keewatin belt consists of sheared agglomerate and tuff. These occur in association with the lavas throughout the belt but are most extensive as a zone in the central part of the Keewatin.

The agglomerates are for the most part acidic in composition. The colour is generally greenish-grey on a fresh surface and light-grey on a weathered surface. The fragments, which lie in a tuffaceous groundmass, are largely rhyolite and rhyolite porphyry. A few are andesitic in composition. The shapes of the fragments are angular to elongate depending on the amount of shearing to which the rocks have been subjected. Good exposures occur on the property of Lake Head Gold Mines and on the Current river in mining claim No. 73E.

Basic agglomerates occur chiefly in the volcanic belt running from Hazelwood lake to Beaverlodge lake, where they are associated with coarse andesitic and hornblendic rocks. In some instances, where the fragments have the same composition as the groundmass, they may be flow breccias. These rocks typically show a greater proportion of fragments to groundmass than do the acidic agglomerates. All observed outcrops were distinctly sheared.

Massive and stratified tuffs are usually closely associated. They are largely acidic in composition and vary in texture from fine- to medium-grained. Some have a porphyritic appearance due to the presence of coarse quartz and feldspar grains in a fine-grained groundmass. The feldspars usually show a good crystal form. Examples of this type occur on the property of Lake Head Gold Mines. In a more basic type of tuff, andesitic material is present in fragmental grains. An example of this type occurs on the road between lots 12 and 13, concession II, Gorham township.

The tuffs occur in association with lavas and are highly metamorphosed. Some are now chlorite and sericite schists; others have been highly carbonatized. The feldspars are extensively altered to sericite and kaolin.

Minor amounts of sedimentary materials other than the stratified tuffs are present in the Keewatin rocks. These are usually associated with tuffaceous material, and on the map they are all grouped together. They include iron formation, chert, and banded carbonate rock. The iron formation in the Keewatin occurs in narrow widths, consisting of layers of magnetite and finely crystalline silica. Chert is usually associated with the iron formation as small irregular lenses. Banded carbonate rock occurs locally within the tuffaceous rocks. An example occurs on the bank of McIntyre creek, close to the Dog Lake road, lot 15, concession II, Gorham township.

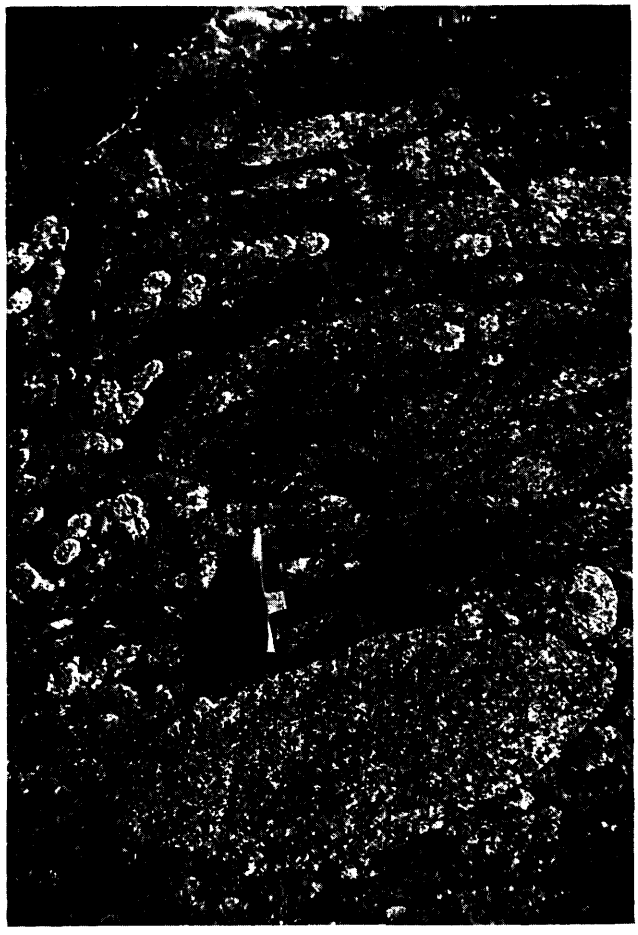
Acid Volcanics

The acid volcanics consist of rhyolite and rhyolite porphyry. Although they are not as abundant as the basic volcanics they are the common type in the southern part of Ware township and the southwestern part of Gorham. The rhyolites are usually massive and have a dense siliceous appearance. A few associated sericite schists are considered to be schistose phases of the flows. The rhyolite porphyries have a groundmass similar to the rhyolites, but contain phenocrysts of quartz or quartz and feldspar. The colour of both types varies from pink to dark-grey, the commonest colour being a dull grey.

In the absence of visible intrusive relationships the porphyries are considered to be flow rocks, although some may be intrusive porphyries. That at least part of them are flows is indicated in certain outcrops by the presence of flow banding. Other outcrops contain both rhyolite porphyry and volcanic fragmental material.

Post-Keewatin Sediments

A group of clastic sediments, which lie stratigraphically above the Keewatin, occupy three elongate areas in Ware and Gorham townships. The rocks consist of conglomerate, arkose, greywacke, fine siliceous sediments, and iron formation. The coarser clastics, such as conglomerate and arkose, are poorly stratified. Many of the greywackes, fine siliceous sediments, and iron formations show



Boulder conglomerate, lot 10, concession I, Ware township.

bedding structures; but since gradation in grain size is not apparent, no information was obtained as to the direction of the tops of the beds.

The base of the sedimentary series consists of conglomerate, conglomeratic grit, or arkose. Examples of conglomerate are to be seen in the central part of lot 10, concession I, Gorham township; on the road between lots 10 and 11, concession I, Gorham township; and in the central part of lot 1, concession II, Ware township. An excellent example of boulder conglomerate occurs on the road between lots 10 and 11, concession I, Ware township. The pebbles range in length from 1 inch to 2 feet. The types of pebbles observed include granite,

chert, jasper, andesite, and vein quartz. Granite pebbles are the predominant type. The pebbles are round to elongate and lie in a massive to sheared, reddish-grey or grey arkosic groundmass.

Arkose occurs extensively within the sedimentary group, in some places associated with conglomerate, in others with coarse greywacke. The arkoses vary from coarse, massive, dull-red types to finer-grained, sheared, light greenish-grey types. They are composed of angular grains of quartz and feldspar together with such alteration products as sericite, kaolin, and chlorite.

A group of fine-grained, massive and stratified sediments occur in the belt occupying the southeastern part of Gorham township. Many of them are greywackes; others are very fine grained, light-grey to greenish-grey siliceous rocks. The fine-grained varieties may be waterlain tuffs.

Iron formation occurs in several horizons within the sedimentary series. One type consists of grey slaty material with beds of fine-grained silica and hematite or magnetite. Another type is less finely banded, and the iron is in the form of fine-grained magnetite.

Batholithic Intrusives

The granitic rocks of the area occur in seven masses. The main types are grey biotite granite, pink biotite and hornblende granite, and pink porphyritic hornblende granite. Despite the fact that the granites show marked differences in composition, texture, and colour, no evidence was obtained to show differences in age.

Grey biotite granite lies to the north of the Coutchiching sediments in the northern part of the area. The contact is in some places gradational, and many schistose inclusions are present in the granite. Some of the ghost-like inclusions impart a gneissic structure to the granite, but the major portion is massive. Coarse pegmatitic phases occur within the granite.

Pegmatitic dike-like bodies occur in the Coutchiching sediments. These are considered to be intrusive phases of the grey granite. Several outcrops of dioritic intrusive rock also occur within the Coutchiching. These are regarded as basic phases of the granitic intrusion or hybrid rocks resulting from assimilation of Coutchiching sediments.

Pink hornblende granite and biotite granite occur in five separate masses. The mass bordering the southwestern part of Gorham township and the southeastern part of Ware is a medium-grained, massive hornblende granite. A mass of similar type occurs in the central part of Gorham township to the south of Hazelwood lake. Parts of the mass are a biotite granite. The contacts are usually sharp. Where the granite intrudes basic Keewatin rocks, coarse massive hornblende phases may be present, as in the southeastern part of lot 8, concession V, Gorham township.

Three intrusive masses occur on the east side of the area. The southern mass consists of pink, massive granite. It differs from the other granites in having a higher content of quartz. Biotite is the usual accessory mineral; hornblende is present in some of the border phases. The granite mass in the northern part of MacGregor township and the eastern part of Gorham township is a medium-grained, pink to grey biotite or hornblende granite. It contains numerous inclusions of schistose country rock. The northern mass is a pink, medium-grained, massive biotite granite.

Pink porphyritic hornblende granite occurs in the southeastern part of Jacques township, in the southern part of Fowler township, and in the northern part of Ware. It is uniformly porphyritic, containing phenocrysts of feldspar

up to an inch in length. In the region of One Island lake this granite mass comes in close proximity to the grey granite of the northern part of the area. It was impossible, however, to obtain any information as to the relative ages of the two granites, as the contact is covered by overburden.

Basic dikes occur in the area, but they are too small to be indicated on the map. They are known to intrude both Coutchiching and Keewatin rocks but occur most abundantly in the Coutchiching rocks near their contact with the northern volcanic belt.

Keweenawan

A few outcrops of medium- to fine-grained diabase were encountered in the area. Since the rock is lithologically similar to the Keweenawan diabase of the Fort William area, it is here classed as Keweenawan. It occurs in isolated outcrops, which are thought to represent dike-like bodies. No information was obtained as to their trend or their true widths.

A mass of olivine gabbro occurs in lots 11 and 12, concessions I and II, Gorham township. The rock has a medium to coarse granitic texture and consists of andesine feldspar, pyroxene, and olivine. The feldspar shows a slight alteration to sericite. On the basis of its freshness and composition the rock is classed with the diabases as being Keweenawan in age.

Pleistocene and Recent

Pleistocene deposits of till and stratified sand, gravel, and clay are present in various parts of the area. Boulder clay occurs as a thin mantle in many places. Stratified gravel and sand occurs quite extensively as rolling plains or low ridges in the southern part of the area. A thin mantle of stratified, rusty-coloured clay occurs in lots 8 and 9, concessions IV and V, Ware township.

Evidence of glacial erosion can be seen in the rounded nature of the rock hills and in the presence of glacial striae on numerous outcrops. Two sets of striae are present, the more predominant one trending south-southwest, the other trending south-southeast. Several outcrops reveal both sets. For a more detailed description of the glacial phenomena of the area, the reader is referred to Tanton's report on the Fort William and Port Arthur area.[1]

Post-glacial accumulations of muskeg are present, but owing to the moderate relief of the area drainage is good and the muskegs are neither numerous nor extensive.

STRUCTURAL GEOLOGY

Primary structures suitable for the determination of the attitude of beds and lava flows are present in some parts of the area. Pillow structures are few and usually poor. The Coutchiching sediments show grain-size variations in many places. The attitudes in the post-Keewatin sediments could not be determined.

The formations show a general east to east-northeast trend. Schistosity runs parallel to the trend of the formations and has, in many places, destroyed primary structures. The schistosity dips steeply or is vertical. The attitude of the formations, as determined by the dip of sedimentary beds and lava flows, is also steep or vertical. Some of the beds have been overturned as much as 20 degrees.

The attitude of the sedimentary beds in the Coutchiching sediments affords the chief evidence for placing the formation stratigraphically below the Keewatin. The contact between the sediments and the Keewatin volcanics crosses

[1]T. L. Tanton, Geol. Surv. Can., Mem. 167, 1931, pp. 76-80.

the road to Lottit lake in lot 8, concession V, Gorham township. For a distance of one and a half miles north of this contact the sediments show tops of bedding to the south. North of this mile and a half zone the beds are too highly sheared to show distinct grain-size variations. The sediments, then, occupy a position stratigraphically below the volcanics, unless the contact represents a major fault contact. In concessions III and IV of Ware township, two volcanic lenses lie within Coutchiching-like sediments. To the north and south of these volcanics the sediments show tops south, so that the apparent relationship indicates an interbanding of sediments and volcanics. Thus the major part of the Coutchiching sediments is considered to be pre-Keewatin in age, since it would be necessary to postulate several major faults, for which there is no direct evidence, to satisfy a contention for post-Keewatin age. The Coutchiching-like rocks lying to the south of the northern volcanic band may be considered as occupying a transition zone from a period of dominant sedimentary action to one of dominant volcanic action. The post-Keewatin sediments occupy synclinal basins in the Keewatin.

Highly sheared zones are probably indications of faulting that took place during the folding of the rocks. In some places the formations have been slightly offset by cross-faults. Fracturing has occurred in some of the more massive types of rocks.

ECONOMIC GEOLOGY

Iron

The mineral possibilities of the area have been investigated intermittently over a period of more than forty years. The iron formations were first investigated as possible sources of iron ore. Many test pits were sunk on them, but the material was not found to be of commercial grade. The patented mining claims of the area were taken up during the period of investigation for iron. Tanton[1] states, in connection with the grade of the iron formations in the Eastern Part of the Matawin Iron Range, that, "The possible commercial value of the richest known parts of the Keewatin iron formation depends on the feasibility of employing a method of beneficiation."

Molybdenum

Molybdenite is known to occur in several places in the Port Arthur region. So far none of the occurrences has proved to be of economic value. A few tons of rock containing molybdenite were shipped during 1938 from a deposit near Loon lake in McTavish township, but the material was not of commercial grade. An occurrence of molybdenite on the south edge of lot 10, concession I, Jacques township, was staked in 1938 by Y. Nelson, of Fort William. Other occurrences in the vicinity of this deposit are reported, but none of them was visited.

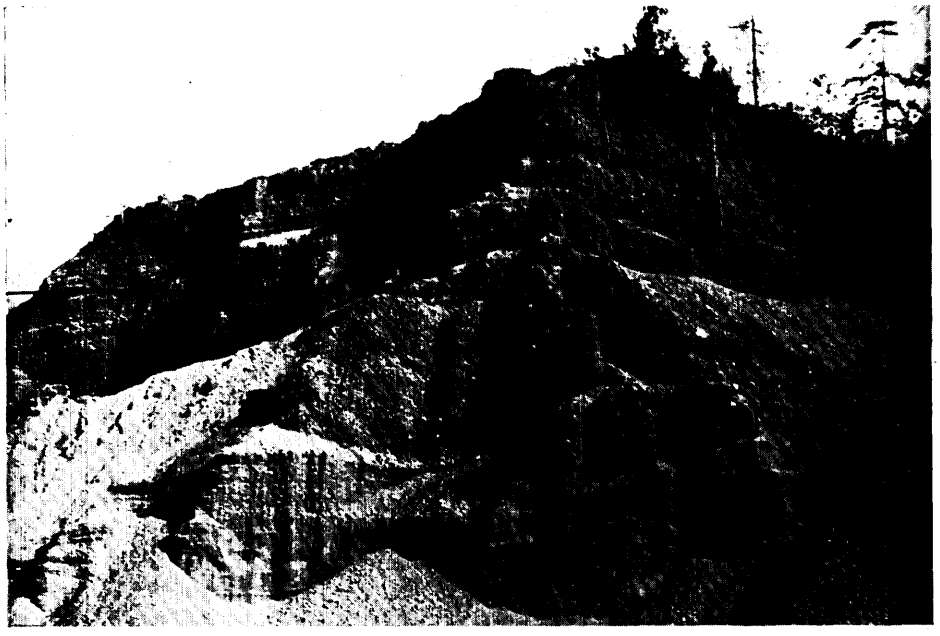
Gold

Present economic interest in the area was brought about by the discovery of gold early in the year 1935. Gold has since been found in several places within the area, but only two finds have so far shown promise of developing ore bodies of commercial grade. The gold occurs in quartz veins in greenstone, tuff, and agglomerate. The veins occupy shear zones or fractures and may be lenticular or regular in shape.

[1]T. L. Tanton, Geol. Surv. Can., Sum. Rept. 1924, pt. C, p. 22.

The known gold occurrences lie in a belt of carbonatized Keewatin greenstones and pyroclastics in concession II, Gorham township. No genetic source is postulated for the gold-bearing veins, since no granites lie close to the belt and no intrusive porphyries were distinguished in the field.

The two main gold occurrences of the area are on the properties of Gorham Gold Mines, Limited, and Lake Head Gold Mines, Limited. Low values in gold are reported from a vein in lot 11, concession II, Gorham township; and in lot 10, concession II, a thin stringer of quartz is said to contain much visible gold. W. W Beaton reports that exploratory work during the fall of 1938 on the Universal claims, lot 5, concession II, Gorham township, has met with some encouragement.



Face of pit in deposit of stratified sand and gravel, lot 16, concession II, Gorham township.

Sand and Gravel

Glacial sands and gravels have been used extensively in the area for the surfacing of motor roads and for building purposes. A deposit of stratified sand and gravel, situated in lot 16, concession II, Gorham township, was used during 1938 as a source of material for the paving of the Dawson Road highway.

Prospecting Conditions

Although the area in the vicinity of Port Arthur was first prospected many years ago, it is only within the past five years that any systematic search has been made for gold. Within these years several gold occurrences have been located. In view of the short period of activity and the limited amount of prospecting that has been done, the area presents many possibilities for future work. Rock outcrops are quite abundant, and in many places only a relatively thin overburden covers bed rock. It is difficult, however, to obtain prospecting rights, since much of the land is now under patent.

Because of their massive and homogeneous nature the granites and Coutchiching sediments do not present likely areas in which to prospect for gold. There is a possibility that molybdenite may be present in economic quantities in association with the pegmatites that intrude the Coutchiching rocks. The most favourable gold areas are apparently those underlain by sheared and carbonatized. lavas and tuffs. Although no gold-bearing veins have been located in the post-Keewatin sediments, they should not be neglected as prospecting areas since many of the rocks are distinctly sheared.

Quartz veins of appreciable size are not common in the area. Although many appear to be barren on the weathered surface, some of them contain metallic minerals below the weathered zone. The veins occur as quartz injections in sheared zones or as definite veins having sharp walls against the country rock. A carbonate mineral, probably ankerite, is present in many of the veins. Pyrite and, to a lesser extent, chalcopyrite are the chief metallic accessory minerals in the auriferous veins. Galena and sphalerite were also noted in certain veins.

DESCRIPTION OF PROPERTIES

Gold

Lake Head Gold Mines, Limited

The property of Lake Head Gold Mines, Limited, is situated in Gorham township and comprises the south halves of lots 7 and 8, concession II, and mining claim R. 463.

Gold was discovered on the property early in the year 1935. In 1936 Lake Head Gold Mines, Limited, was formed to develop the property, and during the summer and fall of that year an extensive programme of surface exploration was carried out. Work was then discontinued till the spring of 1938, when some surface work and diamond-drilling were done in an attempt to locate the extension of the main vein on the property of Gorham Gold Mines, Limited. No development work was done during the late summer and fall of 1938.

The country rock on the property is largely acid volcanic tuffs and agglomerates. Some andesitic lava flows are interbanded with them. The tuffs include even-grained massive and banded types, and porphyritic-looking types, in which grains of feldspar and quartz lie in a finer-grained groundmass. A more basic type of tuff, which contains fragmental grains of basic material, occurs along the south side of the property. Many of the tuffs are highly carbonatized. No intrusive porphyries were observed on the property. A few zones show marked shearing, but in general the rocks are moderately sheared.

Veins.—Development work has disclosed three main veins and several minor ones. They trend in a general east-west direction parallel to the schistosity of the formations.

No. 1 vein lies in a sheared zone between andesite and banded tuff and has been opened for a distance of approximately 350 feet. It strikes N. 85° E. to S. 85° E. and dips about 80° S. Quartz has been injected in the shear zone, forming one main vein with subsidiary stringers alongside. The injected zone averages less than 4 feet in width. Ankerite is common in the quartz. Metallic mineralization consists of irregularly disseminated pyrite, minor amounts of chalcopyrite, and visible gold. A pyritized zone, ranging in width from 6 inches to 3 feet, lies along the north side of the vein. The pyrite, which is coarse and cubic, is evenly distributed. Sampling results, supplied by W. W. Beaton, show

an average of 0.6 ounces in gold over 27 inches for a length of 124 feet. The gold, however, is unevenly distributed along this zone.

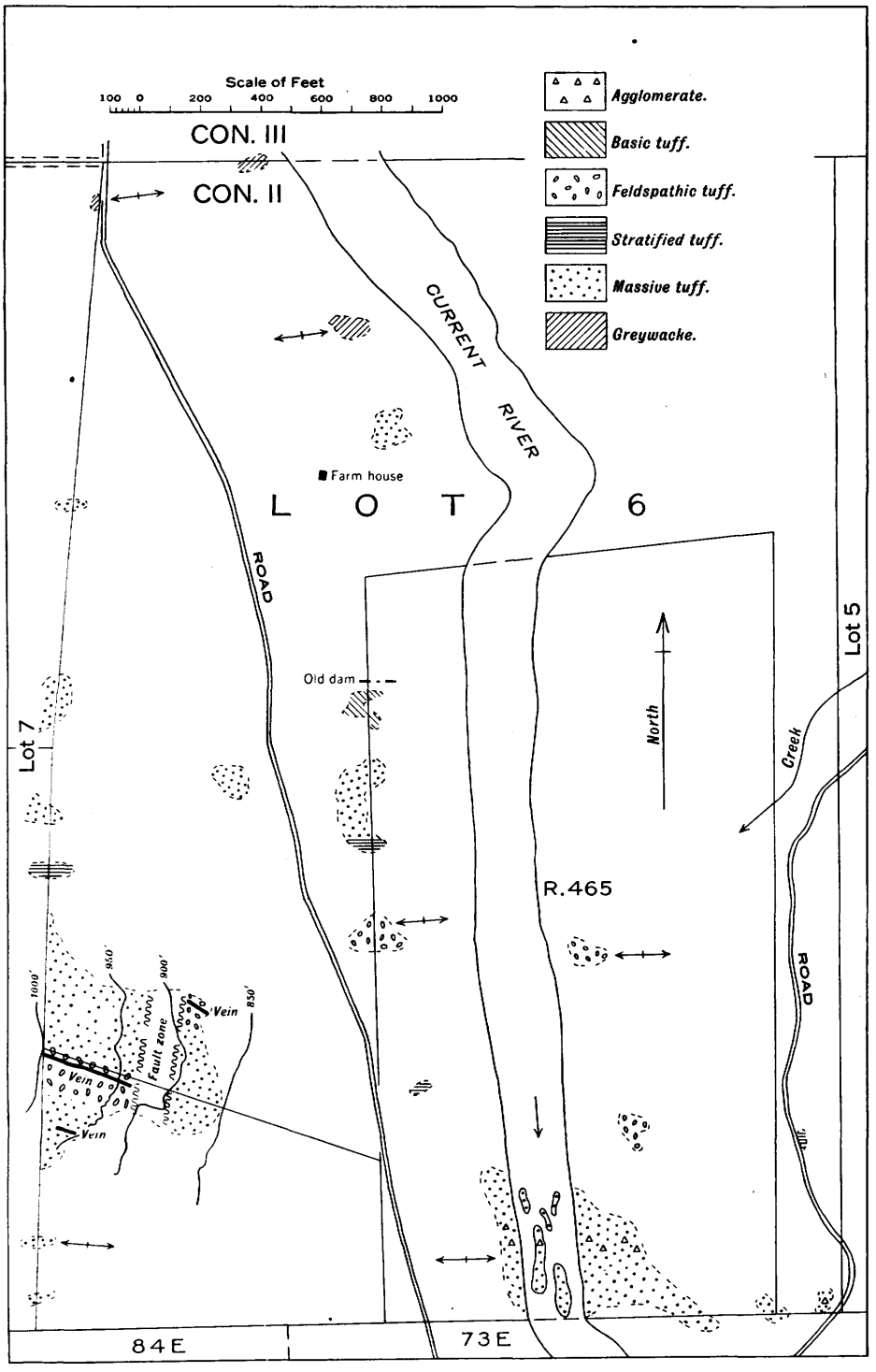
No. 2 vein occupies a sheared zone in chloritic and agglomeratic tuff. The shear zone has a maximum width of 9 feet; the vein averages less than one foot in width. The vein strikes east-west, dips 80° S., and has been traced for a length of 500 feet. At its west end it narrows and pinches out; the east end is drift-covered. Cross-faulting has displaced the vein in two places, a distance of



Pit in No. 1 vein, Lake Head Gold Mines, Limited.

2 feet towards its west end and a distance of 18 feet about 80 feet from its east end. The vein quartz contains ankerite and is irregularly mineralized with pyrite. Visible gold is reported from the vein.

The supposed westward extension of No. 2 vein occurs in the central part of mining claim R. 463. It has been traced for a length of 900 feet and opened for approximately 325 feet. The strike varies from east-west to S. 75° E. The vein consists of an irregular quartz injection averaging less than one foot in width in a sheared acid tuff. Mineralization consists of quartz, ankerite, and disseminated pyrite. Pyrite also occurs in the wall rock close to the vein. Assay values are not known.



GEOLOGICAL SKETCH MAP OF THE PROPERTY OF GORHAM GOLD MINES, LIMITED.

No. 3 vein is an irregular quartz vein ranging in width from 6 inches to 3 feet. It occupies a shear zone in feldspathic tuff. Ankerite occurs with the quartz, and the quartz is slightly mineralized with pyrite. Visible gold is reported as occurring in the vein over a length of 30 feet.

Gorham Gold Mines, Limited

The property of Gorham Gold Mines, Limited, lies to the east of the property of Lake Head Gold Mines, Limited, and occupies lot 6, concession II, Gorham township, exclusive of mining claim R. 465.

Gold was discovered on the property in September, 1937. In January, 1938, the Gorham Gold Mining Syndicate was formed. The syndicate carried on surface work and completed 500 feet of diamond-drilling. In May, 1938, Gorham Gold Mines, Limited, was formed to carry on further development. During the summer, over 5,000 feet of diamond-drilling was completed, after which operations were suspended. Late in September an adit was started on the main vein structure.

The country rock on the property consists of sediments, tuffs, and agglomerates. The sediments, lying in the northern part of the property, have the appearance of greywackes but are considered to be tuffaceous in origin. The southern half of the property adjoins the east side of the Lake Head property and contains similar rock types. The strike of the rocks varies from N. 85° E. to S. 75° E.

Veins.—The main vein is situated near the west boundary of the property and occupies a shear zone in carbonated feldspathic tuff. The vein strikes N. 80° W. and dips vertically. It extends eastward from the west side of the property for 325 feet. In the west 45 feet the vein is very narrow, but for the remaining 280 feet it averages 3½ feet in width. This width was shown by diamond-drilling to hold at depths of 300 feet. At its east end the vein is cut off by a cross-fault. Ankerite occurs in the vein quartz. Metallic mineralization consists of irregularly disseminated pyrite, minor amounts of chalcopyrite, and gold. According to J. D. Wright, an average of surface sampling showed a gold content of 0.32 ounces for a width of 3½ feet and a length of 280 feet. Since erratic values were obtained from diamond-drilling, it was decided to drive an adit along the vein from its east end, where it outcrops on the face of a hill. Wright reports that by mid-January, 1939, the adit had been driven for 86 feet and that the vein in the adit showed an average width of 4.8 feet with assay values averaging 0.26 ounces.

A vein that is considered to be the eastward extension of the main vein has been located on the east side of the fault zone, 350 feet north of the main vein. This vein has been traced for 75 feet to a point where it is covered by heavy overburden. The vein has an average width of 5 feet and contains pyrite and visible gold.

A second zone in highly carbonatized tuff occurs 200 feet south of the main vein. It is mineralized with pyrite and is reported to contain visible gold. Values ranging from 0.09 to 0.52 ounces in gold were reported by Wright, but no continuity of values was established.

Mining Claim No. 211T

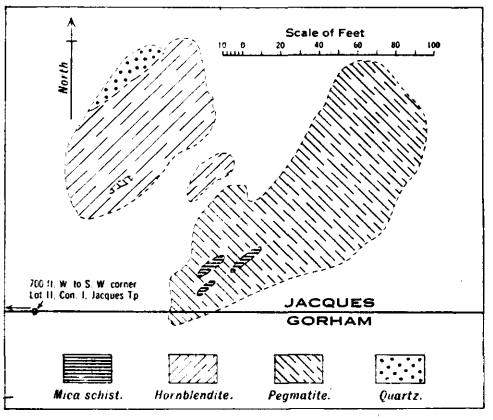
A mineralized quartz vein on mining claim No. 211T, Ware township, has been prospected by J. Matsen. The vein averages less than 2 feet in width and has been opened in only one trench for a length of 15 feet. It strikes N. 10° E. and dips 80° W. The vein lies in andesite and contains galena, sphalerite, and chalcopyrite. Some pyrite occurs in the wall rock. Assays are reported to show

values up to 0.12 ounces in gold and 5.5 ounces in silver per ton. Other mineralized veins occur on the property, but no encouraging values have been obtained from them.

Molybdenum

Claim T.B. 26,536

An occurrence of molybdenite was noted on claim T.B. 26,536, lot 10, concession I of Jacques township. The molybdenite occurs in an irregular quartz vein, trending N. 50° E., which is exposed for a length of 50 feet and a maximum



Geological sketch map of molybdenite deposit, claim T.B. 26,536, Jacques township.

width of 12 feet. The vein is in contact with a granitic-textured hornblendite on the south and is drift-covered on the north. A mass of granite pegmatite occurs 150 feet south of the vein. Small pegmatite stringers cut the hornblendite, and mica schist inclusions occur in the pegmatite. The molybdenite occurs as platy segregations in the vein quartz. A few crystals were also noted in the hornblendite. The vein quartz and molybdenite are evidently younger than the hornblendite and are thought to have been derived from the pegmatite.

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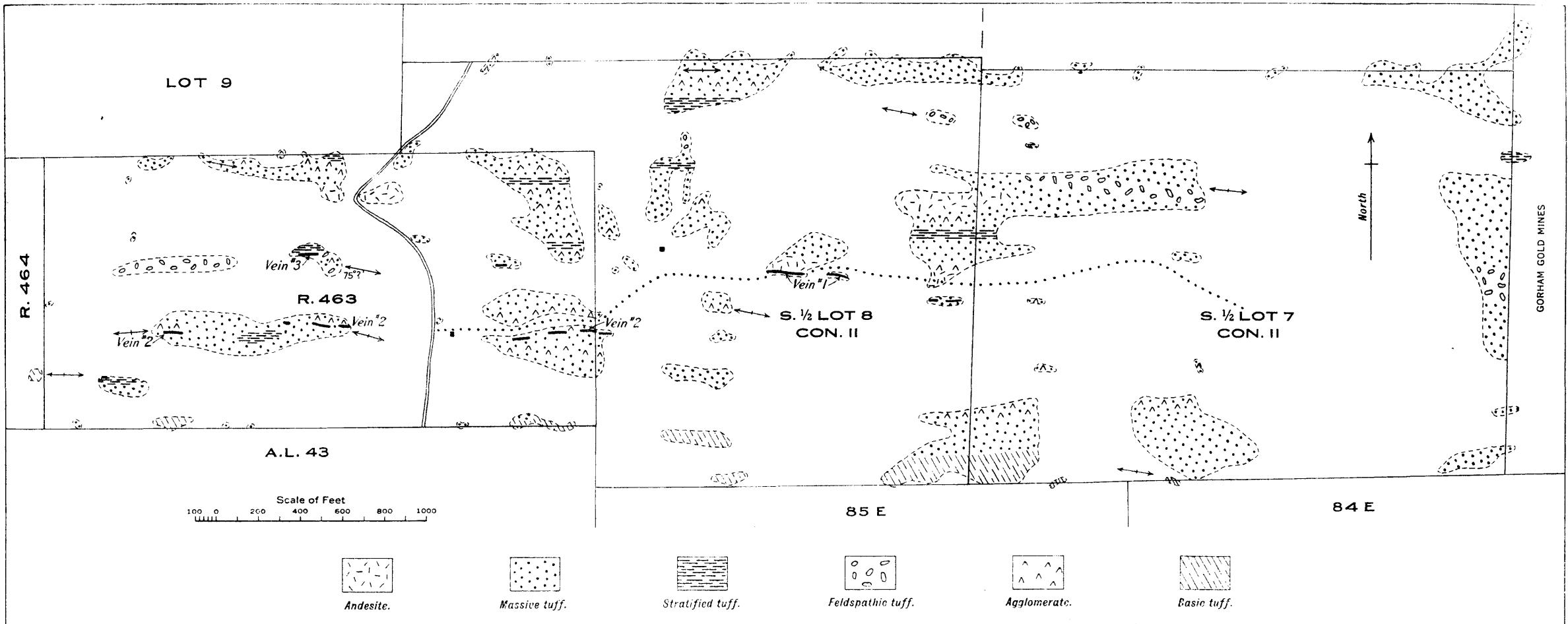
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GEOLOGICAL SKETCH MAP OF THE PROPERTY OF LAKE HEAD GOLD MINES, LIMITED









PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. ROBERT LAURIER, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART IV, 1939

Geology of the Eagle Lake Area

By

W. W. MOORHOUSE

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COLOURED GEOLOGICAL MAP

(In pocket at back of report)

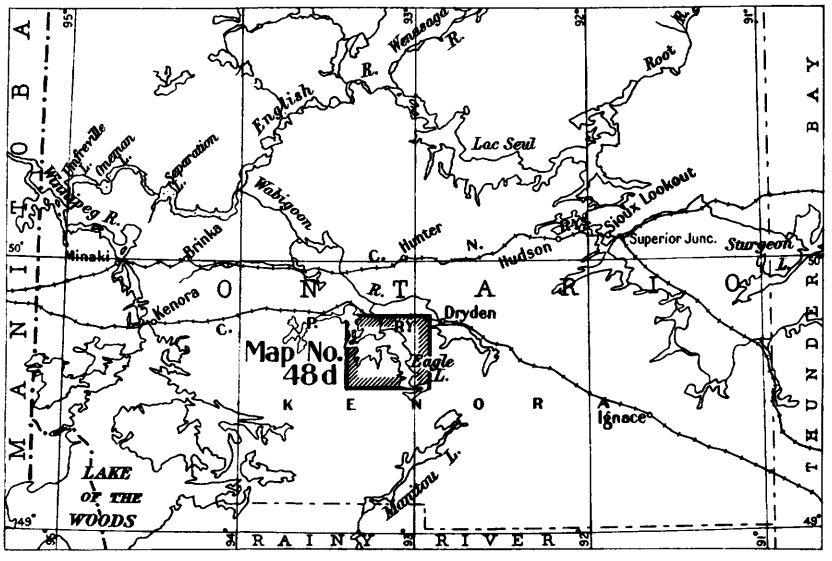
Map No. 48d—Eagle Lake Area, district of Kenora, Ontario. Scale, 1 mile to the inch.

Geology of the Eagle Lake Area

By W. W. Moorhouse

INTRODUCTION

The Eagle Lake map area is located in northwestern Ontario, on the main line of the Canadian Pacific railway, between Kenora and Port Arthur. It is some 70 miles east of the former, and 12 west of the town of Dryden. The area is bounded on the north by the north boundaries of Aubrey and Temple townships (approximately 49° 49′ north latitude), and on the south by Niven's base line (49° 32′ 18″ north latitude). It extends west from Niven's sixth meridian



Key map showing the location of the Eagle Lake area.
Scale, 50 miles to the inch.

(92° 56′ 21″ west longitude) to about 93° 25′ west longitude and embraces the main expanse of the lake whose name it bears. The area covers approximately 360 square miles, its length and breadth being 20 and 18 miles, respectively. The field work on which this report is based was done during the summer of 1938.

History of the Area

Prior to 1900 the area received little attention from prospectors. As a result of the interest developed at the turn of the century in the gold deposits around the Lake of the Woods, Mine Centre, and other parts of northwestern Ontario, prospectors extended their search for gold to Eagle lake, with the result that a number of prospects were located, chiefly in granite near the contact with greenstone on the southwestern part of the lake. Attempts to develop the discoveries into mines failed, and by 1912 virtually all operations had ceased.

In the fall of 1920 work was resumed at the Grace property and continued spasmodically for two or three years. Subsequently the company transferred its attention to a deposit of soapstone a quarter of a mile north of the gold prospect, but in June, 1927, work was suspended altogether.

There was another flurry of prospecting in 1936 and 1937 occasioned by the discovery of rather erratic gold values near Hardrock bay.

Method of Survey

The topography of the map that accompanies this report is derived from three principal sources: a traverse of the lake; township and mining claim surveys; and the Dryden sheet (No. 52f), prepared from oblique aerial photographs by the Division of Topography, Ottawa.

The information that forms the basis of the report and the accompanying geological map is the product of shore geology and pace-and-compass traverses. The latter crossed the strike of the formations at quarter-mile intervals and were tied to topographical points located by the base maps mentioned. Wherever possible, these cross-sections were run along surveyed lines. Most of the lot lines, claim lines, and base lines cannot now be located, though in a few cases they were found to have been recut; in other places they may be picked up in spruce swamps and forest not since ravaged by fire.

Acknowledgments

To his assistants, A. T. Prince, E. B. Owen, and H. A. Pearson, the author is deeply indebted for their efficiency, interest, and willing co-operation at all times. Mr. Prince acted as chief assistant, and deserves special recognition for his careful work and judgment in that part of the mapping for which he was responsible.

J. A. Cross, the station-master at Eagle River, Louis and Stephen Malmberg of Eagle River, L. MacKenzie of the Big Eagle–Muskie camp, and W. Davis of the Eagle Lake Lodge did many favours for the members of the party during the summer.

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The writer is also indebted to the late Professor Philip Krieger of Columbia University and F. Chayse for reading the manuscript and to E. F. Murphy, A. Murphy, and Harry Anisgard, who assisted in the preparation of the report and the illustrations.

Means of Access

All parts of the area are easily accessible by water from either Eagle River or Vermilion Bay, stations on the Canadian Pacific railway. Because of the size and irregular shape of Eagle lake there are no sections of the central and southern thirds of the area more than a few hours walk from the lake. Consequently, such portages as exist are in rather poor repair and apparently but little used.

The northern third of the area, though less completely accessible by water, is traversed by several good roads. Considerable areas here are cleared and under cultivation.

Previous Geological Work

William McInnes was the first to report in any detail on the geology of the area, in connection with an early reconnaissance survey of the Manitou Lake area. His results were published in the Manitou Lake Sheet,[1] in 1902.

[1]Geol. Surv. Can., Pub. No. 720.

Other early sources of information may be found in the references to prospects and mines in the area contained in the publications of the Ontario Bureau of Mines from 1901 on. Slight attention, however, is accorded geology in these reports, except for those by A. L. Parsons in 1911 and 1912, in which parts of McInnes' map were reproduced.

Aside from these occasional references to mining activity, nothing has since been published regarding the area. The writer had access to an unpublished report and map of the Eagle Lake area made by E. M. Burwash for the Ontario Department of Mines in 1936. The reports of Ellis Thomson[1] on the Dryden area, J. F. Wright[2] on talc in Wabigoon, and F. J. Pettijohn[3] on structure and regional correlation are of interest in connection with the age of the sediments, which extend westward from Wabigoon lake to Eagle lake.

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Topography

Relief

The relief of the Eagle Lake area is not great. Few hills reach elevations of more than 300 or 400 feet above lake-level (about 1,190 feet), and the average is much less. The greatest heights are reached by granite and greenstone escarpments west of Emmanuel lake, hills of massive gabbro and norite north of Straight lake, and persistent outcrops of greenstone in the northeastern part of the area.

One prominent ridge of drift, which deserves special mention, is the terminal moraine that extends diagonally across the area southeastward from Eagle river. It forms the north shore of Eagle lake, west of Windigo point, and in the eastern part of the area sinks to a series of low bouldery mounds.

In spite of the lack of conspicuous relief, the abundance of outcrops renders the country quite rugged. This is especially true where greenstone prevails.

Drainage

Eagle lake is situated north of the continental divide and drains northward through Eagle river, which flows into the Wabigoon river, a tributary of the English river, about 6 miles north of the town of Eagle River.

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[1]Ont. Bur. Mines, Vol. XXVI, 1917, p. 172.
[2]"Talc Deposits of Canada," Geol. Surv. Can., Econ. Geol. Series, No. 2, p. 59.
[3]Bull. Geol. Soc. Amer., Vol. 48, 1937, p. 172.

Since so much of the map area is occupied by the lake, other drainage features are relatively insignificant. The lakes which dot the surrounding country are small and generally empty more or less directly into Eagle lake. There are several navigable streams, notably Barren brook and Meander, Emmanuel, and Eldorado creeks in the south and Aubrey creek in the north. For the most part they are not important as travel routes.

Owing to the large amount of rock outcrop and the excellent drainage afforded by the big lake, swamps are few except around the heads of some bays, such as Muskeg, Bottle, Temple, Froghead, and others.

Springs are rare except in those parts of the country in which drift predominates, and even there they are not abundant. This may be owing to the widespread presence of tough, impervious clay, which facilitates drainage and prevents ground-water circulation. One interesting occurrence was noted in Spring bay. At the end of the trail at the head of the bay a cold clear spring in silty soil is depositing heavy iron hydroxide precipitate and has a very distinct sulphur taste and odour. It is probably in contact with a decomposing sulphide zone which is buried under the glacial cover. In the cultivated sections wells are dug in the clay and apparently need only be of shallow depth (20 to 30 feet) to supply the farmers' normal requirements.

Structural Significance of the Topography

Most of the lakes in the area have rocky shores. As a result their shape is largely influenced by the local structure and the distribution of non-resistant belts of rock. The bays of Mulcahy lake seem to be located on easily eroded zones of shearing and hydrothermal alteration in otherwise rather massive norite. The shapes of Langford, Johnline, and Robbins lakes are modified by the presence of porphyry dikes, which being sheared have weathered readily. Shako lake, Emmanuel lake, and Barren brook show well the controlling effect of schistosity in granite and greenstone. In most parts of Eagle lake, such as Buchan bay, Partridge point, Temple bay, and the bay east of Detour point, the trend of the shore line and the elongation and grouping of islands trace the direction of strike accurately. The position of Meridian bay, Chancellor lake, and History lake on the greenstone-granite contact also deserves mention. The almost perfect alignment of these with the course of the Eagle river suggests that they may conceal a line of structural deformation.

Other topographical features which may owe their shape and location to the differential erosion along contacts include Bottle Bay lake and Peganeis lake, located on the contact of gneiss and granite; Swanson lake, Outlet bay, and Littleneck bay, which appear to be controlled in part by the greenstone-paragneiss contact; and the north shore of North Twin island, which follows rather closely the greenstone-granite contact.

Boat island and other granite islands and headlands in Portage bay are surrounded on the east shore by a more or less continuous rim of paragneiss, whereas inland the granite is relatively free from inclusions. It is reasonable to infer that these islands exist by virtue of the greater resistance of the granite and that on the submerged floor of the bay to the east paragneiss is the dominant rock.

Outcrops

The southern two-thirds of the area is remarkable for the abundance of rock outcrops; east of Meridian bay and Chancellor lake, they are almost continuous. Even north of Eagle lake, where drift often predominates, rock is abundant enough to allow fairly accurate mapping and structural interpretation.

Natural Resources

Agriculture

It has already been mentioned that a considerable amount of farming is carried on near the railroad. The soil cultivated is a stiff, varved lake clay, grey to almost white in colour. When dry the clay becomes extremely hard and must be rather difficult to work. The chief crops are hay, clover, and some grain.

Forest

Most of the commercial timber in the area has been cut by the Dryden Paper Company. Virgin timber still stands in the rugged country north of Straight lake, but even here some cutting has been done. Fires have burned off considerable areas south and east of Straight lake. Except for this, fire damage during the last twenty or thirty years has been rather local.

The principal trees occurring in the area are jackpine, red and white pine, spruce, balsam, birch, and poplar in the higher country, and cedar, spruce, and ash in low or swampy country. Second growth is chiefly poplar, though locally spruce and jackpine are abundant. Scrub oak was also observed in a few places.

At present lumbering activity is confined to the cutting of pulpwood and cedar posts by the local farmers.

Water Power

Hydro-electric power is being developed by the Dryden Paper Company on the Eagle river at two plants, one at the town of Eagle River and the other about a mile farther downstream. O. S. Johnson of the Engineering Department of the company has kindly given the writer the following information: The plant at Eagle River is furnished with one vertical 2,200 k.v.a. unit operating under a head of 36 feet, and the one downstream is supplied with a vertical 1,400 k.v.a. unit operating under a head of 27 feet.

Fish and Game

Fishing, both for sport and commerce, is carried on extensively at Eagle lake. During the field season of 1938, there were five lodges located on various parts of the lake offering accommodation to tourists, who are attracted by the pickerel, muskelunge, and pike fishing.

Two commercial fisheries were also operating, one near North Twin island, the other on the north side of Detour point. Their catches include pike, whitefish, lake trout, and tulibees.

Game, including deer, moose, and grouse, is abundant in the southern part of the area, away from the railroad. Timber wolves and bear also are to be found.

GENERAL GEOLOGY

The consolidated rocks of the Eagle Lake area are pre-Cambrian in age. They have been glaciated and are partly covered by glacial-lacustrine clays and gravels and, more rarely, by Pleistocene morainal deposits.

As far as possible the divisions in the table below are chronological. The relationship between the sedimentary series and the basic intrusives could not be determined in the field. The relative position of the sediments and volcanics is not based on conclusive evidence, nor is it certain that all the granitic types occupy the same position with respect to the other formations. Since sediments were nowhere observed lying on an erosional surface of granite, there is no way short of radioactive age determinations of demonstrating the presence or absence of intrusives older than the sediments.

The terms Keewatin, Timiskaming, Haileyburian, and Algoman are used in this report for convenience of description only. No correlation in time with formations of the same name in their type localities is intended.

Table of Formations

QUATERNARY	
PLEISTOCENE:	Varved lake clays, till, sand and gravel.
PRE-CAMBRIAN	
KEWEENAWAN:	Diabase dikes.
ALGOMAN(?):	Granitic intrusives: Pegmatitic granite; granodiorite, quartz diorite, granite gneiss. Hybrid intrusives: Diorites, amphibolites intrusive into the Keewatin and cut by granite.
HAILEYBURIAN(?):	Basic intrusives: Norite, diabase, gabbro, anorthosite, and transitional phases; diorite; sheared, chloritized, and silicified equivalents; some granites.
TIMISKAMING(?):	Sedimentary series: Greywacke and paragneiss with minor amounts of slate and quartzite; iron formation.
KEEWATIN:	Volcanic complex: Flows of basalt, andesite, dacite, and rhyolite and their pyroclastic and altered equivalents; associated porphyry dikes, possibly, in part, of Algoman age.

The sedimentary series occurs as a strip of varying width, with an east-west to southwest-northeast trend in the northern third of the area. It is bounded on the north and west by intrusive granite, granite gneiss, and pegmatitic granite; on the south, by greenstone. The volcanic rocks also form a continuous belt of variable width crossing the area. In addition a narrow spur branches southwestward past the Grace and Eldorado mines; a broad synclinal belt of undetermined length lies between Meridian bay and Bear narrows; and a blunt tongue terminates a little south of Nabish creek. Between these three belts, granitic rocks extend northwards in broad, rounded lobes, one extending to Net and North Twin islands between the first two belts, the other reaching only a little north of Nabish creek. An elliptical cupola or stock of granite surrounds Froghead bay, and three long narrow lenses of granite were mapped, one south of the Froghead stock, one east of Stanton island on the mainland, and another extending from a point a mile or so east of Bottle bay to the Eagle river, or possibly as far as Ardis lake.

The hybrid Algoman intrusives form an irregular zone between the granite and basic lavas in the southeast corner of the area and occur in minor amounts along other contacts, especially in the vicinity of Straight lake, along Meridian bay, and on the southwest side of Emmanuel lake. The Haileyburian(?) basic intrusives occupy a compact area between Eldorado creek and Straight lake on the north and south and Meander creek and Muskeg bay on the east. They extend for an unknown distance west of the area. Diabase dikes were recognized only east of Eagle river in the sediments and pegmatitic granite.

Keewatin

The "Keewatin" volcanics consist predominantly of basic lavas, but contain two large lenticular areas and numerous narrow, often persistent bands of acid and intermediate effusives and intrusives, together with tuffs, breccias, and agglomerates. Near the greenstone-sediment contact narrow greywacke and quartzite beds are intercalated with the flows.

Basic Volcanics

The largest area of the basic members of the series is found east of Meridian bay. It is underlain by an almost uninterrupted series of dark-bluish andesites, commonly exhibiting pillow structure and fragmental flow tops.

From east to west, south of the greenstone-sediment contact, pillow lavas occur in association with basic flows and interlaminated dacites, acid andesites, and rhyolites. The basic lavas are mostly chloritic, but west of Partridge point hornblendic types are common.

Massive dioritic greenstones and some sheared hornblendic types and pillowed lavas occur north of Nabish creek. On several of the islands just south of the mainland, west of Temple bay, there is a fine-grained black lava which gives a white powder under the hammer. Under the microscope, it is seen to be a silicified andesite containing abundant brown biotite.



Small regular pillows in greenstone, on the large island in Garnet bay.

Metamorphism.—In the neighbourhood of the exposed granite, especially near the south boundary of the area and in certain zones that apparently overlie granite at relatively shallow depths, fine-grained lavas like those near Meridian bay have undergone recrystallization and granitization. The latter has been so intense in certain areas, as for example east of Passover lake, that a *lit par lit* structure has developed parallel to the schistosity.

Just south of Nabish creek, greenstones near the granite contact have been converted into gneissoid rocks, which in thin section consist of rather fine grained mosaics of quartz and feldspar, together with biotite, epidote, and, near the granite, sericite.

Typical of recrystallized material is a massive, fine-grained hornblendic trap, which is well developed along the north shore of the lake, north of Schroeder island. Hornblendic recrystallized greenstones are also abundant at the head of Littleneck bay and in Farabout peninsula to the south.

At one or two places along the shore of Garnet bay, there are exposures of chloritic schist or tuff containing large garnet crystals.

Structures of the Basic Lavas.—Pillow structures are abundant in Keewatin flows of basic composition. The ellipsoids are of varying size, from a foot or less

to 5 feet in diameter. They are sometimes smooth-bordered and elliptical, sometimes crenulated. The latter appear to have narrower selvages than the smooth type.

In many places vesicles and amygdules are present around the borders of the pillows. They are frequently concentrated toward the top of the pillow. This latter fact often assists in corroborating determinations of the tops of flows by means of the shape of the ellipsoids themselves.

Flow-top breccias of fine-grained material enveloped in a coarser matrix are of common occurrence east of Meridian bay.

Intermediate Lavas

Volcanic rocks of intermediate composition are not as numerous as the basic representatives. The largest of these is the belt of intermediate and acid flows and intrusives north of Buchan and Hardrock bays. The intermediate members of this complex include chloritic porphyritic schists, light-green sericite-chlorite schists, and dark-grey, heavily sheared dacites. The first occurs along the north shore and to the west of Buchan bay. The second is common south of Aubrey lake. The third type is found along the mainland just south of Poplar island and as a remarkably persistent horizon extending from Schroeder island to Farabout peninsula, and perhaps even to the mainland opposite Swanson islands. It is so well laminated and so dotted with subangular to rounded quartz eyes as to resemble a sediment. It is locally fragmental.

Another important area of intermediate and acid rocks occurs southwest of Flambeau lake. The intermediate members of this group include fragmental flows together with considerable amounts of a dark-grey, finely laminated, chalky-weathering lava or tuff without much obvious volcanic structure.

On the north side of Net island there is a narrow zone of brown-weathering, vesicular sheared lava, highly carbonatized and carrying considerable amounts of quartz and minute prisms of actinolite. This is represented in several small islands just off North Twin island by white-green, sheared feldspathic flows. Intermediate flows and tuffs and light-green sericite-chlorite schists are also rather widely distributed farther east, south of Aubrey lake.

Acid Volcanics

Acid volcanics appear to be more important quantitatively than the intermediate group. They also are most extensive north and west of Buchan bay. The most abundant types are rather massive, sericitic, carbonatized quartz and feldspar porphyries and carbonate schists. Some of the porphyries are certainly volcanic, for they contain angular fragments of similar materials. This type may be seen in prospect pits north and south of Fornieri bay and in a few places north of Buchan bay. Contact relations in one locality suggest that some feldspar porphyries may have been intruded before the tuffs were entirely consolidated and are, therefore, of Keewatin age. Some of the porphyries, on the other hand, may well be Algoman, related to the granite that outcrops on the islands half a mile west of Fornieri bay. Thin sections show these acid rocks to consist of rounded or subangular phenocrysts of feldspar, in a groundmass of quartz, feldspar, and sericite. Patches of chlorite also are present, and sericite and carbonate as alteration products of the feldspar are abundant.

These flows and fine-grained, bluish-white rhyolites, which are of common occurrence on the mainland east from Poplar island, are frequently heavily sheared and altered to carbonate-sericite schists.

Another frequently occurring and puzzling member of this acid complex is an extremely aphanitic, cherty-looking rhyolite, which weathers a light-tan,

creamy-white and grey, or pinkish-white. Its most striking attribute is the universal presence of a system of fractures intersecting at an angle varying from 30 to 90 degrees, by which it is broken into a mosaic of lozenge-shaped prisms. For the most part this rock occurs as flows or sills(?) interbedded with other lavas of various types. On Stanton island, however, it forms a lenticular body a quarter of a mile wide of remarkably uniform texture and structure throughout. It contains inclusions of intermediate and basic lavas, and on the south side of the island it cuts intermediate tuffs in a series of irregular dikes and tongues. It is believed that this body is an intrusive of Keewatin age, since fragments having the same composition occur in volcanic breccias. Similar sills or flows, differing only in the presence of quartz eyes, occur along the north shore of Net island. Rather massive, white rhyolites are found to the east on North Twin and other islands southeast of it. Other localities in which rhyolites and rhyolitic breccias



Well-bedded agglomerate and tuff on Pioneer island.

are found include the narrow greenstone belt in the vicinity of the soapstone quarry, a quarter of a mile north of the Grace gold mine, and scattered occurrences south of Aubrey lake and south of Flambeau lake.

Agglomerates, Tuffs, Etc.

Two classes of agglomerate can be recognized in the area: true agglomerates, composed entirely of fragmental material, and agglomeratic flows, i.e. normal lavas, carrying foreign volcanic fragments. Of these two, the latter is the predominant type and is abundant in the acid-intermediate complex north of Buchan bay. The best exposures occur on the west side of Stanton island. Light-coloured agglomeratic flows, in which both fragments and matrix are of the same composition, are quite common north of Buchan bay. Similar flows are found northwest of the soapstone quarry and northwest of Lavo lake.

True agglomerates composed of more or less angular fragments in a tuffaceous matrix were observed at several points on the mainland east of Poplar island.

An agglomerate composed of fragments of chloritic lavas, rhyolite, and vesicular material is exposed on the large island near the head of Buchan bay. On Pioneer island there is an agglomerate (see photograph above) composed of rounded and angular fragments, usually 1 to 2 inches in diameter but occasionally reaching a width of 12 to 16 inches, embedded in a matrix of bedded chloritic tuff.

Tuffs are less abundant, or at least less easily recognized than the agglomerates. In some cases, as in the outcrops on the east side of Midway point, they show distinct banding. Other banded tuffs occur on the shore northeast of Buchan bay and in the region south of Aubrey lake. Sometimes it is possible to distinguish individual grains in the tuff, and in one case on Stanton island the direction of the tops of the tuff beds could be determined from the grain gradation.

Intrusives

Two belts of coarse-grained diorites and amphibolites, the one extending west from Temple bay just south of the Keewatin-Timiskaming contact, the other forming the axis of Schroeder island, may be Keewatin intrusives.

Coarse-grained quartz diorites were recognized in Keewatin outcrops south and southeast of Aubrey lake.

The rhyolites of Stanton island and related dikes appear to be intrusive in many cases and are tentatively considered to be Keewatin, as is a distinct belt of silicified and chloritized quartz gabbro, which may be intrusive into the intermediate-acid complex west of the island.

Iron Formation

Iron formation in the volcanic series is of rather local development. It was observed along the north shore of Hardrock bay, where a thin band of interbedded, fine-grained magnetite and chert, associated with banded cherts, occurs in pillow lavas and fragmental volcanics. At the Meridian Bay mine magnetite is associated with the heavy sulphide deposit and may represent what was once iron formation. A little iron formation also occurs near the northeast corner of the north side of North Twin island.

Along the north shore of Littleneck bay, banded cherty quartzitic beds may represent the continuation of the same zone.

Timiskaming(?)

The sedimentary series typically consists of fine-grained, thin-bedded, sheared, dark-grey or brown greywackes. With these are associated slaty and quartzitic bands, fragmental and nodular-weathering beds, and magnetic iron formations.

The greywacke is well developed along the south side of the sedimentary belt, and in some instances has been found interbedded with pillow lavas. This is best seen at the south end of the portage that crosses the narrow neck of Detour point.

To the north across the belt of sediments towards its contact with the granite a marked change occurs. Biotite becomes recognizable and progressively coarser-grained, the bedding becomes highly contorted, and granite and pegmatite dikes abound. Through the influence of the intrusive the greywacke thus becomes paragneiss. In one or two cases, sheared, white quartz-sericite schist instead of biotite gneiss was produced by the metamorphism. In places the latter process may have been so thorough in its effects that the gneiss has become almost indistinguishable from granite. Gneisses of this nature sometimes grade into granite. This is best illustrated in the islands and on the shore line of Portage bay.

Mineralogically, the greywacke appears to be composed largely of quartz, biotite, actinolite, or hornblende with a little garnet, feldspar, sericite, magnetite, titanite, zircon, and apatite. In a specimen more gneissic than the typical greywacke, biotite and quartz are practically the only constituents representing

original minerals, and igneous influence is indicated by the presence of euhedral tourmaline crystals.

A little sillimanite was recognized by the writer in a gneiss consisting chiefly of recrystallized quartz and feldspar. Typical metamorphic minerals such as staurolite and sillimanite have been reported by others working in these sediments.[1] Nodular-weathering greywackes may represent altered staurolite schists, although examination shows that the nodules now consist of quartz and biotite.

Iron Formation

The iron formation in the sedimentary series is a continuation westward of the Wabigoon iron band. As typically developed, it consists of layers rich in magnetite alternating with more siliceous *laminae.* Red garnet is sprinkled through the entire zone, which is 8 to 10 feet wide. In thin section it is found to



Irregularly bedded paragneiss, cut by pegmatite, east of the southeast corner of Vermilion bay.

consist mostly of quartz, tremolite and actinolite, magnetite, and scattered large garnet grains, around which the well-developed schistosity of the rock curves.

The iron formation was not traced as a continuous band, but where not exposed its presence may sometimes be detected by its effect on the compass. Of interest is the preservation of the iron formation, just east of Boat and Canoe islands, in paragneisses, which form for the most part inclusions in the granite.

In Temple bay along the greenstone-sediment contact a thin, bluish, slaty band of magnetite of Keewatin type outcrops.

Structures

Structures may be considered under two categories, original sedimentary structures and secondary structures due to deformation.

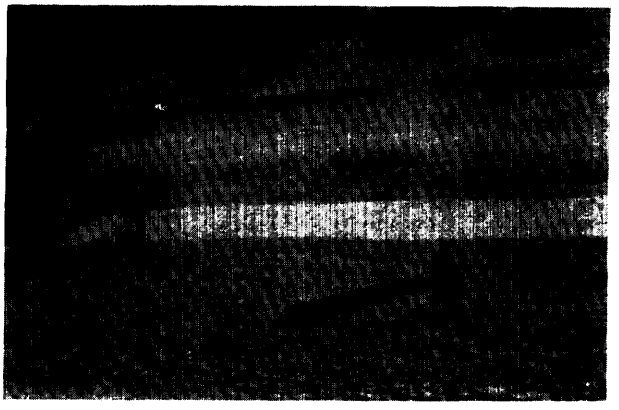
Of the original structures, bedding is the most important and is usually well developed. The maximum width of well-defined beds is 2½ to 3 feet, but in general they are narrower. Sometimes the bedding is accentuated by streaks of biotite distributed through or concentrated at the base of a stratum.

Often the bedding is almost varve-like in appearance. The most striking example of this is seen in an outcrop a short distance east of the south end of Bottle Bay lake.

[1]Ellis Thomson, "Dryden Gold Area," Ont. Bur. Mines, Vol. XXVI, 1917, p. 174.

Grain gradation is sometimes well marked, though it is rarely possible to determine positively the direction of the tops of strata. Cross-bedding was found in a few places, but only one or two cases was it possible to determine the orientation of the beds.

Some of the greywacke beds have a nodular or pebbly structure. The pebbles are half an inch to 2 inches in diameter and consist of quartzitic or fine amorphous grey material. They are embedded in a matrix of much the same character. These are believed to be "intraformational" conglomerates; that is, the pebbles are formed by the breaking-up of slightly consolidated layers, with subsequent rounding and redeposition of the fragments. These fragments are useful in structural interpretations because they frequently exhibit a gradation in size, being smaller towards the top of the stratum. Nodular structures on a smaller scale may have a similar origin or may represent altered staurolites, or garnets.



Well-bedded paragneiss, showing intraformational conglomerate in the immediate foreground, east of Vermilion bay.

Structures due to deformation are of widespread occurrence in the gneiss near the contact with the granite. Extreme crenulation, contortion, and drag-folding occur together with *lit par lit* injection of granite and quartz.

Haileyburian(?)

The rocks of the Haileyburian(?) group occur chiefly in an area extending for an undetermined distance west from Muskeg bay. They consist chiefly of norites, gabbros, and anorthosites with their altered derivatives.

The most typical rock types are the norite and hypersthene gabbro, which are found as massive or faintly sheared, brown-weathered outcrops. In thin section the important primary minerals are hypersthene, pinkish or pale-brown augite, andesine or labradorite feldspar, and biotite. Magnetite and hornblende are present in abundance and are late-stage minerals. Still later in the paragenesis than hornblende and magnetite are quartz, actinolite, uralite, and chlorite, which are probably in part hydrothermal. The same mineral relations and composition are shown in both fine- and coarse-grained and light- and dark-coloured varieties of the norite.

Many exposures exhibit a marked banding of alternating light and dark zones, the former approaching anorthosite in composition. Fine examples may

be found along the northeast shore of Mulcahy lake and, locally, a quarter to half a mile north of Straight lake. In some exposures to the east and northeast of Mulcahy lake, the anorthosite contains narrow bands of coarse-grained feldspar and local concentrations of magnetite.

Narrow basic "pegmatites," up to a foot in width, are occasionally present. These are made up of very coarse grained hornblende and magnetite with some feldspar and appear to have gradational contacts rather than sharp, chilled borders with the normal norite.

A noteworthy feature of the norite and related rocks is the hydrothermal alteration that they have undergone. This is clearly shown along the north shore of Mulcahy lake, where several exposures of banded or faintly sheared norite or gabbro may be traced through somewhat chloritic phases to strongly sheared chloritic rocks. The original texture is feebly preserved and, under the microscope, the rock is seen to be composed of fine-grained quartz, chlorite, uralite, actinolite, and variable amounts of carbonate, epidote and clinozoisite, feldspar, sericite, and pyrite. Only magnetite and apatite, which are sometimes fractured, remain to represent the primary constituents. Usually these greenstone-like schists are associated with thin dikes of pink granite. Similarly altered rocks are abundant south of Eldorado creek and Eldorado bay, at the contact of the norite and granite.

An unusual olivine gabbro or peridotite outcrops on two small islands in the western half of Straight lake and on the north side of the norite area, a third of a mile south of Castor lake.

The most important structural feature of these rocks is the grain orientation, banding or shearing. North of Mulcahy lake these structures trend a little east of north, whereas south of it their direction is a little south of west.

The presence of numerous dikes of granite and pegmatite in the norite and related rocks, the zone of chloritic types along the north boundary of the mass, and the occurrence of isolated areas of norite in granite and hybrid diorite, with gradational contacts indicating assimilation, are evidence that the granite (Algoman) is later. Some of the chloritic rocks, especially along the north boundary, may actually represent inclusions of Keewatin lavas. On this possibility rests proof of the later age of the norite. The relationship of the basic intrusives to the sedimentary series cannot be determined. Hence their classification as "Haileyburian" is purely tentative. The norites are almost identical in structure and alteration to those described by F. L. Finley,[1] from the Kamiskotia area and assigned by him to the Haileyburian.

Algoman(?)

Hybrid Diorite and Amphibolite

Hybrid diorite and amphibolite are found at many places along the contact of granite and Keewatin, especially where the latter is composed of basic lava. The largest exposures occur in the southeastern part of the area around Nabish lake and south of Nabish creek.

The rocks in this region are characteristically hornblendic and black or mottled black and white. They range in composition from recrystallized lavas, through massive amphibolites, coarse- and medium-grained diorites and granodiorites, to granite.

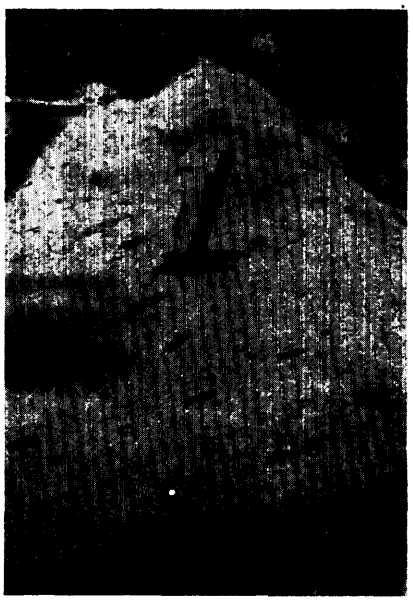
Many granite dikes and lenses cut the diorites and may become so abundant that they form the matrix of a breccia of the older rock.

[1]F. L. Finley, "Kamiskotia Gold Area," Ont. Dept. Mines, Vol. XXXIV, 1925, pt. 6, p. 50.

Inclusions of greenstone in the diorite are cut by dikes of diorite. This indicates that the diorite is a true intrusive, although it is closely related to and grades into granite.

A much smaller elliptical area of diorite occurs east of Emmanuel lake. It forms a rim from 2 to 10 chains wide around a central core of sheared siliceous granite. On its borders and in its northerly extension, which appears to run out into a narrow dike, it penetrates older greenstone.

Other local areas of hybrid diorite are distributed along Meridian bay, in one or two outcrops northeast of Passover lake, and along the south border of the norite north of Straight lake. They always occur along the contacts between



Medium-grained granite carrying hornblendic inclusions, near paragneiss, east of Vermilion bay.

granite and basic rocks. Under the microscope the diorites are seen to consist of tremolite, actinolite, epidote, sericite, and altered feldspars.

To summarize their time relationship, they intrude the Keewatin and Haileyburian(?) and are intruded by granite. Their position with respect to the Timiskaming(?) is unknown.

Granite, Gneissic Granite, and Granodiorite

Granites and related rocks are the most abundant rocks in the area. Some reference has already been made to their distribution,[1] which need not be repeated here.

Wherever studied the granites proved to be extremely variable, except at distances of a mile or more from the contact with older rocks. This variability is expressed in the percentage of dark minerals, in texture, and in the amount of shearing and jointing.

[1]See page 6.

Changes in colour from white to shades of pink, purplish, or even deep-red are common. No evidence was discovered suggesting that difference in colour indicates difference in age. The pink and white types grade into one another, proving that they are of identical age. In Portage bay, where grey gneissic types are cut by massive or pink pegmatitic granites the former appear to be hybrid rocks inheriting the gneissic structure, in part at least, from the older paragneisses.

Owing to the fact that detailed work in the granite area was largely limited to the vicinity of contacts with the older rocks, where assimilation and other border effects have largely affected it, little massive granite was encountered. Normal biotite granite was encountered in traverses west from Eldorado and Meridian bays and in the vicinity of Osbourne bay. Many of the islands south and southwest of North and South Twin islands and Net island and in certain parts of Osbourne bay have fairly typical granite. The same is true of the shore



Hybrid granite cut by pegmatite dikes,
Straight lake.

line between Muskeg and Midway bays and of parts of the west sides of Boat and Canoe islands.

In Portage bay sheared grey granite is common and is cut by successively younger grey or pink intrusives and pink or red pegmatitic granite. The gneissic variety, as already mentioned, grades into paragneiss, which has the appearance of a sediment, and in some places gradations may be found between normal granite and the pegmatitic type.

On the north side of Net island and on the mainland to the west, the granite at its contact with the Keewatin is a chlorite schist, distinguished by the presence of quartz eyes. This gives place to more normal types, still tending to be chloritic and broken up by an extremely complex system of jointing and shearing. On North Twin island to the east, the same chloritic fractured granite with opalescent blue quartz eyes intrudes intermediate and rather acid lavas. Owing to the recrystallization and probable silicification of the latter, the contact is difficult to determine.

The granite-greenstone contact east of Emmanuel lake is notable for the parallellism of strike of the contact, of shearing in greenstone and granite alike, and of inclusions of schist in the intrusives near the northeast end of the lake. Both the granite and the intruded rock are gneissic. The greenstone is traversed by numerous siliceous dikes or sills. Near the northeast end of the lake, the

granite possesses an unusual alternation of coarse, sheared material and fine-grained, massive aplitic bands striking parallel to the nearby contact.

In the southeast corner of the map area, where hybrid diorites predominate, the granite is rather variable in its content of basic constituents and in its degree of shearing and banding. Just west of the main diorite intrusives, it is strongly gneissic and greyish-white in colour. Farther west it becomes typically massive, siliceous, and pink. Its foliation is not usually pronounced where it intrudes the diorite, and its composition may range from diorite to granodiorite.

The same is true of the granite south of the norite body on Straight lake. Here, its relations with hybrid diorites and amphibolites are too complex to satisfactorily distinguish the two in mapping. South of Straight lake, the granite is so contaminated that for a mile or more it is represented only by diorites and granodiorites or, near Niven's base line, by extremely contorted complex gneissic rocks.

Similar contamination of the granite during intrusion is to be found along the contact on Meridian bay and Chancellor lake. The Froghead bay granite, on the other hand, is little affected near its contacts, though the dark minerals sometimes occur in proportions greater than normal.

Pegmatitic Granite

Coarse-grained pegmatitic granite is of rare occurrence except in the northern part of the map area, north of the sedimentary belt. There it intrudes all the other granites and the sediments. Its gradation into normal granite indicates that it is of the same magmatic period.

The pegmatite occurs as large masses, as dikes, sills, and *lit par lit* injections in the paragneiss, and as dikes in the granite. It is composed of coarse pink feldspar, quartz, and mica. It also contains minor amounts of beryl, tourmaline, magnetite, and garnet in some localities. The magnetite and garnet probably represent recrystallized sedimentary inclusions. Cassiterite has been reported by Burwash[1] from pegmatite dikes in Partridge bay.

Relationships

Granites intrude the Keewatin, Timiskaming(?), Haileyburian(?), and their own diorite and amphibolite contact phases. They are intruded by pegmatite and aplite produced in the late stages of their own consolidation. In summary, three types of contacts may be recognized.

1. *Gradational.*—The greenstone may undergo progressive introduction of siliceous and feldspathic material as the contact is approached, becoming foliated, while the granite is also sheared and gneissic, as at Passover lake and the regions east of Emmanuel lake and south of Nabish creek. Sometimes the greenstone is relatively unaffected, while the granite becomes sheared and chloritic, as at Net island near the contact. In this type, as already stated, shearing and banding in intrusive and intruded rock is parallel to the contact.

2. *Hybrid.*—Diorite masses separate the granite from the greenstone. The diorite intrudes the latter and is itself cut by granite. The most typical and extensive occurrence is in the southeast corner of the area.

3. *Sharp.*—The massive, light-coloured Froghead bay granite intrudes the Keewatin without any noticeable effect on the massive pillow lavas except recrystallization.

The characteristics of the first group are those to be expected along the deeper contacts of an intrusive magma. The same is true of the *lit par lit* structure

[1]E. M. Burwash, Jour. Geol., Vol. XLVII, 1939, p. 767.

and extensive granitization of the granite-sediment contact. The conditions of formation of the second type are obscure, but their association with profoundly altered and granitized greenstones south of Nabish creek is presumptive evidence of a similarly deep-seated origin. The Froghead bay granite, judging from the type of contact, was intruded under conditions of less intensity than the others.

Granite and Porphyry Dikes

Granite dikes and sills are numerous near the greenstone-granite and sediment-granite contact in the intruded rock. This is especially true east of Emmanuel lake. They are siliceous granites, sometimes sheared and white, in other cases pink and massive. At and near Flambeau lake sheared siliceous granite dikes with a northwest strike are abundant. Some mineralization along the north shore of the lake is associated with them.

Porphyry dikes occur in considerable numbers in the greenstone belt east of Meridian bay. They are extremely fine grained and siliceous with scattered phenocrysts of quartz and feldspar, which are not usually obvious in the hand specimen. They are for the most part less than 20 feet wide and generally, though not always, parallel to the strike of the greenstone. Often they are cut by clear veins of massive or sugary, barren-looking quartz. A mile or two east and south of Shako lake, quartz porphyries were found containing thin lenses of granular, dark, watery quartz with a little fine-grained sulphide. Sometimes the dikes are rusty, and one was discovered that carried large cubes of pyrite. Quartz and granite porphyry dikes also are abundant in islands just north of the mouth of Meridian bay and in the peninsula dividing Meridian bay from Midway bay. A few cut the acid-intermediate rocks north of Buchan bay, and many are exposed on the shore between the bay and Bear narrows.

These are believed to be chiefly, if not entirely, Algoman porphyries rather than Keewatin, because of their abundance near the north and south extremities of the Froghead bay intrusive and because they are found occasionally cutting across the normal strike of the formation.

Dark feldspar porphyry dikes are present along the north shore of Hardrock bay. They differ considerably in texture and colour from the preceding types. They may be Keewatin rather than Algoman in age.

Keweenawan

Diabase Dikes

Several dikes of brown, altered diabase intrude the gneiss and pegmatitic granite to the north, east of the town of Eagle River. They range in width from a foot or two to over 100 feet and normally strike northwest-southeast. Sometimes the narrower dikes have a step-like form in the sediments, in part forming sills between the beds, in part cutting across them.

Fine-grained fresh trap rock is found north of Flambeau lake, more or less irregularly cutting sheared siliceous granite and recrystallized greenstone.

Pleistocene

Varved clay forms most of the glacial cover in the Eagle River section. It usually consists of light- and dark-grey bands, half an inch to 1 inch thick. In several parts of the area a band of red clay about 6 inches wide was observed to occur 2 or 3 feet beneath the present surface.

Ground moraine and related materials are not a typical surface feature. The most important deposit of this type is a long ridge which forms the north shore

of the lake east of the Indian Reserve, extending northwestward to cross the Eagle river at the town of that name. It continues northwest of Eagle River out of the area; southeast of the Indian Reserve, it loses its identity, becoming a discontinuous series of mounds of bouldery drift. This ridge is probably a terminal moraine, since it strikes northwest-southeast, perpendicular to the direction of ice movement, and on its north side is dotted with huge granite erratics. It is not, however, typical morainic material, since it exhibits regular stratification where it has been exposed along the lake shore by wave action. It contains deposits of irregularly cross-bedded gravels along its crest. These features indicate the modification of moraine formation by fluvial and possibly



Irregular bedding in a sand and gravel pit near Eagle Lake Lodge.

lacustrine processes. Just west of Eagle River a coarse feldspar-quartz sand is spread as an outwash at the foot of the moraine. The two small lakes here, as well as one or two basin-like depressions which are not normally filled with water, may be kettle holes.

Measurements on glacial striae in the area ranged between N. 13° E. and N. 60° E., indicating that the movement of the ice was in a general southwesterly direction.

STRUCTURAL GEOLOGY

Folding

The principal structural feature of the Eagle Lake area is a northeastward-trending syncline, whose centre is occupied by the Timiskaming(?) sediments. The evidence on which this conclusion is based includes: (1) the orientation of the tops of pillow lavas along the south side of the belt; (2) the distribution of gentle eastward dips in Portage bay; and (3) the determination of the attitude of the sedimentary beds throughout the series by grain gradation and cross-bedding.

Although the great majority of top determinations in pillow lavas indicate that the flows face north, there were four instances in which the reverse orientation was observed. These are all located in the western part of the area, the farthest east being on a little point near the mouth of Littleneck bay. While no definite explanation of this anomaly can be given, the distribution of Keewatin(?)

diorites just west of Temple bay suggests that drag-folding may have taken place on a large scale along the greenstone-sediment contact to give this reversal of orientation.

The distribution of strikes and dips around Portage bay is rather confusing. Most of the gentler dips are to the east and suggest a synclinal structure plunging to the east.

Determination of the orientation of beds by grain gradation could rarely be made with certainty. In view of the practically isoclinal folding of the beds, the evidence obtained is rather scattered and not sufficiently complete in any one cross-section to warrant positive conclusions.

Pettijohn,[1] who did work on the same belt around Thunder lake some miles east of the area, came to the conclusion that the structure there was anticlinal and that the sediments were, therefore, older than the lavas to the south. A tongue of greenstone occupies the axis of anticline in that area and must, therefore, be considered older than the sediments.

To the writer it seems equally logical to consider that this greenstone is of the same age as the Keewatin to the south of the structure (on Wabigoon lake) and that it occupies an anticlinal wedge dividing the main syncline (at Thunder lake) into two smaller flexures. Further work is necessary along the intervening belt to establish positively which of the two interpretations is correct.

The most puzzling feature of the main synclinal structure is that, although part at least of the sediments of the north flank have been preserved, the Keewatin has been completely obliterated. The absence of the older rocks on the north limb might reasonably arouse doubts as to whether they were ever present. Thomson[2] and Wright[3] classified the sediments as Keewatin and thus avoided the difficulty of accounting for the missing volcanic series. The facts at hand, however, lead to the inference that the Keewatin, or whatever ancient basement the Timiskaming was deposited on, has been destroyed by the intrusion of granite to the north of the syncline.

The simple synclinal fold is further complicated by lateral extensions, four on the south and one on the north limb. The extension on the latter was not explored, owing to lack of time. It includes much metamorphosed, micaceous paragneiss intricately contorted and cut by numerous dikes of granite. It extends an undetermined distance northward from Bottle Bay lake.

Of the southern extensions the westernmost passes out of the area in the vicinity of Detour point as a narrow belt of greywacke and greenstone. On the Kenora Sheet[4] it is shown to be continuous with the Lobstick bay sediment-greenstone series.

East from this belt is a narrow spur of greenstone, which extends southwestward past the Grace and Eldorado mines towards Castor lake. It persists as a continuous belt for 2 to 3 miles, and is recognizable as interrupted inclusions in the granite for a short distance farther south.

The most persistent of these structures is east of Meridian bay, extending southwards beyond the south boundary of the area. Determinations of tops in the abundant pillow lavas suggests a simple synclinal structure. The picture is complicated by the presence of the Froghead bay granite and the smaller intrusive body to the south, west of Emmanuel lake, and more especially by the acid volcanic series north of Buchan bay. This series appears to occupy a fairly

[1]F. J. Pettijohn, Bull. Geol. Soc. Amer., Vol. 48, 1937, p. 172.
[2]Ellis Thomson, Ont. Bur. Mines, Vol. XXVI, 1917, pp. 172-175.
[3]J. F. Wright, Geol. Surv. Can., Econ. Geol. Series No. 2, 1926, p. 59.
[4]Geol. Surv. Can., Pub. No. 720, 1902.

central position in a very thick part of the Keewatin section. The same is true of the acid volcanics on the mainland east of Stanton island.

Shearing

Except for massive intrusives, the rocks of the area are, almost without exception, more or less schistose or foliated. The direction of shearing varies abruptly throughout the area, a fact which can be appreciated by referring to the structural map (see insert facing this page). The latter further demonstrates that this variation is a systematic one, involving the consistent parallelism of the strike of bedding and schistosity to the general boundary of the main intrusive masses.

Shearing appears to have been so widespread that localized zones of heavy deformation have not usually developed, except where relatively incompetent rocks are intercalated between massive and resistant formations. This seems to have been the case with the Algoman porphyries in the greenstone series east of Meridian bay and with the zones of alteration in the norite series. It must be emphasized, however, that zones of heavy shearing are especially subject to weathering and erosion, and hence could not be recognized in the field because they are not exposed. Intense shearing is characteristic of the area of acid and intermediate rocks east from Poplar island, on the mainland and adjacent islands. Where carbonated, these rocks have been so intensely sheared that the general shape and appearance of their outcrops suggest slaty sediments rather than volcanic rocks.

The fracture and flow cleavage of the sediments are not thought to be due to the folding of the latter, since structural interpretations based on their relationship to bedding do not agree with conclusions based on grain gradation. They are perhaps due to later structural adjustments connected with granite intrusion.

Faulting

Faulting of any importance was not definitely recognized in the field, though an unusually abrupt cliff in the paragneiss just northeast of Elfra lake may be a fault scarp. In general, the recognition of faults and fault zones is difficult because, like shear zones, they may be hidden beneath overburden or lakes. Moreover, structural adjustment was probably largely accommodated by shearing and flow, rather than actual fracturing.

Relationships of the Sediments and the Volcanic Series

As already stated, the sediments are believed to occupy a synclinal structure in the "Keewatin," and are, therefore, to be considered younger. The two seem to be conformable, because along the south boundary of the sedimentary belt interbedding of greywacke and pillow lavas is of frequent occurrence. It is true that, locally, strikes and schistosity do not exactly parallel the contact. This may be due to the lenticular nature of lava flows, the presence of local unconformities and large-scale cross-bedding in the sediments, and structural movements along the contact.

There is no evidence that the greywacke and quartzite were derived locally. The sediments are no coarser in grain near the greenstone contact than higher in the series, nor do they appear to contain fragments of the underlying older rock. These facts, together with the composition of the sediments, suggest a distant source with abundant supplies of quartz. The important series of coarse sedi-

ments around Minnitaki lake suggests a derivation from that direction, though no evidence in the form of ripple marks, cross-bedding, or coarsening of grain towards the east substantiates this.

Structural Relationships of the Granite Intrusives

The parallelism of the schistosity of the Keewatin and Timiskaming(?) to the borders of the granite area has already been mentioned. The variety of strikes shown by both is clear evidence that the schistosity could not have been formed previous to the intrusion of the granite. Thus the conclusion seems justified that the present orientation of these features is a result of the intrusion of the granite, rather than that the distribution of the granite is due to the control of earlier structure.

ECONOMIC GEOLOGY

The chief economic mineral in the Eagle Lake area is gold. Between 1925 and 1927, soapstone was quarried on a small scale.

Gold

In the past, three types of gold deposits have been investigated in various parts of Eagle lake. Of these the earliest to receive attention were shear zones in granite rocks near the contact with Keewatin lavas. The Eldorado, Grace, Golden Eagle, and Baden-Powell mines are the chief representatives of this group. The mineralization includes quartz in various, but usually large proportions, small amounts of disseminated sulphide, and occasionally native gold. The second type, which to date has not the economic importance of the other two, includes shear zones and quartz veins in basic Keewatin lavas. The Morning Star and Lone Pine prospects belong to this group. The most promising prospects discovered in recent years are located in silicified shear zones or bodies of highly quartzose porphyries in the acid volcanics and porphyries north of Hardrock bay. Mineralization in this type, too, is for the most part rather sparse.

No properties were being operated in the area during the summer of 1938, and many have not been worked since 1912. Most of the early work was done on narrow quartz veins and shear zones in and near granite. Some of these contained a little native gold, but the deposits were too small to be of commercial value.

In connection with the older properties of the area, figures and historical data are entirely drawn from the various accounts in the publications of the Ontario Bureau of Mines.

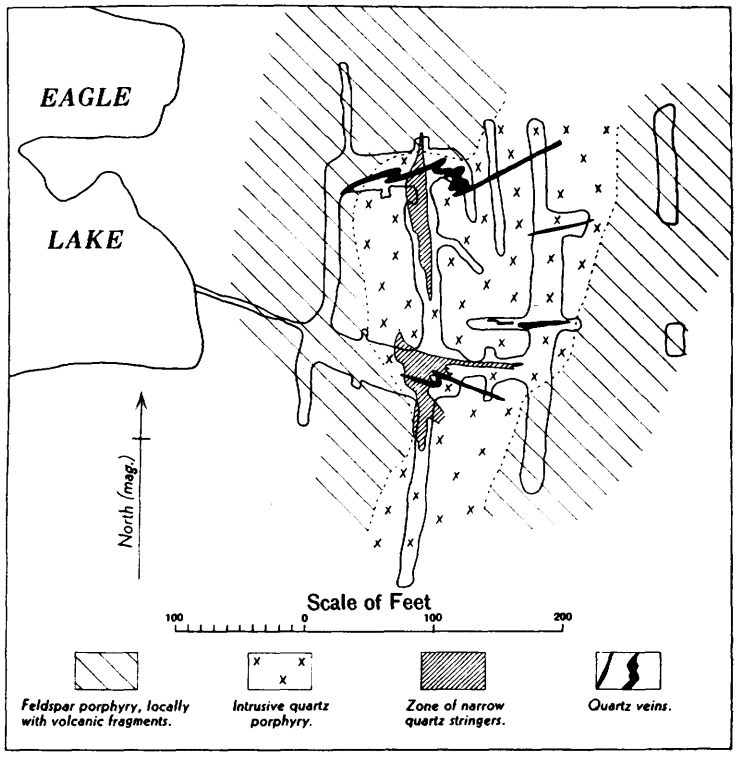
Fornieri Claims

The Fornieri claims, located on Fornieri bay, include claims K. 5,591–5,599 and 5,742–5,747. Most of the work was performed on the property while under option to Erie Canadian Mines, Limited. The main workings have exposed an an area underlain by a complex series of feldspar porphyry (rhyolite?), fragmental volcanics, and quartz porphyry. These rocks have undergone some fracturing and are reported to be faulted to a minor degree.

The quartz porphyry is exceedingly siliceous and is cut by numerous narrow ribbons of quartz, slightly mineralized with pyrite. The porphyry appears to intrude the associated rocks.

The heaviest mineralization occurs near the northeast corner of the main workings in a siliceous, fine-grained, greenish feldspathic porphyry, near its

contact with the quartz porphyry. The mineralization includes compact masses of pyrrhotite, disseminated chalcopyrite, and pyrite, a few patches of a silvery columnar mineral (bismuthinite?), and some native gold. The accompanying quartz occurs in stringers and masses, associated with a silvery bluish mica and patches of chlorite. In some cases the quartz is well crystallized and has drusy cavities, coated on the inside with perfect octahedra of pyrite and occasional grains of native gold. The latter is also found in more massive quartz. G. L.



Plan showing the main workings on the Fornieri claims. (Plan of workings and quartz veins by members of the staff of Erie Canadian Mines, Limited; generalized geology by W. W. Moorhouse.)

Holbrooke,[1] of Erie Canadian Mines, Limited, states that visible gold was especially abundant near the noses of small drag folds in the veins.

Mineralization is also reported to occur in strong shear zones in rhyolite, which strike east-west and dip steeply. They carry stringers of quartz and quartz-carbonate, with fine pyrrhotite, chalcopyrite, and pyrite.

W. W. Smith Claims (Birch Bay Gold Mines, Limited)

The W. W. Smith property is situated on the north shore of Hardrock bay and includes a block of 11 claims, K. 5,616–5,624, 5,838, and 5,839. The claims were prospected by Birch Bay Gold Mines, Limited, by trenching in the summer of 1936 and by diamond-drilling under the direction of S. S. Saxton during the winter of 1937–38.

[1]Personal communication.

The No. 7 showing, located about a quarter of a mile inland on claim K. 5,619, is a rather irregular, narrow, poorly defined dike of quartz porphyry with large quartz eyes. It is cut by numerous stringers of quartz. These veinlets strike about N. 30° W. and are from a quarter to a third of an inch wide. They are mineralized along their borders with finely disseminated sulphides, pyrrhotite and chalcopyrite, and visible gold, according to a report by J. H. Morgan. The porphyry is intrusive into a greenish feldspathic tuffaceous porphyry. Morgan's report states that diamond-drilling disclosed erratic values underground but failed to encounter the dike.

On the north shore of Hardrock bay, just west of the large island, a great deal of trenching and stripping has been done on a shear zone or series of shear zones in chert and iron formation, in massive feldspar porphyry, in acid volcanics, and in pillow lavas. The acid volcanics may be in part Algoman porphyries. The zones are narrow and silicified and contain disseminated pyrite, chalcopyrite, and chlorite.

Farther east along the same shore, trenches were opened in pillow lavas, interbedded with chert and iron formation, and in fragmental greenstone and massive porphyritic rocks. Silica and disseminated pyrite are irregularly distributed along this zone. South of it, a trench reveals iron formation, agglomerate, and tuff, cut by porphyry and locally mineralized with pyrrhotite and a little chalcopyrite. On the small island directly to the west of these, some work on massive rusty greenstone and chert are reported to have revealed low values.

Baden-Powell Mine

The Baden-Powell mine, which in the first decade of the present century produced $1,273 worth of gold,[1] is located on a bay of South Twin island. It lies in an area of grey hybrid igneous rock surrounded by more normal, pink, coarse granite. The property is reported to have three quartz veins, on one of which a shaft was sunk to a depth of 140 feet and a little drifting done. Mineralization is reported to have included fine, scattered pyrite and native gold in remarkably coarse grains. No work was done at the property after 1906. At that time it was said to have been provided with a 5-stamp mill.

Grace Gold Mine

The Grace gold mine is located in a hybrid granite, just east of the contact with greenstone on the mainland opposite Pioneer island. Six narrow veins are reported to occur in the granite. On one of these a shaft was sunk to a depth of 135 feet. A tunnel was also driven into the granite hill for 150 feet, at a point on the lake shore a quarter of a mile south of the shaft. The veins are reported by W. E. H. Carter[2] to be narrow, carrying galena, sphalerite, pyrite, and an unusual quantity of visible gold. When visited during the field season of 1938, no trace of mineralization beyond a few grains of pyrite was found in the rather extensive dump. A 5-stamp mill was erected on the property in 1907. Work was suspended before 1911, but was resumed in 1920 and continued till 1922.

Eldorado Mine

The Eldorado mine is located on the north shore of Eldorado bay in the southwestern part of the lake, where a strong shear zone occurs in massive, hornblendic granite containing blue quartz eyes. A shaft was sunk on the shear zone to a depth of approximately 140 feet, and some lateral work was done on two levels. The shear zone is approximately 500 feet long and at the shaft is about

[1]A. C. Young, "Statistical Review of Ontario's Mineral Industry in 1935," Ont. Dept. Mines, Vol. XLV, 1936, pt. 1, p. 21.

[2]W. E. H. Carter, "Mines of Western Ontario," Ont. Bur. Mines, Vol. XIII, 1904, pt. 1, p. 64.

4½ feet wide. It has been silicified and impregnated with scattered, fine-grained pyrite. A small mill was erected on the property in 1900, but no production is recorded from the mine. No work was performed on the property after about 1910.

Pioneer Island

The Pioneer Island location, McA. 245, a small island a third of a mile northeast of the Grace mine, is situated on the contact of granite with "green trap." The mineralization includes massive, abundant pyrite and quartz. The weathered gossan is reported to have panned gold. The shaft is reported to reach a depth of 80 feet, with 160 feet of drifting at the 70-foot level.

Golden Eagle Mine

A 70-foot shaft was put down on the Golden Eagle property, and 160 feet of drifting done. Some 29 tons of ore put through the Eldorado mill in 1903 is reported to have yielded $307.50 in gold.[1] No work is reported after 1906.

Meridian Bay Mining Company

The property of the Meridian Bay Mining Company is situated on Meridian bay on what appears to be a replacement of an inclusion in hybrid diorite. It has been exposed in three trenches to a width of 3 to 12 feet. The mineralization consists of pyrrhotite, chalcopyrite, and pyrite, according to Parsons.[2] It appears also to contain magnetite in unweathered portions. The sulphide is reported to carry one-half to 1 per cent. of nickel with copper and gold.[3] A similar deposit occurs along the shore a quarter of a mile to the north. Here the mineralization appears to consist entirely of massive, nodular pyrite.

Other Properties

Shafts have been sunk on several other properties, including the Buffalo and Viking. Pits were opened on the Swanson and Manhattan gold locations, but no work of any importance has been done. A shaft was also put down on a quartz vein in greenstone at the Lone Pine mine.

Iron

Parsons[4] mentions that some interest was aroused in the economic possibilities of the iron formation that outcrops on the south side of Detour point and of an iron gossan capping a sulphide zone on Net island.

Titaniferous Magnetite

During the field season of 1938, heavy concentrations of magnetite were noted associated with the norite series north of Straight lake. None of these are so far known to be of sufficient size or richness to be of economic interest.

Mica

The writer has been informed that a little mica was taken out of a small deposit near Oxdrift station. The great abundance of pegmatite, which is characteristic of the northern part of the area, would seem to suggest the possibility that other deposits of the same mineral may exist.

---

[1]P. E. Hopkins, Ont. Dept. Mines, Vol. XXX, 1921, pt. 2, p. 51.
[2]A. L. Parson, Ont. Bur. Mines, Vol. XX, 1911, pt. 1, p. 196.
[3]Ibid.
[4]A. L. Parsons, "Goldfields of Lake of the Woods, Manitou and Dryden," Ont. Bur. Mines, Vol. XXI, 1912, pt. 1, p. 184.

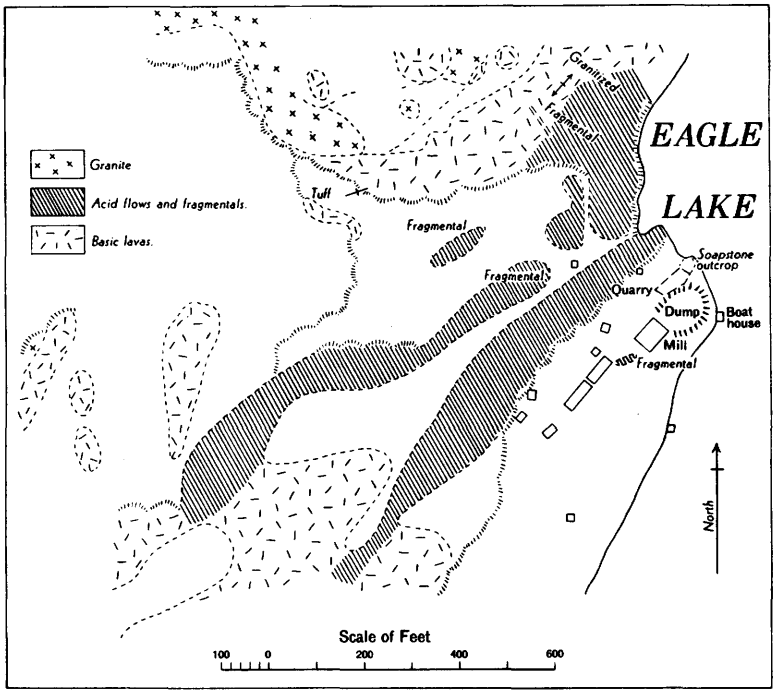
Nickel

Parsons[1] records the reported presence of nickel in a very massive sulphide deposit at the Meridian Bay mine.

Soapstone

Eagle Lake Soapstone Quarry

The Eagle Lake soapstone quarry, also known as the Grace mine, is located a quarter of a mile north of the Grace gold mine. The soapstone is an altered volcanic flow. It is dark bluish-green, weathers white, and is cut by veinlets and lenses of carbonate (calcite and ankerite?), with maximum width of 3 inches.



Sketch map of the geology in the vicinity of the Eagle Lake soapstone quarry.

With the calcite is associated greenish, coarse talc and chlorite, and with the ankerite, disseminated sulphides. There is considerable evidence of movement along these fractures, as shown by slickensides. Under the microscope the soapstone appears to be composed of carbonate and chlorite with talc or a related mineral. A quarry 28 feet wide and 65 feet long has been opened in the deposit.

The soapstone was removed by channelling and then sawn into blocks, for lining the furnaces of Kraft paper mills. Approximately 174 tons were cut during 1925 and 1927. Operations were discontinued in June, 1927.

SUGGESTIONS TO PROSPECTORS

While the area has been prospected off and on for the past forty years, the writer feels that it has not been as thoroughly investigated as it deserves. Owing

[1]A. L. Parsons, Ont. Bur. Mines, Vol. XX, 1911, pt. 1, p. 196.

to the fact that so much of the area is accessible from the lake, much of the work appears to have been confined to its shores, and except in restricted areas little trace of prospecting activities was found inland.

Gold

There are certain sections of the area that appear to merit further prospecting for gold. Reference to the accompanying map will show that mineralized zones and quartz veins occur chiefly at the "noses" or ends of the granite bodies, i.e. in areas where the directions of schistosity and bedding converge. Localities in which these relationships were observed include the sulphide mineralization associated with the converging strikes about the diorite nose northwest of Nabish lake; an extensive greenstone breccia cemented by rusty vein quartz north of Froghead bay, together with the sulphide mineralization to the east; the gold-quartz mineralization north of Hardrock bay; the mineralization on the north tip of Midway point; the zone of porphyry dikes south of Froghead bay; the porphyry dikes and mineralization on Midway point; and possibly the sulphide-bearing shear zones at Ardis lake.

Another structural condition that seems to favour mineralization is found where granite masses, possibly of different age, through differential movement during or after intrusion create zones of shearing or fracturing in the narrow belts of older rocks that separate them. An example of this is the porphyry with quartz and sulphide mineralization just west of Bear narrows between the Froghead bay and the Bear narrows granite. Of somewhat similar significance are spurs of greenstone that pinch out in the granite. The best example of this is found in the shear zones and deposits in the vicinity of the Grace and Eldorado mines. A sulphide zone on a small island just west of the Grace mine may warrant investigation.

The porphyry dikes south of the Froghead bay granite have been sheared and fractured and in some cases silicified, owing to the fact that their behaviour under stress is different from that of the surrounding greenstone. No important mineralization was observed associated with these dikes except in one locality already mentioned, west of Bear narrows, and a small dike a short distance west of Shako lake. Such porphyry dikes, however, especially between Robbins lake and the Froghead granite, should be prospected.

Mention has already been made of the sheared altered chloritic zones that intersect the massive norite in several places north of Straight lake and around Mulcahy lake. At one locality indicated on the map north of Straight lake a well-mineralized quartz vein was observed in one of these chloritic shear zones. Such zones are thought to be worthy of careful prospecting.

Favourable structural conditions may occur in the complex series of rocks lying north and west of Buchan bay. A rather wide silicified zone was observed on the large island at the mouth of Spring bay. It occurs in an alternating series of basic flows, agglomerate, and carbonate rock.

Other Metals

The norite and related rocks north of Straight lake show on a small scale characteristics like those of certain other basic complexes with which such elements as chromium, platinum, nickel, and copper are associated. In prospecting this area the possibility of finding these metals should be kept in mind.

The titaniferous magnetite concentrated in certain zones in the norite series merits attention. Some narrow zones carrying locally as much as 50 per cent. magnetite were observed. A magnetic survey of the norite mass appears justified.

[redacted]

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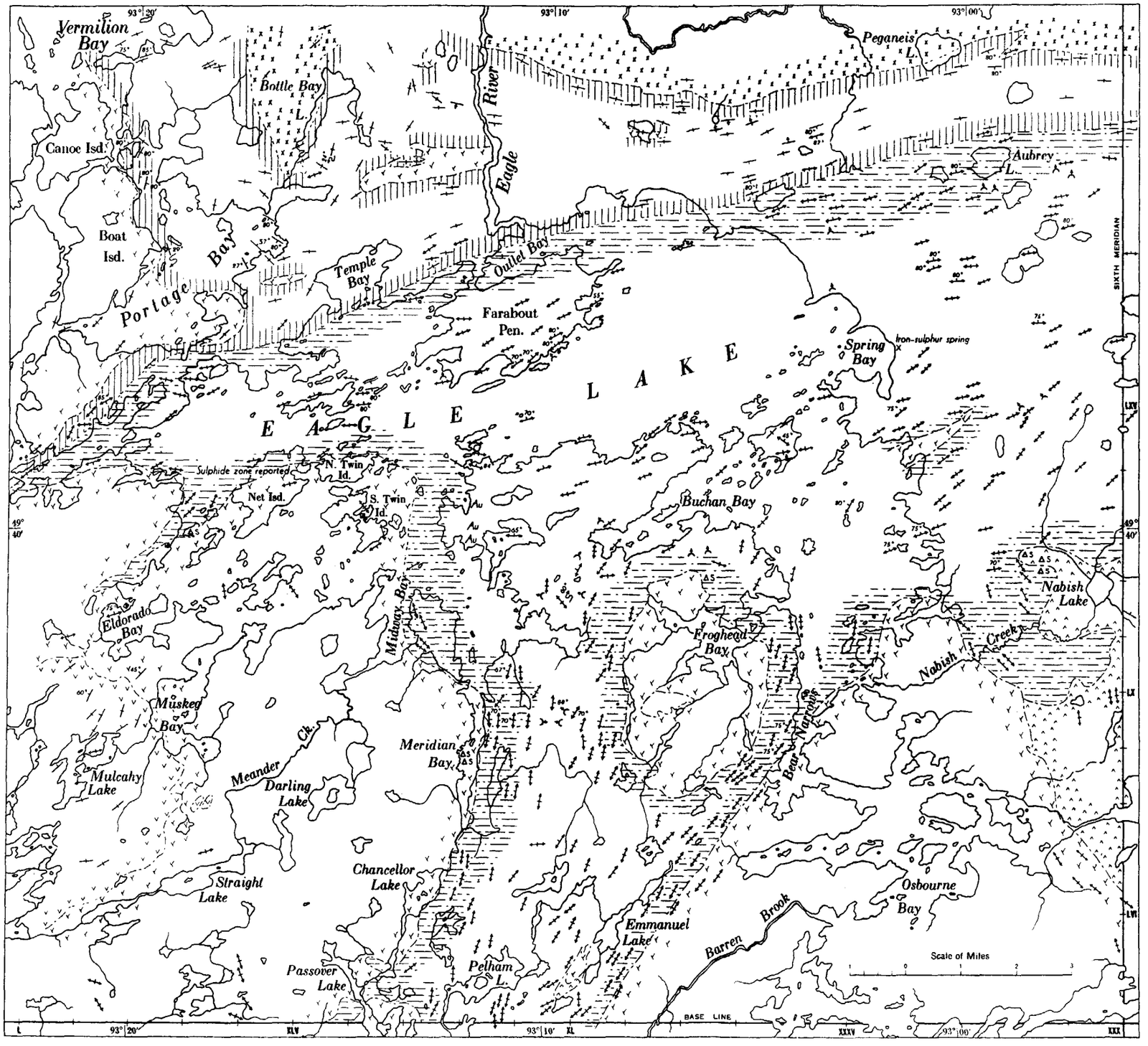
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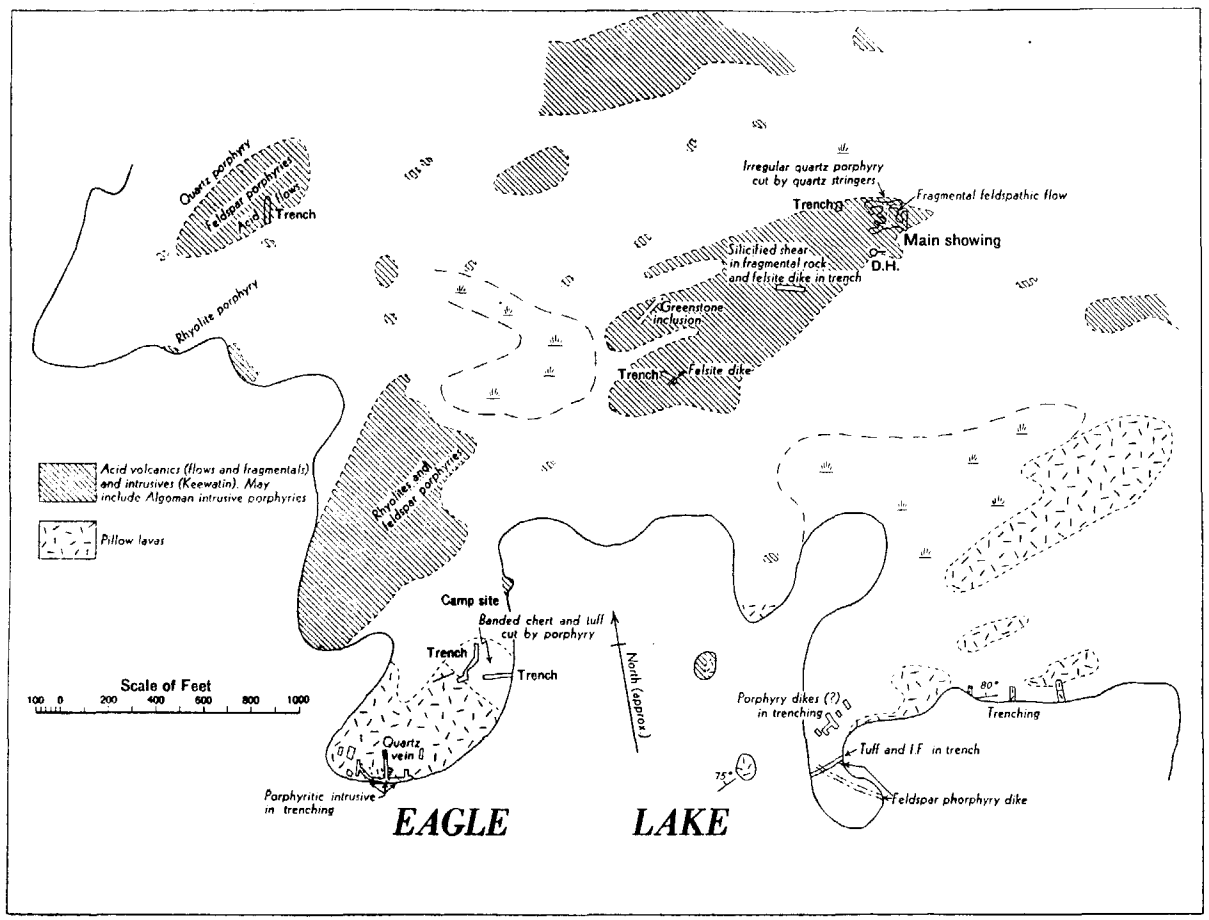
- Pegmatitic granite
- Granite, granodiorite etc.
- Hybrid diorite and amphibolite
- Norite series.
- Sediments.
- Volcanic series

SYMBOLS

- Geological boundary, approximate.
- Geological boundary, assumed.
- Strike and dip of stratum.
- Strike and vertical dip of stratum.
- Flow contact, top being in direction from light toward heavy line.
- Direction in which lava flows face.
- Direction in which strata face.
- Direction in which strata face, dip vertic
- Direction in which strata face, indicated by gradation in grain size.
- Strike and dip of schistosity.
- Strike and dip of vertical schistosity.
- Drag folds.
- Shaft.
- ΔS Sulphide mineralization.

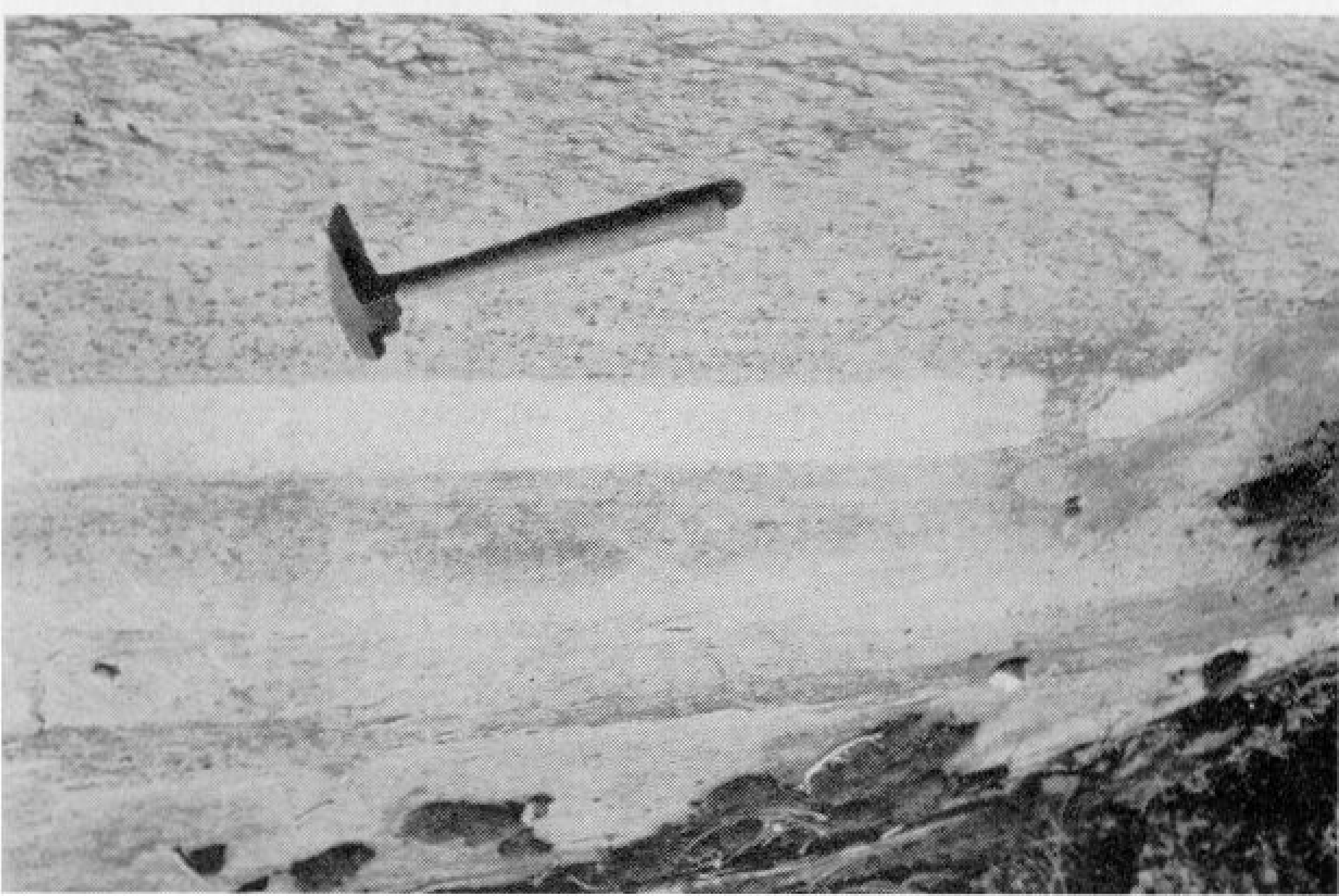
STRUCTURAL MAP OF THE EAGLE LAKE AREA

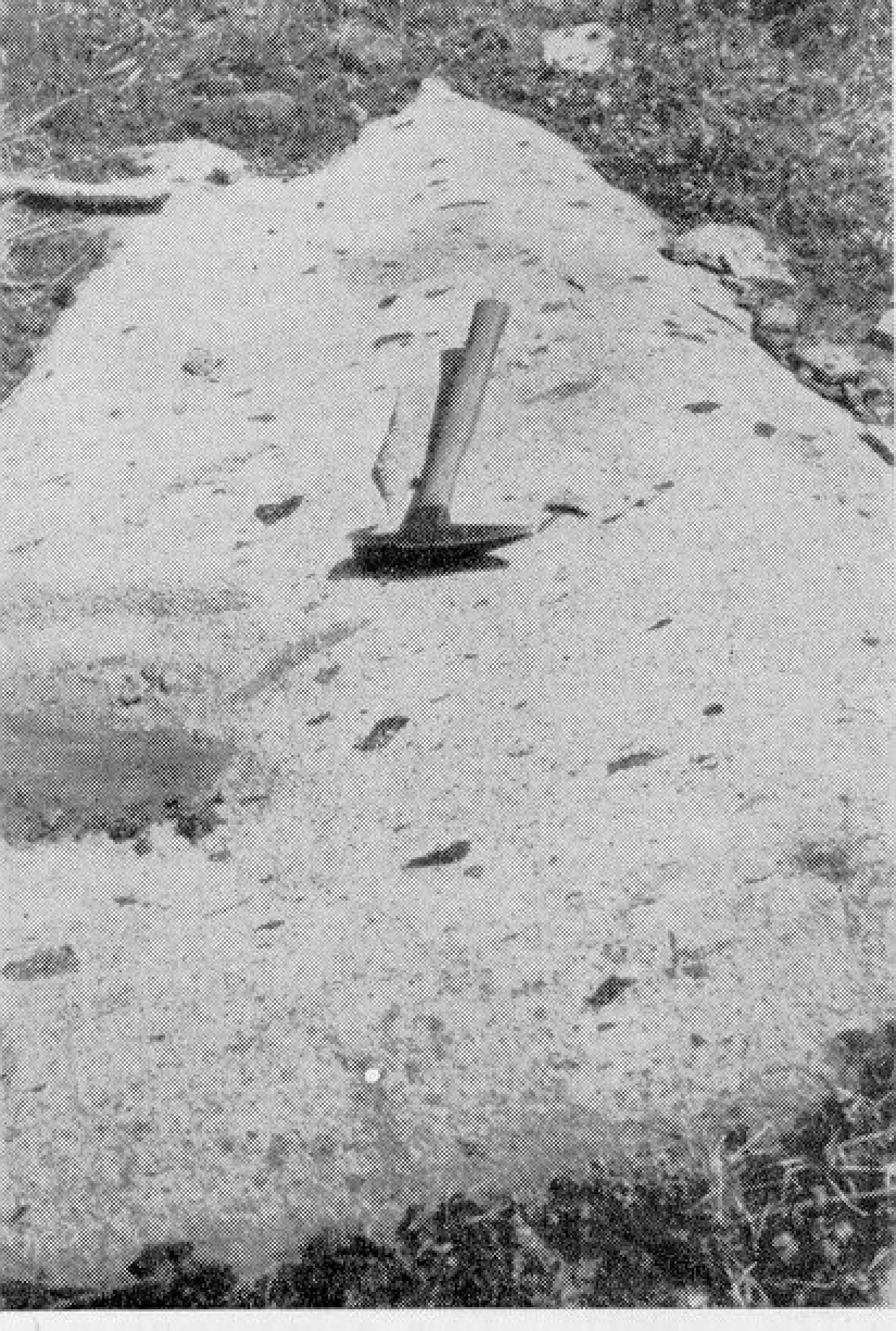
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GEOLOGICAL SKETCH MAP SHOWING THE GEOLOGY AND PRINCIPAL WORKINGS OF THE W. W. SMITH PROPERTY.
Some of the rocks mapped as acid flows may actually be intrusive porphyries of Keewatin or Algoman age.













PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

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VOL. XLVIII, PART V, 1939

Natural Gas in 1938, by R. B. Harkness - - - - 1-62

Petroleum in 1938, by R. B. Harkness - - - - 63-66

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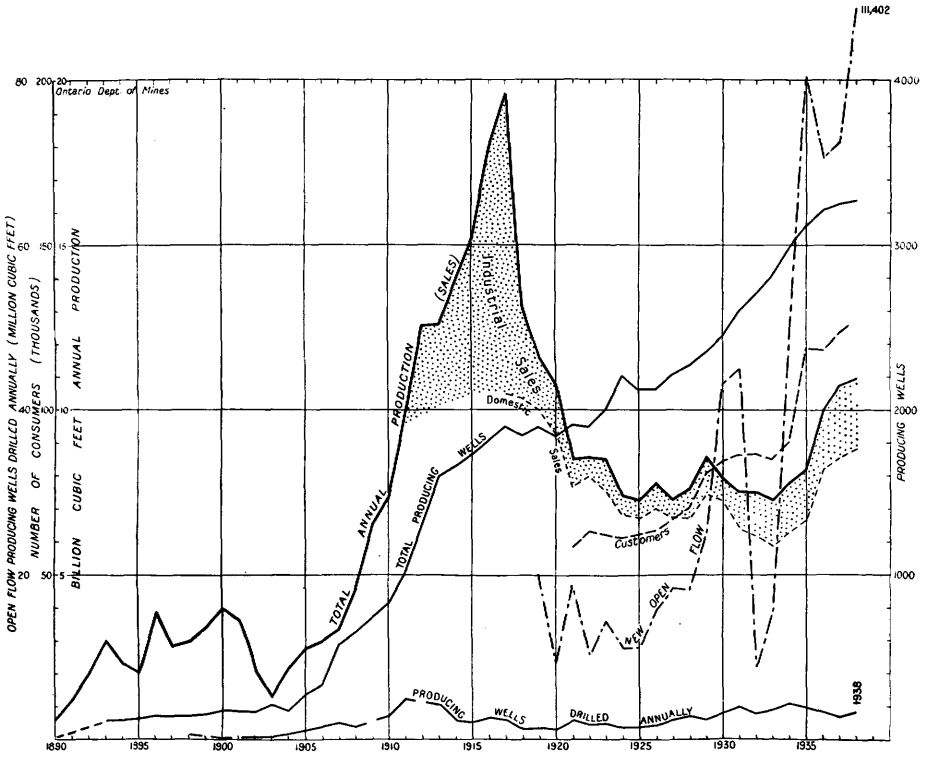
Graph of the natural gas industry in Ontario for the past forty-eight years ... 1

NATURAL GAS IN 1938

By R. B. Harkness

General

The production of natural gas in 1938 was 10,952,806 M cubic feet. This is an increase over 1937 of 206,472 M cubic feet. The value, however, shows a decrease of $128,012. These items can be seen in Table I. The decrease in value is actually not as much as it would appear. In past years it has been the practice to value the output of the producers who wholesale this gas to distributing companies at retail rates, which placed a fictitious value on the portion of this



Graph of the natural gas industry in Ontario for the past forty-eight years.

gas that leaked from the pipe lines in transit. This error was a very minor one until the past year or two, when the proportion of wholesaled gas increased enormously.

The number of domestic consumers shows an increase of 4,334, and the quantity used per consumer and the gas used in industries shows a slight decrease. The total number of producing gas wells shows a slight increase, but the number of producing wells drilled during the year shows a decrease. The acres under lease and the capital invested in the industry show a considerable increase, but the number of employees and wages paid, a small decrease.

TABLE I—NATURAL GAS PRODUCTION BY FIELDS, 1938

County	Field	Quantity
		M cu. ft.
Essex	Kingsville	3,265,726
	Tilbury	
Kent	Declute	1,797,789
	Dover	509,677
Lambton	Dawn	1,894,730
	Oil Springs	
Oxford	Brownsville[1]	556,922
Elgin		
Elgin	Bayham	113,651
Norfolk	Norfolk	437,867
Lincoln	Lincoln	1,912,882
Haldimand	Haldimand	
Wentworth	Wentworth	
Welland	Welland	253,085
Brant	Onondaga	135,348
Bruce	Amabel	1,129
Wells in surface drift	Harwich and Howard tps.	14,000
Private wells		60,000
Total produced		10,952,806
Value		$6,460,763
		M cu. ft.
Imported mixed gas		125,807
Total distributed		11,078,613

[1]Dereham township, 506,005 M cu. ft.; Bayham township, 50,917 M cu. ft.

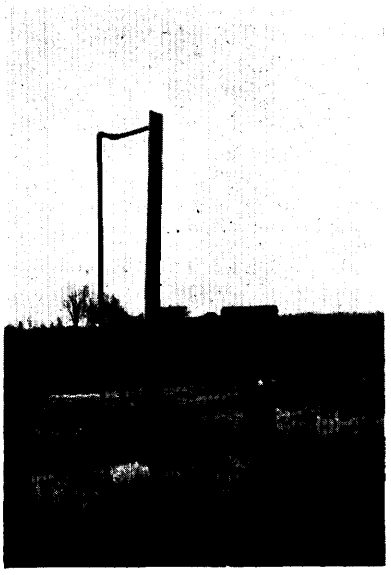
TABLE II—DOMESTIC CONSUMPTION OF NATURAL GAS, CAPITAL INVESTED, AND WAGES PAID, 1921–1938

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	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	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	89,990	5,262,631	58.5	41,934,395	931	1,010,979
1935	60	118,719	5,553,902	46.8–52	42,975,846	1,273	1,219,520
1936	60	118,117	6,956,453	59.3	45,197,240	1,336	1,354,611
1937	60	123,527	7,767,359	62.8	49,059,740	1,501	1,668,188
1938	60	127,861	7,912,220	61.8	51,189,094	1,439	1,631,677

On the whole, the natural gas industry is in a healthy state and producers are optimistic, as indicated by the great increase in acreage under lease. The gas fields are producing sufficient to meet the demands, although the pressure in the old fields is becoming dangerously low. Drilling in the Brownsville field

has practically ceased; wells have been spaced much closer than has ever before been the practice except along boundaries of lease blocks.

The practice of "crowding the line" along competitive boundary lines has been frowned on by the Department of Mines since the control of the industry was first placed in the hands of the government. A regulation was put into effect in 1919 fixing the distance between the wells of opposing interests at 1,000 feet, a distance considered to be good practice. Prior to this date wells of opposing interests had been drilled as close as 50 feet. The 1919 regulation was found unsatisfactory because where wells were drilled on small acreages or on narrow leases and all others made to keep 1,000 feet distant, other lease owners would in many cases have been deprived of the right to drill for and recover their own gas. So much investigation and arbitration was entailed in the administra-



Well on lot 24, concession XII, Dereham township. This well is blown every hour. Note the accumulation of salt water in the foreground.

tion of this regulation and such difficulty was found in carrying it out that it was repealed by common consent and a new regulation substituted on February 4, 1937. The new regulation is:—

No person shall drill any well within three hundred and fifty (350) feet of a boundary line of a property owned or leased by any person or company other than the person or company which proposes to drill the said well, without the approval of the Commissioner.

Manufacturers of gas appliances continue to improve their wares along lines of convenience, efficiency, and colour schemes. The gas industry presents a new gas range known as the C.P. Range (Certified Performance). This stove appears to approach perfection. All burners light automatically when the burner valve is opened; a regulator and filter is provided that ensures against fluctuations in pressure, which have been the bugbear of automatic lighting; more insulation and a larger oven burner give a quick and even heat with less gas; and with the assurance that no carbon monoxide can be formed from partially burned gases, the smoke pipe has been removed. Another appliance that has reached maturity

of design and has passed trials in the hands of the public is the gas refrigerator. It operates with either natural or manufactured gas and has no moving parts. Further advances have been made in the design of moderately priced water heaters and furnace burners.

Analysis of Gas Consumption

The increase in the consumption of gas in 1938 over 1937 is only about 2 per cent. and can be accounted for by the increase in the number of consumers. Brownsville and Glencoe have been added to the municipalities supplied with natural gas. There has been a healthy growth in the demand for natural gas for all purposes.

There has been little change in the rates charged for natural gas, and any revision has been somewhat downward in the average price. Rates are noted in the last column of Tables III and IV, and details of rates referred to by letters will be found in the table below.

Tables similar to this have been published since 1921 and in them will be found an interesting comparison of gas consumption and the growth of the industry.

NATURAL GAS RATES, 1938

Classification letter	Season, company, or locality	Classification according to amounts of gas used	Net rate and seasonal discount
A		Up to 10 M cu. ft.	85c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.
B	October to April	Up to 10 M cu. ft.	55c. per M cu. ft.
		From 10 M to 20 M cu. ft.	60c. per M cu. ft.
		Over 20 M cu. ft.	70c. per M cu. ft.
	May to September		80c. per M cu. ft.
C	October to April	Up to 10 M cu. ft.	50c. per M cu. ft.
		From 10 M to 20 M cu. ft.	55c. per M cu. ft.
		Over 20 M cu. ft.	65c. per M cu. ft.
	May to September		75c. per M cu. ft.
D	October to April	Up to 10 M cu. ft.	40c. per M cu. ft.
		From 10 M to 20 M cu. ft.	45c. per M cu. ft.
		Over 20 M cu. ft.	55c. per M cu. ft.
	May to September		70c. per M cu. ft.
E	October to April	Up to 10 M cu. ft.	60c. per M cu. ft.
		From 10 M to 20 M cu. ft.	65c. per M cu. ft.
		Over 20 M cu. ft.	75c. per M cu. ft.
	May to September		85c. per M cu. ft.
F		Less than 1 M cu. ft.	$1.50
		From 1 M to 10 M cu. ft.	$1.00 per M cu. ft.
		Over 10 M cu. ft.	$1.30 per M cu. ft.
	Where imported mixed gas is used		Additional charge for duty
	City of Niagara Falls	Over 10 M cu. ft.	$1.00 per M cu. ft.
G		Minimum bill	80c.
		Up to 10 M cu. ft.	80c. per M cu. ft.
		From 10 M to 25 M cu. ft.	65c. per M cu. ft.
		Over 25 M cu. ft.	55c. per M cu. ft.
H		Up to 5 M cu. ft.	$1.00 per M cu. ft.
		From 5 M to 10 M cu. ft.	90c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.

NATURAL GAS RATES, 1938—*Continued*

Classification letter	Season, company, or locality	Classification according to amounts of gas used	Net rate and seasonal discount
I		Up to 5 M cu. ft.	$1.00 per M cu. ft.
		From 5 M to 10 M cu. ft.	90c. per M cu. ft.
		From 10 M to 15 M cu. ft.	80c. per M cu. ft.
		From 15 M to 25 M cu. ft.	70c. per M cu. ft.
		Over 25 M cu. ft.	60c. per M cu. ft.
J		Up to 200 cu. ft.	40c. per hundred cu. ft.
		From 200 cu. ft. to 5 M cu. ft.	70c. per M cu. ft.
		From 5 M cu. ft. to 10 M cu. ft.	60c. per M cu. ft.
		Over 10 M cu. ft.	45c. per M cu. ft.
	October to April, discount.	On bills under $5.00	15 per cent.
		On bills between $5.00 and $10.00	10 per cent.
	May to September, discount	On bills under $5.00	10 per cent.
K		Up to 200 cu. ft.	40c. per hundred cu. ft.
		From 200 cu. ft. to 5 M cu. ft.	75c. per M cu. ft.
		From 5 M cu. ft. to 10 M cu. ft.	65c. per M cu. ft.
		Over 10 M cu. ft.	50c. per M cu. ft.
	October to April, discount.	On bills under $5.00	15 per cent.
		On bills between $5.00 and $10.00	10 per cent.
	May to September, discount	On bills under $5.00	10 per cent.
L	Fonthill-Ridgeville Gas Co.	First 400 cu. ft., minimum charge	85c.
		Over 400 cu. ft.	75c. per M cu. ft.
	Dominion Natural Gas Co.		75c. per M cu. ft.
M		Up to 15 M cu. ft.	75c. per M cu. ft.
		Over 15 M cu. ft.	55c. per M cu. ft.
N		Up to 1 M cu. ft.	$1.00 per M cu. ft.
		From 1 M to 10 M cu. ft.	80c. per M cu. ft.
		From 10 M to 25 M cu. ft.	65c. per M cu. ft.
		Over 25 M cu. ft.	55c. per M cu. ft.
O		Up to 5 M cu. ft.	80c. per M cu. ft.
		From 5 M cu. ft. to 10 M cu. ft.	70c. per M cu. ft.
	Port Colborne	Over 10 M cu. ft.	55c. per M cu. ft.
	Summer residents		$2.00 per M cu. ft.
P		200 cu. ft. or less	$1.00
		Over 200 cu. ft.	60c. per M cu. ft.
R	November to April	Up to 10 M cu. ft.	65c. per M cu. ft.
		Over 10 M cu. ft.	55c. per M cu. ft.
	May to October	Up to 10 M cu. ft.	70c. per M cu. ft.
		Over 10 M cu. ft.	55c. per M cu. ft.
S		Up to 5 M cu. ft.	$1.00 per M cu. ft.
		From 5 M cu. ft. to 10 M cu. ft.	90c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.
T	October to April	Up to 5 M cu. ft.	70c. per M cu. ft.
		Over 5 M cu. ft.	50c. per M cu. ft.
	May to September		70c. per M cu. ft.
U		1 M cu. ft. or less	95c. per M cu. ft.
		From 1 M cu. ft. to 10 M cu. ft.	60c. per M cu. ft.
		From 10 M cu. ft. to 15 M cu. ft.	55c. per M cu. ft.
		Over 15 M cu. ft.	50c. per M cu. ft.

Tables III and IV give in detail the quantity of gas used by pay, free, and industrial consumers in Ontario, and the rates paid in each municipality. Similar tables have been published since the year 1921 and reflect the changes that have taken place in each municipality during those years.

TABLE III—GAS CONSUMPTION IN TOWNS AND CITIES, 1938

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	650	208	1	12,484	69	.....	20	K
Ancaster	.....	111	....	12,412	.....	.....	170	70c.
Appin	.....	36	....	2,429	.....	.....	32	K
Attercliffe	.....	25	....	1,500	.....	.....	3	60c.
Aylmer	1,990	835	....	75,460	.....	6,003	16	T
Bartonville	602	192	....	6,480	.....	.....	19	60c.
Belle River	810	149	1	12,494	144	543	29	B
Belmont	317	119	....	3,473	.....	.....	92	$1.00
Binbrook	100	14	1	400	300	.....	1	60c.
Blenheim	1,702	617	2	53,544	310	2,947	20	C
Bothwell	685	176	1	12,786	1	.....	14	J
Brantford	31,282	5,520	5	288,034	1,320	21,760	140	G
Brigden	433	145	....	9,255	.....	183	30	B
Brownsville	.....	77	....	2,169	.....	.....	1	30c.
Burlington	3,680	494	....	32,992	.....	.....	48	H (M.B.[1]50c.)
Byron	350	82	....	9,117	.....	48	51	K
Cainsville	325	102	....	5,406	.....	.....	4	G
Caledonia	1,410	517	2	31,632	190	23,445	7	60c.
Canfield	165	60	....	3,478	.....	.....	1	60c.
Cayuga	664	234	2	16,578	193	396	6	60c.
Chatham	16,153	4,347	5	417,387	4,176	18,896	22	J
Coatsworth	321	29	1	1,867	76	517	4	D
Comber	505	151	....	14,111	.....	1,315	19	C
Cottam	425	91	4	6,581	418	181	35	60c.
Courtland	350	69	....	3,805	.....	67	3	60c. (M.B. 50c.)
Courtright	334	114	1	6,755	81	.....	53	B
Crystal Beach	510	154	....	7,613	.....	.....	1	F
Delhi	1,675	497	....	40,497	.....	549	4	60c. (M.B. 60c.)
Dorchester	403	120	....	6,614	.....	.....	95	E (M.B. 50c.)
Dresden and Tupperville	1,700	522	2	42,625	147	541	38	C
Dundas	4,955	1,094	1	55,186	2	6,652	172	70c.(M.B.$1.00)
Dunnville	4,005	1,071	3	87,466	349	7,602	7	60c.
Dutton	810	253	3	17,781	117	671	52	B (M.B. 50c.)
Echo Place	735	81	....	4,345	.....	.....	5	G
Eden	150	32	....	2,053	.....	.....	11	60c. (M.B. 50c.)
Essex	1,785	496	1	39,885	120	5,176	33	B
Fairground	75	18	....	523	.....	.....	1	60c. (M.B. 50c.)
Fenwick	330	132	....	6,168	.....	.....	18	75c.
Fingal	170	36	....	2,304	.....	.....	71	B (M.B. 50c.)
Fisherville	160	46	....	3,009	.....	.....	2	50c.
Florence	185	60	....	4,198	.....	341	5	J
Fonthill	870	255	....	7,274	.....	.....	25	L
Fort Erie	5,755	1,416	2	52,941	1,620	.....	8	F
Galt	14,410	2,601	1	121,347	19	14,813	147	G
Glencoe	1,980	150	....	4,025	.....	.....	28	K
Grimsby		377	....	10,990	.....	1,376	10	85c.
Grimsby Beach		86	....	3,760	.....	.....	11	85c.
Hagersville	1,307	428	....	30,291	.....	.....	14	60c. (M.B. 35c.)
Hamilton	154,020	12,198	3	411,083	1,009	676,039	47	M
Hepworth	380	27	....	1,129	.....	.....	1	75c.
Hespeler	2,800	511	....	26,299	.....	19,537	155	N (M.B. $1.00)
Highgate	345	109	2	8,250	391	.....	32	B (M.B. 50c.)
Ingersoll	5,175	1,168	2	58,422	277	9,695	100	G
Inwood	250	74	....	4,285	.....	839	14	A

[1]M.B.—Minimum monthly bill.

TABLE III—GAS CONSUMPTION IN TOWNS AND CITIES, 1938—*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	
Jarvis	505	206	....	13,632	.....	.....	9	60c.
Kingsville	2,365	635	3	57,082	190	787	30	U
Lake Shore	.....	112	....	6,079	.....	.....	16	F
Lambeth	475	155	2	14,036	177	509	85	K
Leamington	5,445	1,660	....	159,184	.....	4,270	20	55c.
London	73,880	17,036	4	1,577,477	91	93,997	55	K
Lynedoch	175	43	....	3,346	.....	.....	2	60c.
Merlin	400	156	2	14,398	1,479	2,277	2	D
Merritton	2,644	530	....	19,207	.....	8,909	35	70c.
Mount Brydges	525	114	1	11,899	59	876	43	K
Nelles Corners	86	7	1	730	120	.....	1	60c.
Niagara Falls	18,747	3,783	....	108,598	.....	21,768	11	F
Oil Springs	470	137	....	8,045	.....	882	2	R
Paris	4,325	971	2	46,292	198	10,294	129	G
Petrolia	2,710	773	2	64,989	379	1,066	60	B
Port Burwell	450	283	1	11,779	65	76	3	60c.
Port Colborne and Humberstone	8,975	2,132	4	101,552	302	3,298	5	O (M.B. $1.00)
Port Dover	1,640	649	....	42,947	.....	109	1	60c.
Port Rowan	690	235	....	12,348	.....	.....	1	60c.
Preston	6,415	1,094	1	62,075	46	13,609	151	G
Ridgetown	1,955	634	5	54,342	1,579	1,739	28	C
Ridgeway	1,100	216	....	11,112	.....	.....	1	F
Rodney	722	248	1	16,497	85	299	40	B (M.B. 50c.)
St. Anns	120	25	....	756	.....	.....	7	85c.
St. Catharines	26,834	6,045	1	259,696	463	83,452	35	70c.
St. George	510	144	....	5,283	.....	.....	148	80c.
St. Thomas	16,210	3,041	2	149,371	557	.....	75	K
St. Williams	410	111	....	5,248	.....	941	1	60c. (M.B. 50c.)
Sarnia	18,955	5,044	4	297,912	1,473	36,110	55	B
Selkirk	200	132	2	9,401	156	.....	1	60c.
Shedden	235	98	....	6,163	.....	666	63	B (M.B. 50c.)
Simcoe	5,826	2,023	2	183,953	827	13,538	20	60c.
Smithville	570	184	....	7,047	.....	.....	6	75c.
Sombra and Port Lambton	420	138	....	9,776	.....	79	45	B
Springfield	420	102	....	8,779	.....	1,260	5	T
Stevensville	420	38	....	1,681	.....	.....	1	F
Straffordville	255	98	....	8,101	.....	1,074	6	60c. (M.B. 50c.)
Thamesville	814	250	1	21,959	99	2,899	13	J
Thorold	4,905	1,108	....	41,178	.....	1,787	35	70c.
Tilbury	1,900	571	2	46,959	647	623	14	C
Tillsonburg	3,830	1,276	1	95,894	498	135,337	16	63c.
Vienna	225	137	1	6,328	77	16	1	60c. (M.B. 50c.)
Vittoria	205	141	....	4,844	.....	.....	3	60c.
Wallaceburg	4,535	1,284	2	110,975	265	405,604	19	C
Wallacetown	175	53	1	3,271	2	589	60	B
Waterdown	900	41	....	1,648	.....	.....	45	I
Waterford	1,250	229	....	14,418	.....	91	30	P (M.B. $1.00)
Welland	10,925	3,215	7	84,608	1,091	5,256	3	F
West Lorne	745	188	1	10,557	150	400	49	B (M.B. 50c.)
Wheatley	745	229	1	17,306	30	397	12	60c. (M.B. 60c.)
Windsor (Border Cities)	114,390	20,432	6	1,315,404	9,498	308,372	45	K
Woodstock	11,380	2,487	3	123,272	248	6,692	110	G
Wyoming	528	145	....	8,826	.....	570	65	A
Total	.....	119,344	112	7,381,252	32,180	1,990,650	.....	.....

TABLE IV—GAS CONSUMPTION IN TOWNSHIPS, 1938

County and township	Population	No. of consumers		Quantity consumed			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
				M cu. ft.	M cu. ft.	M cu. ft.	
ESSEX:							
Gosfield North	2,164	117	.....	6,896	.....	.....	60c.
Gosfield South	2,311	384	1	31,407	349	53,784	60c.
Maidstone	2,976	72	7	5,183	1,351	772	B
Mersea	4,929	341	4	30,617	622	15,020	60c.
Rochester	2,260	196	7	14,131	1,239	2,870	B
Sandwich East	5,376	12	1	880	200	.....	B
Sandwich South	2,066	110	5	7,906	960	809	B
Tilbury North	1,920	36	1	1,706	149	3,731	C
Tilbury West	1,554	28	1	1,933	96	.....	C
LAMBTON:							
Brooke	2,217	22	.....	533	.....	.....	A
Dawn	2,160	101	4	6,222	667	1,701	D
Enniskillen	2,725	107	.....	5,091	.....	393	B
Euphemia	2,692	8	.....	271	.....	.....	J
Moore	2,873	322	1	18,459	311	2,565	B
Plympton	2,681	5	.....	425	.....	.....	A
Sarnia	3,156	.....	4	.....	800	.....	B
Sombra	2,746	65	.....	3,416	.....	1,012	B
KENT:							
Camden	2,152	15	.....	762	.....	.....	C
Chatham	5,832	82	.....	4,541	.....	1,444	C
Dover	3,906	406	1	33,805	125	4,169	D
Harwich	5,010	436	9	32,868	3,037	311	C
Howard	2,813	153	2	11,932	700	.....	C
Orford	1,718	23	2	2,280	260	.....	C
Raleigh	4,230	615	24	50,727	6,662	1,360	D
Romney	1,456	77	41	5,484	13,114	364	D
Tilbury East	3,406	251	70	18,395	21,398	3,210	D
Zone	859	22	.....	979	.....	115	A
ELGIN:							
Aldborough	2,708	18	1	1,018	376	.....	B
Bayham	3,265	54	16	4,052	2,404	2,574	60c.
Dunwich	2,357	58	1	2,922	60	49	B
Malahide	2,714	56	.....	2,612	.....	35,891	70c.
Southwold	2,397	112	1	7,483	48	386	B
Yarmouth	5,030	87	.....	3,114	.....	.....	A (M.B.[1] 85c.)
MIDDLESEX:							
Caradoc	3,026	9	.....	598	.....	.....	K
Delaware	1,180	2	.....	290	.....	.....	K
Ekfrid	1,971	12	.....	560	.....	.....	K
Lobo	.....	2	.....	17	.....	2,340	K
North Dorchester	2,932	21	.....	1,176	.....	.....	E
Westminster	6,730	72	.....	6,277	.....	.....	K
NORFOLK:							
Charlotteville	2,978	12	5	965	806	1,413	60c.
Middleton	2,493	75	2	4,991	357	.....	60c.
North Walsingham	2,118	8	1	784	184	.....	60c.
South Walsingham	1,711	20	4	2,046	469	.....	60c.
Townsend	2,968	31	.....	2,945	.....	.....	60c.
Windham	3,618	3	3	329	489	.....	60c.
Woodhouse	2,308	186	10	15,750	1,376	960	60c.
BRANT:							
Brantford	7,336	51	.....	2,622	.....	.....	G
Burford	3,697	7	.....	431	.....	.....	G
Onondaga	964	33	9	2,076	884	.....	70c.
South Dumfries	2,523	3	.....	125	.....	.....	80c. (M.B. 50c.)
Tuscarora	2,654	15	.....	797	.....	.....	25c.

[1]M.B.—Minimum monthly bill.

TABLE IV—GAS CONSUMPTION IN TOWNSHIPS, 1938—*Continued*

County and township	Population	No. of consumers		Quantity consumed			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
				M cu. ft.	M cu. ft.	M cu. ft.	
OXFORD:							
East Oxford	1,957	16	.....	992	.....	.....	80c. (M.B. 50c.)
West Oxford	1,796	57	.....	2,494	.....	.....	G
HALDIMAND:							
Canborough	840	83	30	4,107	5,289	841	60c.
Dunn	805	129	6	6,192	667	.....	60c.
Moulton	1,590	162	16	5,836	2,570	13	60c.
North Cayuga	1,282	49	14	2,668	2,103	.....	60c.
Oneida	1,301	102	12	6,004	2,047	.....	60c.
Rainham	1,608	200	24	9,618	4,312	1,007	60c.
Seneca	1,590	140	33	7,675	5,303	.....	60c.
Sherbrooke	350	28	3	1,887	655	.....	60c.
South Cayuga	580	55	14	1,818	1,898	.....	60c.
Walpole	3,145	336	55	17,190	7,993	554	60c.
LINCOLN:							
Caistor	1,260	81	24	3,301	3,323	295	60c.
Gainsborough	2,090	18	2	412	98	.....	60c.
Grantham	5,010	15	.....	767	.....	.....	75c.
Louth	2,905	13	.....	675	.....	.....	75c.
WELLAND:							
Bertie	4,175	156	59	8,223	9,011	.....	F
Crowland	5,082	55	16	2,241	1,300	.....	F
Humberstone	2,370	265	30	11,602	4,251	.....	F
Pelham	2,690	78	2	4,040	271	.....	L
Stamford	8,020	93	4	4,171	542	.....	F
Wainfleet	2,720	326	19	6,814	3,056	105	60c.
Willoughby	905	27	26	1,339	3,703	.....	F
WENTWORTH:							
Ancaster	3,603	82	.....	6,041	.....	.....	70c. (M.B. $1.00)
Barton	1,840	109	.....	8,317	.....	.....	60c.
Binbrook	1,080	99	19	5,825	3,169	495	60c.
East Flamborough	3,705	70	.....	4,550	.....	.....	S
Glanford	1,265	143	2	9,824	709	453	60c.
Saltfleet	4,837	504	.....	22,460	.....	.....	M (M.B. 75c.)
WATERLOO:							
North Dumfries	2,361	68	.....	2,740	.....	.....	80c. (M.B. 50c.)
Waterloo	7,591	5	.....	316	.....	.....	G
Total	.....	8,517	648	530,968	121,763	141,006	.....

SUMMARY

	M cu. ft.
Total distribution to customers	10,197,819
Used by companies for all purposes	56,756
Used by private well-owners	74,000
Leakage in transmission lines	228,004
Leakage in distribution plants	249,438
Leakage in rural lines	14,701
Field operations: leakage in gathering and transmission lines to measuring stations (estimated)	257,895
Total amount of gas distributed	11,078,613

Gas Wells and Their Production

In Table V will be found full details of the natural gas fields of Ontario. Similar tables have been published since 1921. The development and decline of the natural gas fields can be followed by comparing these annual statements.

TABLE V—GAS WELLS AND THEIR PRODUCTION, 1938

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	28						160	2,103	$286.50
	Malden			1					2,039	
	Mersea	5			1	50		310	50	
Kent	Chatham	8					5,063,515	771		
	Raleigh (Declute)	33	1	2	6	18,857		497		
	Raleigh	25		2	6	5,058		190	1,828,564	
	Romney	139	5		5	3,584		190		
	Tilbury East	145	8	1	1	114		190		
	Orford			1						
	Dover	23	1		1	900	509,677	570	11,080	241,556.77
Lambton	Dawn	29		3			1,885,003	523	45,318	
	Enniskillen	6					8,927	220		
	Euphemia			2						
	Sarnia	13					800	35		
Middlesex	Delaware			1					15,870	
	London								19,008	
	Mosa	3						730		
	West Nissouri			2						
Perth	Blanshard			1						
Oxford	East Nissouri			1						
	Dereham (Brownsville)	59		1	14	51,642	506,005	410	23,435	7,075.68
Elgin	Bayham[1] (Brownsville)	18		2	10	27,348	50,917	410	775	1,492.55
	Bayham	54		1	3	502	113,651	200	1,770	2,471.00
	Dunwich			2					12,700	
	Malahide	1		3				220	33,112	
	South Dorchester			2					11,174	
	Southwold			1					30,538	
	Yarmouth			1						
Brant	Onondaga	42	7		5	31	135,348	78	45,495	4,056.00
	Tuscarora	78	2		2	25		95		

Norfolk	Charlotteville	13	2	.....	.....	.....	437,867	218	270,884	101,034.80	
	Houghton	4	.....	.....	.....	.....		455			
	Middleton	55	.....	.....	.....	.....		210			
	North Walsingham	9	.....	.....	.....	.....		237			
	South Walsingham	17	.....	.....	.....	.....		364			
	Townsend	2	.....	.....	.....	.....		250			
	Windham	10	.....	.....	.....	.....		209			
	Woodhouse	72	.....	1	4	566		222			
Haldimand	Canborough	173	10	.....	.....	.....	1,912,882	90			
	Dunn	49	2	1	.....	.....		196			
	Moulton	120	2	.....	.....	.....		129			
	North Cayuga	200	7	1	1	20		184			
	Oneida	67	8	.....	.....	.....		124			
	Rainham	312	4	9	19	1,195		222			
	Seneca	169	9	.....	.....	.....		88			
	Sherbrooke	16	.....	.....	.....	.....		126			
	South Cayuga	57	1	.....	.....	.....		133			
	Walpole	434	7	6	13	735		242			
Wentworth	Ancaster	.....	1	.....	.....	.....		.....			
	Binbrook	51	1	.....	.....	.....		69			
	Glanford	12	.....	.....	.....	.....		56			
Lincoln	Caistor	63	3	.....	4	90		82			
	Gainsborough	15	.....	.....	2	45		79			
Welland	Bertie	108	3	1	9	452	253,085	93			
	Crowland	26	.....	.....	.....	.....		100			
	Humberstone	56	.....	.....	.....	.....		61			
	Wainfleet	32	2	1	3	65		52			
	Willoughby	45	.....	3	3	48		170			
Bruce	Amabel	1	6	.....	.....	.....	1,129	100	.....	.....	
Grey	Keppel	.....	1	.....	.....	.....	.....	.....	.....	.....	
Prince Edward	South Marysburgh	1	.....	.....	.....	.....	.....	20	.....	.....	
	Hallowell	6	.....	.....	2	75	.....	65	.....	.....	
Surface wells	Harwich, Howard	69	.....	.....	.....	.....	[2]14,000	.....	.....	.....	
Private wells	.....	[3]300	.....	.....	.....	.....	[4]60,000	.....	.....	.....	
Total	.....	3,273	93	53	114	111,402	10,952,806	.....	2,353,915	$357,973.30	

[1]That part of Bayham that with Dereham township forms the Brownsville field.
[2]This gas is not metered, and therefore must be estimated.
[3]Principally in Haldimand, Norfolk, and Welland counties.
[4]Estimated.

Drilling continued in the Declute field with average success. The wells drilled in Raleigh township are in the extension of the Dover township gas and oil field, which now reaches across the Thames river into Raleigh township for about one mile, and the limits have not yet been reached. These wells are about 3,000 feet deep, and most of them produce both gas and oil. No drilling was done in Chatham township in 1938, where 8 producing wells are now closed in until further exploratory work is done. Drilling in the Dawn field in Lambton county has been most discouraging in 1937 and 1938; no producing wells have been found. Drilling in Middlesex to test the producing horizons of the Guelph and Clinton has met with no success, nor has a deep test well to the Trenton limestone in Blanshard township, Perth county. In the Brownsville field drilling continued throughout the year. There were at the end of the year 77 producing wells. Nine dry holes were drilled in Elgin county, in search of gas in the Guelph, which is the producing horizon of the Brownsville field. There was little drilling in Norfolk county. Drilling in Haldimand county has fallen off greatly; 50 wells were drilled in 1938 as compared with 67 wells in 1937. In previous years most of this drilling was in Walpole township, but in the past year Rainham township received the most attention. In Lincoln, Welland, and Brant counties a few wells are drilled each year. These fields are very old, and the rock pressure has declined to a minimum. Drilling in Bruce and Grey counties did not prove profitable, and the few producers drilled in 1936 with one exception have been abandoned. Two more producing wells have been drilled in the vicinity of Picton in Prince Edward county.

Although drilling activity as represented by totals was not as active in 1938 as in 1937, the year saw considerable exploratory work, which in 1939 is rapidly developing a new gas field in Malahide township. A new territory in the northern part of Huron county is claiming the attention of prospectors, who believe that a promising structure has been located. This structure was indicated in a map by M. Y. Williams published by the Geological Survey of Canada in Memoir 111, "The Silurian Geology and Faunas of Ontario Peninsula and Manitoulin and Adjacent Islands." Further work by independent geologists has been done since the work mentioned was published in 1919.

In 1938, 53 dry wells with a footage of 63,885 and 118 producing wells with a footage of 114,801 were drilled, a total of 171 wells and 178,686 feet.

The number of drilling rigs working was 63, and the number of men employed, 148. The wages paid them was $95,149. The capital invested in drilling equipment amounted to $327,716. These statistics are included in those in Table II.

Changes, Improvements, and Additions

In the past year distributing companies have spent a very considerable sum in improvements to service as evidenced by the addition to capital in Table II.

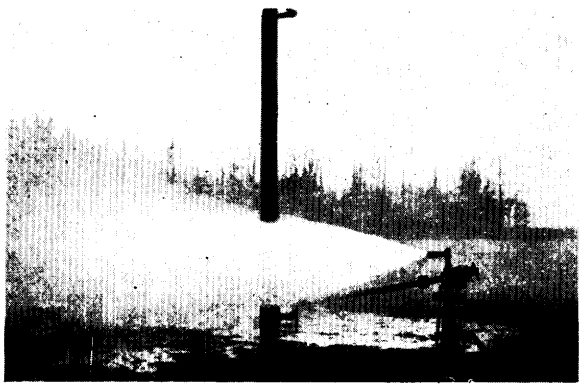
A distributing system was installed in Brownsville by the Oxford Pipe Line Company and in Glencoe by the Union Gas Company, giving these municipalities natural gas for the first time.

A compressor station was built by the Dominion Natural Gas Company at Rainham, in the central part of Haldimand county, in order to improve service to the Port Colborne and St. Catharines areas. Some remote wells in Sherbrooke township were also connected into the Port Colborne pipe line, and some larger-sized pipe lines were added in St. Catharines. In St. Thomas a considerable amount of new intermediate pressure line was laid, and two new regulator stations were installed. This became necessary through the increase in the demand for gas.

The Dominion Natural Gas Company sold its wells and lines in and around the villages of Vienna, Port Burwell, and Straffordville to the Central Pipe Line Company. The Dominion Natural Gas Company report seven leakage surveys, renewals, and repairs throughout their pipe-line system.

The Union Gas Company report having laid 19 miles of high-pressure transmission pipe line from 3-inch to 10-inch to replace old pipe, which was mostly of smaller sizes. This includes renovating and various alterations to improve service to municipalities. Five miles of new distributing lines were laid to replace old pipe in Windsor, Wallaceburg, Petrolia, Sarnia, Dresden, and Tilbury.

The Provincial Gas Company report having replaced one mile of 8-inch pipe and 1½ miles of smaller sizes.



Blowing the siphon at the well on lot 24, concession XII, Dereham township. The siphon is blown for four minutes once every hour to keep the well clear of water.

The Central Pipe Line Company extended their operations in the Brownsville field. Originally they had two wells supplying gas through a 3-inch pipe line to Aylmer, with a purification plant at Springfield; they have now drilled producing wells in the adjoining lots in Bayham township and are delivering gas through an 8-inch pipe line to the Dominion Natural Gas Company's transmission line near the village of Eden. This company has built another purification plant near Corinth.

Leakage

Mention was made in the report for 1937 of the advances made in detecting leaks in buried pipes and the steps taken by gas companies to curtail leakage. Satisfactory progress is now being made by all gas companies in curtailing this waste of gas. There are, however, a few places where the leakage is too high and more work is necessary, i.e. Delhi, Highgate, Leamington, and Port Dover.

The leakage in transmission lines is about 3½ per cent

TABLE VI—LEAKAGE IN DISTRIBUTION PLANTS, 1938

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.	
Alvinston	Union Gas Co	6.10	12,837	12,553	284	1,220	209	1,360	5
Belmont	Ontario Salt Co	6	4,878	3,473	1,405	1,200	119	11,806	5
Blenheim	Union Gas Co	13.03	58,482	56,788	1,694	2,606	619	2,737	5
Brantford	Dominion Natural Gas Co	94.25	315,602	310,408	5,194	18,850	5,543	937	4
Brigden	Union Gas Co	3.89	10,837	10,476	361	778	145	2,489	5
Burlington	Dominion Natural Gas Co	36.59	44,200	39,190	5,010	7,318	494	10,142	4
Cainsville	Dominion Natural Gas Co	5.57	10,172	9,752	420	1,114	102	4,117	4
Chatham	Union Gas Co	81.84	441,248	440,454	794	16,368	4,352	182	5
Corunna	Union Gas Co	5.37	10,154	9,492	662	1,074	254	2,606	6
Courtright	Union Gas Co	4.33	7,639	6,836	803	866	115	6,983	5
Delhi	Dominion Natural Gas Co	5.98	48,134	40,939	7,195	1,196	497	14,466	4
Dorchester	Southern Ontario Gas Co	2.86	8,420	7,790	630	572	120	5,250	4
Dresden	Union Gas Co	12.36	44,479	43,312	1,167	2,472	524	2,227	6
Dundas	Dominion Natural Gas Co	12.68	66,089	60,934	5,155	2,536	1,290	3,996	4
Dunnville	Dominion Natural Gas Co	13.87	96,036	90,370	5,666	2,774	1,074	5,275	4
Dutton	Southern Ontario Gas Co	8.16	24,016	22,313	1,703	1,632	256	6,652	4
Eden	Dominion Natural Gas Co	.48	2,176	2,053	123	96	32	3,844	4
Fenwick	Dominion Natural Gas Co	1.51	6,422	5,347	1,075	302	132	8,144	4
Fonthill	Fonthill Gas Co	5.33	9,090	7,274	1,816	1,066	255	7,121	5
Hagersville	Dominion Natural Gas Co	7.38	31,714	30,291	1,423	1,476	428	3,325	4
Hamilton	Dominion Natural Gas Co	117.29	947,877	928,620	19,257	23,458	8,951	2,151	4
Highgate	Southern Ontario Gas Co	2	10,185	8,378	1,807	400	111	16,279	4
Ingersoll	Dominion Natural Gas Co	20.82	62,223	61,898	325	4,164	1,172	277	4
Inwood	Union Gas Co	2.10	5,199	5,124	75	421	74	1,013	5
Kingsville	Southern Ontario Gas Co	13.49	65,150	59,948	5,202	2,698	638	8,153	4
Lambeth	Southern Ontario Gas Co	3.84	14,879	14,546	333	768	157	2,121	4
Leamington	Leamington Corporation	25.47	180,509	163,454	17,055	5,094	1,660	10,274	8
London	City Gas Co	257.49	1,672,950	1,641,781	31,169	51,498	16,755	1,860	6
Merlin	Union Gas Co	2.67	18,265	18,154	111	533	158	703	4
Merritton	Dominion Natural Gas Co	4.52	12,825	11,126	1,699	904	530	3,206	4
Mount Hamilton	Dominion Natural Gas Co	22.91	56,081	52,855	3,226	4,582	1,295	2,491	4
North Pelham	Dominion Natural Gas Co	.72	345	276	69	144	6	11,500	4
Paris	Dominion Natural Gas Co	14.92	50,789	48,343	2,446	2,984	973	2,514	4
Petrolia	Union Gas Co	16.70	69,301	66,434	2,867	3,340	775	3,699	6
Port Burwell	Dominion Natural Gas Co	3.84	5,485	5,159	326	768	139	2,345	4
Port Colborne	Dominion Natural Gas Co	30.40	115,125	110,532	4,593	6,080	2,136	2,319	4

Port Dover	Dominion Natural Gas Co.	7.94	47,595	41,760	5,835	1,588	649	8,991	4
Port Lambton	Union Gas Co	2.03	4,415	4,008	407	406	73	5,575	5
Ridgetown	Union Gas Co	17.86	60,008	58,142	1,866	3,572	639	2,920	5
Rodney	Southern Ontario Gas Co.	5.39	18,123	16,796	1,327	1,078	249	5,329	4
St. Catharines	Dominion Natural Gas Co.	68.80	438,729	418,717	20,012	13,760	6,046	3,310	4
St. Thomas	Dominion Natural Gas Co.	55.85	174,894	153,038	21,856	11,170	3,043	7,182	4
Sarnia	Union Gas Co	90.19	342,177	325,091	17,086	18,039	5,048	3,384	5
Shedden-Fingal	Southern Ontario Gas Co.	6.11	10,078	9,133	945	1,222	136	6,948	4
Sombra	Union Gas Co	2.62	6,429	5,847	582	524	81	7,185	5
South London	Southern Ontario Gas Co.	8.87	36,690	34,719	1,971	1,774	287	6,867	4
Straffordville	Dominion Natural Gas Co.	1.39	6,362	6,311	51	278	101	505	4
Thamesville	Union Gas Co	6.82	25,265	24,958	307	1,363	251	1,223	5
Thorold	Dominion Natural Gas Co.	13.19	50,791	46,542	4,249	2,638	1,108	3,835	4
Tilbury	Union Gas Co	9.27	49,409	48,230	1,179	1,854	573	2,057	5
Tillsonburg	Dominion Natural Gas Co.	23.49	101,468	98,554	2,914	4,698	1,277	2,282	4
Vienna	Dominion Natural Gas Co.	1.04	1,505	899	606	208	78	7,769	4
Wallaceburg	Union Gas Co	23.83	114,740	112,347	2,393	4,766	1,286	1,861	5
West Hamilton	Southern Ontario Gas Co.	3.81	10,818	9,759	1,059	762	278	3,809	4
West Lorne	Southern Ontario Gas Co.	3.89	12,959	10,957	2,002	778	189	10,593	4
Wheatley	Southern Ontario Gas Co.	3.46	18,790	17,733	1,057	692	230	4,596	4
Woodburn	Dominion Natural Gas Co.	2.03	1,718	1,063	655	406	47	13,936	4
Woodstock	Dominion Natural Gas Co.	48.45	133,924	130,207	3,717	9,690	2,490	1,493	4
Windsor (Border Cities)	Union Gas Co	503.91	1,657,218	1,633,430	23,788	100,783	20,438	1,164	4
Wyoming	Union Gas Co	5.10	9,830	9,396	434	1,019	145	2,993	5
Total		1,782.10	7,873,748	7,624,310	249,438	356,420	96,832		

TABLE VII—LEAKAGE IN TRANSMISSION LINES, 1938

Transmission lines	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.
Gas field to Sarnia and Petrolia	6-, 8-, 10-, 12-inch	383.52	1,639,815	1,609,820	29,995	40–80
Glenwood to Hamilton	8-, 10-, 12-inch	710.05	2,180,011	2,068,837	111,174	40–90
Glenwood to Leamington	6-, 8-inch	54.65	436,324	413,902	22,422	30–80
Gas field to Windsor	8-, 10-, 12-, 18-inch	356.81	1,822,666	1,815,542	7,124	30–80
Gas field to Ridgetown	6-, 8-inch	81.6	221,268	194,460	26,808	25–80
Gas field to Bothwell	4-, 6-inch	32.04	47,357	46,637	720	30–50
Gas field to Hamilton	8-inch	58.32	166,533	153,284	13,249	30–50
Dunnville to St. Catharines	8-inch	57.01	476,278	459,766	16,512	60
Total		1,734	6,990,252	6,762,248	228,004	

TABLE VIII—LEAKAGE ON RURAL LINES, 1938

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	5,196	2,198	2,085	113	197	40	2,825	5	3
Dawn	13,581	4,565	4,403	162	515	54	3,000	9	.....
Dover	89,267	28,919	26,537	2,382	3,381	310	7,683	5	9
Enniskillen	10,173	2,001	1,716	285	386	39	7,307	5	.....
Harwich	93,569	27,948	24.954	2,994	3,545	441	6,789	5	5
Howard	18,905	6,378	6,234	144	715	90	1,600	6	4
Moore	11,214	2,279	2,145	134	424	32	4,187	6	.....
Raleigh	144,881	39,640	36,292	3,348	5,488	426	7,859	5	6
Raleigh (Blake system)	32,314	5,899	3,701	2,198	1,224	81	27,136	4	.....
Rochester	33,759	16,570	15,310	1,260	1,279	161	7,826	5	16
Sandwich South	15,101	6,688	6,309	379	572	64	5,921	5	6
Sombra	2,052	592	578	14	78	11	1,272	6	.....
Tilbury East	53,558	25,815	24,527	1,288	2,028	184	7,000	5	7
Total	523,570	169,492	154,791	14,701	19,832	1,933	.....	.....	.....

Licenses Issued in 1938

The Natural Gas Conservation Act, R.S.O., 1937, The Well Drillers' Act, R.S.O., 1937, 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 1938. The licenses required under the above Acts and the cost of each 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, 1938

License No.	Name	Address
1055	Adams, L. W.	Toronto, Ont.
1021	Ajax Oil and Gas Co., Ltd.	Toronto, Ont.
1096	Alley, W. N.	Royal Oak, Mich.
1031	Beattie, James A.	Glencoe, Ont.
1070	Beattie, John	Glencoe, Ont.
1013	Begin, K.	Chatham, Ont.
1097	Blackwell, Roland R.	Petrolia, Ont.
1099	Bond, R. N.	Toronto, Ont.
1091	Bryson, George	Petrolia, Ont.
1056	Burchell, F. W.	Brussels, Ont.
1015	Canadian Penn Grade Producers, Ltd.	Buffalo, N.Y.
1086	Carson, Sam	St. Thomas, Ont.
1044	Coates, Wm. A.	Springfield, Ont.
1009	Coste, L. A.	Chatham, Ont.
1085	Crummer, Keith	Chatham, Ont.
1083	Daly, C. F.	Tupperville, Ont.
1100	Demaray, Clarence	Kerwood, Ont.
1065	Denniss, F. H.	Belmont, Ont.
1106	De Vine, James B.	Kenmore, N.Y.
1221	Domestic Gas and Oil Co., Ltd.	Toronto, Ont.
1061	Dominion Petroleum Co., Ltd.	Glencoe, Ont.
1081	Eby and Fretz	Stevensville, Ont.
1098	Ferguson, Dr. F. C.	London, Ont.
1016	Fitzpatrick, P. H.	Detroit, Mich.
1073	Forrest, William L.	Goderich, Ont.
1082	Gibson, Albert	Petrolia, Ont.
1072	Gillis, Arthur	Selkirk, Ont.
1077	Gregory, F. Ross	Petrolia, Ont.
1027	Grey, Ira	Merlin, Ont.
1041	Haldimand Natural Gas Syndicate	Stevensville, Ont.
1090	Hambly, Frank R.	Strathroy, Ont.
1028	Hanley and Bird	Bradford, Pa.
1060	Heal, A. A.	Corunna, Ont.
1059	High Grade Natural Gas Co., Ltd.	Chatham, Ont.
1067	Holmes, A. B.	Toronto, Ont.
1034	Hoover, A. E.	Selkirk, Ont.
1084	Houk, Bartlett, Fry and Ross	Dunnville, Ont.
1026	Howard, W. C.	Leamington, Ont.
1043	House, Charles C.	Stevensville, Ont.
1053	Hughes, William C.	Detroit, Mich.
1023	Jasperson, Bon.	Kingsville, Ont.
1076	Julian, S. M.	London, Ont.
1038	Kelly Gas and Oil Syndicate, The	Toronto, Ont.
1025	Kiff, William R.	Leamington, Ont.
1101	L'Heureux, Morris	Chatham, Ont.
1103	Lett, Howard J.	Watford, Ont.
1020	Lincoln Gas Co., Ltd.	Toronto, Ont.

TABLE IX—OPERATORS LICENSED TO LEASE AND PROSPECT FOR NATURAL GAS, 1938—*Continued*

License No.	Name	Address
1017	Lymburner Bros. and Webber	Dunnville, Ont.
1030	McGill, Jos.	Bothwell, Ont.
1074	MacIntosh, F. R.	Petrolia, Ont.
1093	McIntyre, M. J.	Belton, Ont.
1094	McKercher, Arthur E.	Watford, Ont.
1047	McKillop, Wm.	Hepworth, Ont.
1033	Mahaffey, A. H.	Toronto, Ont.
1058	Medina Natural Gas Co., Ltd.	Chatham, Ont.
1035	Morris, Geo. F.	Merlin, Ont.
1068	Mytinger, L. P.	Fenton, Mich.
1012	Neath, Charles	Chatham, Ont.
1089	Nicholls, W. J.	Strathroy, Ont.
1040	Nottawa Oil and Gas Co., Ltd.	Toronto, Ont.
1018	Osborne, Eric	Toronto, Ont.
1048	Rawlings, Geo. H.	Chatham, Ont.
1022	Reicheld, F. W.	Jarvis, Ont.
1051	Reichheld, O. E.	Fisherville, Ont.
1057	Rockton Oil and Gas Co., Ltd.	Dundas, Ont.
1052	Rodgers, Alex	Tillsonburg, Ont.
1039	Roth, Elmer A.	Chatham, Ont.
1010	Sadlier, L.	Chatham, Ont.
1080	Schier, Frank	Stevensville, Ont.
1011	Scullard, Fred B.	Chatham, Ont.
1064	Serles, Harvey	Vanessa, Ont.
1034	Smith, Luke	Chatham, Ont.
1029	Sprague, L. E.	London, Ont.
1075	Staysa, H. C.	Buffalo, N.Y.
1069	Stevens, Wm.	Chatham, Ont.
1050	Stewart, Elgin	Jarvis, Ont.
1066	Thompson, Jack	Chatham, Ont.
1063	Toll, Leonard	Blenheim, Ont.
1032	Topp, Nathan E.	Cayuga, Ont.
1087	Treleaven, A.	London, Ont.
1062	Trewartha, Howard C.	Clinton, Ont.
1092	Van Antwerp, William L.	Port Huron, Mich.
1045	Von Berg, John	Detroit, Mich.
1036	Walter, H. A.	Buffalo, N.Y.
1054	W. C. Patterson Gas Co., Ltd.	Jamestown, N.Y.
1042	Welland County Gas Syndicate	Stevensville, Ont.
1079	Western Ontario Natural Gas Co., Ltd.	Toronto, Ont.
1105	Willis, Samuel	Ingersoll, Ont.
1014	Willits, D. E.	Chatham, Ont.
1108	Willits, G. E.	Bothwell, Ont.
1071	Wilson, Bert	Sarnia, Ont.
1019	Wilson, Elgin	Toronto, Ont.
1102	Winnett, J. W. G.	London, Ont.
1046	Wood, D. Ray	Detroit, Mich.
1024	Woodhouse, Henry	Toronto, Ont.
1104	Wyant, Verne T.	Ingersoll, Ont.

TABLE X—OPERATORS LICENSED TO DRILL OR BORE FOR NATURAL GAS, 1938

License No.	Name	Address
909	Ajax Oil and Gas Co., Ltd.	Toronto, Ont.
904	Allen, A. J.	Dunnville, Ont.
860	Culver Estate, W. H.	Dunnville, Ont.
861	Culver Estate, W. H.	Dunnville, Ont.

TABLE X—OPERATORS LICENSED TO DRILL OR BORE FOR NATURAL GAS, 1938—*Continued*

License No.	Name	Address
913	Davidson, F. L.	Wingham, Ont.
906	Demaray, C.	Kerwood, Ont.
897	Dominion Petroleum Co., Ltd.	Petrolia, Ont.
912	Donald, George	Oil Springs, Ont.
914	Duncan, J. F.	Petrolia, Ont.
869	Evans, Harry L.	Brownsville, Ont.
870	Evans, Harry L.	Brownsville, Ont.
893	Glenney and Hussey	Dunnville, Ont.
903	Goit, Lorne R.	Dunnville, Ont.
881	Gregory, Geo. F., and Son	Petrolia, Ont.
911	Gregory, Geo. F., and Son	Petrolia, Ont.
921	Hall, Frank	Petrolia, Ont.
924	Hawkins, E. J.	Stevensville, Ont.
896	Heal, A. A.	Corunna, Ont.
915	Heal, A. A.	Corunna, Ont.
892	High Grade Natural Gas Co., Ltd.	Chatham, Ont.
866	Holmes, E. B.	Bothwell, Ont.
864	Hoover, A. E.	Selkirk, Ont.
865	Hoover, A. E.	Selkirk, Ont.
905	Hoover, A. E.	Selkirk, Ont.
898	House, Charles C.	Stevensville, Ont.
916	Howlett, Fred W., and Sons	Petrolia, Ont.
894	Hussey, W. J.	Petrolia, Ont.
895	Hussey, W. J.	Petrolia, Ont.
852	Jasperson, Bon.	Kingsville, Ont.
854	Jackson, Percy L.	Dunnville, Ont.
855	Jackson, Percy L.	Dunnville, Ont.
856	Jackson, Percy L.	Dunnville, Ont.
857	Jackson, Percy L.	Dunnville, Ont.
858	Jackson, Percy L.	Dunnville, Ont.
859	Jackson, Percy L.	Dunnville, Ont.
926	Johnson, A. B.	London, Ont.
920	Kells, E. E.	Petrolia, Ont.
925	Kerr, H.	Elora, Ont.
867	Kidd, L. W.	Toronto, Ont.
847	Kiser Bros.	Chatham, Ont.
848	Kiser Bros.	Chatham, Ont.
849	Kiser Bros.	Chatham, Ont.
850	Kiser Bros.	Chatham, Ont.
871	Lauer, D. G.	Tillsonburg, Ont.
872	Lauer, D. G.	Tillsonburg, Ont.
927	Lewis, James R.	Williamsville, Ont.
846	Lincoln Gas Co., Ltd.	Toronto, Ont.
845	Lymburner Bros. and Webber	Dunnville, Ont.
910	McBeth, Albert	Ingersoll, Ont.
876	McCutcheon, Thos. J.	Dunnville, Ont.
885	McKechnie, S.	Dunnville, Ont.
886	McKechnie, S.	Dunnville, Ont.
887	McKechnie, S.	Dunnville, Ont.
888	McKechnie, S.	Dunnville, Ont.
889	McKechnie, S.	Dunnville, Ont.
890	McKechnie, S.	Dunnville, Ont.
891	McKechnie, S.	Dunnville, Ont.
874	McKillop, Wm.	Hepworth, Ont.
862	McNinch, S. E.	Canborough, Ont.
902	Nagel, Elmer	Stevensville, Ont.
875	Nicholls, J.	Pelee Island, Ont.
883	Perkins, J. E.	Dunnville, Ont.
868	Prairie Gas and Oil Co., Ltd.	Toronto, Ont.
922	Raeburn, J. A.	Glencoe, Ont.
884	Rockton Oil and Gas Co., Ltd.	Dundas, Ont.
917	Rose, H.	Petrolia, Ont.
851	Roth, F. and H.	Fisherville, Ont.
853	Rowe, E. P.	Toronto, Ont.

TABLE X—OPERATORS LICENSED TO DRILL OR BORE FOR NATURAL GAS, 1938—*Continued*

License No.	Name	Address
908	Rowe, Ernest, Jr., and Rowe, Murray	Toronto, Ont.
919	Smith, C. A.	Brigden, Ont.
899	Smith, Harry B.	Windsor, Ont.
901	Smith, Luke	Chatham, Ont.
873	Smith and Ehde	Lowbanks, Ont.
882	Stewart, Elgin	Jarvis, Ont.
877	Stover and Rawlings	Chatham, Ont.
878	Stover and Rawlings	Chatham, Ont.
879	Stubble, H. H.	Chatham, Ont.
844	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
900	Von Berg, John	Detroit, Mich.
863	Walter Gas Syndicate, Ltd.	Buffalo, N.Y.
907	Western Ontario Natural Gas Co., Ltd.	Toronto, Ont.
928	Willits, G. E.	Bothwell, Ont.
929	Willits, G. E.	Bothwell, Ont.
930	Willits, G. E.	Bothwell, Ont.
923	Wilson, Bert	Sarnia, Ont.
880	Windover, Wm.	Sarnia, Ont.
918	Wright, Ernest	Petrolia, Ont.

TABLE XI—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1938

License No.	Name	Address
1045	Acme Gas and Oil Co., Ltd.	Toronto, Ont.
1215	Adams-Treumner Co.	London, Ont.
1027	Ajax Oil and Gas Co., Ltd.	Toronto, Ont.
1101	Aloka Oil Co., Ltd.	London, Ont.
1236	Amity Gas and Oil Co., Ltd.	Lowbanks, Ont.
1084	Barnhart, Mrs. E. L.	Stevensville, Ont.
1029	Broadway Gas Syndicate	Jarvis, Ont.
1068	Buck, C. S.	Port Rowan, Ont.
1050	Burchell Natural Gas and Oil Syndicate	Toronto, Ont.
1025	Canadian Natural Gas Syndicate	Simcoe, Ont.
1023	Canadian Penn Grade Producers, Ltd.	Goderich, Ont.
1094	Canfield Gas Syndicate	Detroit, Mich.
1062	Canfield Natural Gas Co., Ltd.	Canfield, Ont.
1073	Cartwright, Sydney E.	Detroit, Mich.
1105	Central Pipe Line Co., Ltd.	Chatham, Ont.
1111	Central Seneca Gas Syndicate	Cayuga, Ont.
1243	Colonial Natural Gas and Oil Co., Ltd.	Stoney Creek, Ont.
1087	Columbia Natural Gas and Oil Co., Ltd.	Hamilton, Ont.
1019	Comins, H. M.	Flint, Mich.
1120	Continental Gas Corp., Ltd.	Goderich, Ont.
1242	Coronation Gas Syndicate	Stevensville, Ont.
1040	Culver Estate, W. H.	Dunnville, Ont.
1109	Delhi Gas Syndicate	Cayuga, Ont.
1211	Domestic Natural Gas and Oil Co., Ltd.	Toronto, Ont.
1043	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
1095	Dunnville-Detroit Gas Syndicate	Detroit, Mich.
1213	Economy Natural Gas Syndicate	Stratford, Ont.
1070	Emerald Gas Syndicate	Toronto, Ont.
1241	Emerson, Harry L.	Dunnville, Ont.
1123	Empire Natural Gas, Ltd.	Toronto, Ont.
1064	Erie Gas, Ltd.	Toronto, Ont.
1117	Esmond Avery and Associates Syndicate	Detroit, Mich.
1128	Fisherville Gas Co.	Fisherville, Ont.
1066	Gas Producers Syndicate	Detroit, Mich.

TABLE XI—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1938—*Continued*

License No.	Name	Address
1104	Gifford, Arthur W.	Cayuga, Ont.
1108	Glenney, Daniel	Dunnville, Ont.
1063	Grand River Gas and Oil Syndicate	Fisherville, Ont.
1067	Grimsby Natural Gas Co., Ltd.	Grimsby, Ont.
1110	Haldimand Gas Syndicate	Cayuga, Ont.
1055	Haldimand Natural Gas Syndicate	Stevensville, Ont.
1115	Hartzell, Stone, Thurber, Hartzell and Avery, Minnicog Gas Co.	Detroit, Mich.
1125	Hiawatha Gas and Oil Co.	Hagersville, Ont.
1106	Highbank Oil, Ltd.	Chatham, Ont.
1216	Hill, A. W.	Coatsworth, Ont.
1048	Hope Gas Syndicate	St. Catharines, Ont.
1057	House, Charles C.	Stevensville, Ont.
1082	Ideal Gas Syndicate	Fisherville, Ont.
1038	Jackson, Percy L.	Dunnville, Ont.
1222	Jackson and Graff Syndicate	Dunnville, Ont.
1033	Jasperson, Bon	Kingsville, Ont.
1049	Kelly Gas and Oil Syndicate	Toronto, Ont.
1235	Kidd, L. W.	Toronto, Ont.
1071	Lincoln Gas Co., Ltd.	Toronto, Ont.
1047	Lindsay, Wm. Bethune, Estate	Edmonton, Alta.
1129	Lomac Gas and Oil Co., Ltd.	St. Thomas, Ont.
1024	Lymburner Bros. and Webber	Dunnville, Ont.
1075	Lynn Valley Gas and Oil, Ltd.	Waterloo, Ont.
1214	McKechnie, S.	Dunnville, Ont.
1089	McKechnie and Hussey	Dunnville, Ont.
1097	Melrose Gas and Oil Syndicate	Toronto, Ont.
1086	Middleton-Norfolk Gas Co., Ltd.	Stratford, Ont.
1234	Midfield Gas Corporation, Ltd.	Toronto, Ont.
1034	Midwal Oil and Gas Co., Ltd.	Toronto, Ont.
1072	Mohawk Gas and Oil Syndicate	Hamilton, Ont.
1059	Monarch Gas and Oil Syndicate	Fisherville, Ont.
1091	National Gas Syndicate	Dunnville, Ont.
1042	New Eden Natural Gas Co., Ltd.	Simcoe, Ont.
1044	New Tillsonburg Oil and Gas Co., Ltd.	Toronto, Ont.
1080	Niagara Natural Gas Co., Ltd.	Buffalo, N.Y.
1099	Niece, Elmond	Lowbanks, Ont.
1022	North Cayuga Gas Syndicate	Cayuga, Ont.
1026	North Shore Gas Co.	Selkirk, Ont.
1054	Nottawa Oil and Gas Co., Ltd.	Toronto, Ont.
1035	Petrol Oil and Gas Co., Ltd.	Toronto, Ont.
1240	Pine Ridge Gas Co., Ltd.	Port Stanley, Ont.
1238	Port Colborne–Welland Gas and Oil Co., Ltd.	Port Colborne, Ont.
1225	Prairie Gas and Oil Co., Ltd.	Toronto, Ont.
1051	Provincial Gas Co., Ltd.	Fort Erie North, Ont.
1112	Rainham Gas Syndicate	Cayuga, Ont.
1028	Reicheld, F. W.	Jarvis, Ont.
1041	Reid-Adams Development Co., Ltd.	London, Ont.
1036	Riley, J. V.	Simcoe, Ont.
1232	Romney Gas and Oil Co., Ltd.	Toronto, Ont.
1127	Rossmore Exploration, Ltd.	Toronto, Ont.
1032	Roth, F. and H.	Fisherville, Ont.
1227	Rowe, E. P.	Toronto, Ont.
1052	Salina Gas Co., Ltd.	Chatham, Ont.
1058	Sandusk Gas Syndicate	Fisherville, Ont.
1093	Sarnia Oil and Gas Co., Ltd.	Toronto, Ont.
1065	Smith and Ehde	Lowbanks, Ont.
1037	Southern Ontario Gas Co., Ltd.	Buffalo, N.Y.
1061	Standard Gas and Oil Syndicate	Fisherville, Ont.
1031	Sterling Gas Co., Ltd.	Guelph, Ont.
1039	Stevensville Natural Gas and Fuel Co.	Stevensville, Ont.
1090	Stewart, Elgin	Jarvis, Ont.
1218	Stover, F. H., and Associates	Chatham, Ont.
1221	Sunday Gas Wells	Dunnville, Ont.
1082	Superior Gas Syndicate	Fisherville, Ont.

TABLE XI—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1938—*Continued*

License No.	Name	Address
1060	Sweets Corners Gas Syndicate	Fisherville, Ont.
1085	Tanner, F. O.	Detroit, Mich.
1126	Treleaven, A.	London, Ont.
1018	Turkey Point Co., Ltd.	Simcoe, Ont.
1021	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
1030	Victoria Gas Co.	Dunnville, Ont.
1113	Walpole Gas Syndicate	Cayuga, Ont.
1046	Walter Gas Syndicate, Ltd.	Buffalo, N.Y.
1100	W. C. Patterson Gas Co., Ltd.	Jamestown, N.Y.
1056	Welland County Gas Syndicate	Stevensville, Ont.
1078	Western Ontario Natural Gas Co., Ltd.	Dunnville, Ont.

TABLE XII—OPERATORS LICENSED TO DISTRIBUTE NATURAL GAS, 1938

License No.	Name	Address
542	Central Pipe Line Co., Ltd.	Chatham, Ont.
524	City Gas Co. of London	London, Ont.
530	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
544	Fisherville Gas Co.	Fisherville, Ont.
543	Fonthill-Ridgeville Gas Co., Ltd.	Portland, Ind.
534	Grimsby Natural Gas Co., Ltd.	Grimsby, Ont.
536	Jasperson, Bon	Kingsville, Ont.
540	Leamington, Town of	Leamington, Ont.
528	Manufacturers Natural Gas Co., Ltd.	Buffalo, N.Y.
532	Nottawa Pipe Line Co., Ltd.	Toronto, Ont.
527	Oil Springs Oil and Gas Co., Ltd.	Oil Springs, Ont.
565	Port Colborne-Welland Gas and Oil Co., Ltd.	Port Colborne, Ont.
529	Southern Ontario Gas Co., Ltd.	Buffalo, N.Y.
522	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
525	United Gas and Fuel Co. of Hamilton, Ltd.	Hamilton, Ont.
538	Western Ontario Natural Gas Co., Ltd.	Dunnville, Ont.
523	Windsor Gas Co., Ltd.	Windsor, Ont.

TABLE XIII—OPERATORS LICENSED TO OPERATE PIPE LINES, 1938

License No.	Name	Address
106	Central Pipe Line Co., Ltd.	Chatham, Ont.
105	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
108	Oxford Pipe Line Co., Ltd.	Toronto, Ont.
107	Povec Gas and Oil Syndicate	Tillsonburg, Ont.
104	Southern Ontario Gas Co., Ltd.	Buffalo, N.Y.
103	Union Gas Co. of Canada, Ltd.	Chatham, Ont.

Logs of Wells

The logs of gas and oil wells drilled in 1938, as given by the drillers, will be found on the pages following. All information regarding water horizons and gas and oil horizons is given. At the request of companies doing exploratory drilling the open flow of gas wells is not given. Samples of drill cuttings from representative wells throughout the province are available to the public.

A total of 171 gas wells and 97 oil wells were drilled in 1938. The number of logs published is 268.

ABBREVIATIONS

Con	Concession.
E.½	East half.
N.½	North half.
N.E.¼	Northeast quarter.
N.E.½	Northeast half.
N.L.R.	North of Longwoods Road.
N.R.	Niagara River survey.
N.T.R.	North of Talbot Road.
N.W.	Northwest.
N.W.¼	Northwest quarter.
Pt.	Part.
R.R.	River Range.
S.	South.
S.½	South half.
S.¾	South three-quarters.
S.E.¼	Southeast quarter.
S.E.½	Southeast half.
S.L.R.	South of Longwoods Road.
S.T.R.	South of Talbot Road.
S.W.	Southwest.
S.W.¼	Southwest quarter.
S.W.½	Southwest half.
Tp.	Township.
W.¼	West quarter.
W.½	West half.
W.¾	West three-quarters.
W.F.C.	West of Fairchild creek.

Brant County

CANADIAN PENN GRADE PRODUCERS, LTD.

W. Brown No. 12, lot 6, con. II, W.F.C., Onondaga tp.
Completed April 13, 1938.
Producing gas well.
Rock pressure: 40 lbs.

Formation	Thickness, ft.
Surface	85
Gravel and sand	6
Shale	15
Niagara	258
Shale	45
Clinton	24
Red Medina	37
Blue shale	47
White Medina	7
Red shale	15
Total depth	539

Gas at 411 feet.
Fresh water at 94 feet; black water at 235 feet.

CANADIAN PENN GRADE PRODUCERS, LTD.

W. Brown No. 13, lot 6, con. II, W.F.C., Onondaga tp.
Completed May 14, 1938.
Producing gas and oil well.
Rock pressure: 130 lbs.

Formation	Thickness, ft.
Surface	48
Shale and brown lime	22
Niagara	252
Shale	48
Clinton	20
Red Medina	25
Shale	62
White Medina	7
Red shale	26
Total depth	510

Gas at 380 feet.
Oil at 484 feet.

JACKSON AND LITTLE

G. Ferhman No. 10, lot 17, con. III, Onondaga tp.
Completed August 27, 1938.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	95
Shale	8
Niagara	240
Shale	25
Rochester shale	24
Clinton	20
Red Medina	25
Blue shale	56
White Medina	10
Red shale	17
Total depth	520

Gas and oil at 502 feet.
Fresh water at 90 feet; black water at 225 feet.

JACKSON AND LITTLE

G. Ferhman No. 11, lot 17, con. III, Onondaga tp.
Completed November 21, 1938.
Producing gas well.
Rock pressure: 135 lbs.

Formation	Thickness, ft.
Surface	97
Niagara	243
Rochester shale	45
Clinton	20
Red Medina	28
Shale	55
White Medina	12
Red shale	25
Total depth	525

Gas at 388 feet.
Oil at 500 feet.
Fresh water at 96 feet.

NOTTAWA OIL AND GAS CO., LTD.

T. Hamilton No 3, lot 18, con. III, Onondaga tp.
Completed February 3, 1938.
Producing gas well.
Rock pressure: 130 lbs.

Formation	Thickness, ft.
Surface	90
Shale	26
Niagara	272
Shale	47
Clinton	20
Red Medina	32
Shale	44
Whte Medina	15
Red shale	25
Total depth	571

Gas at 445 and 534 feet.
Fresh water at 100 feet.

AJAX OIL AND GAS CO., LTD.

G. and M. Hill No. 1, lot 32, W.½, R.R., Tuscarora tp.
Completed September 13, 1938.
Producing gas well.
Rock pressure: 141 lbs.

Formation	Thickness, ft.
Surface	72
Salina	29
Guelph and Niagara	283
Rochester	48
Clinton	31
Red Medina	11
Cabot Head	69
White Medina	10
Red shale	7
Total depth	560

Gas at 433 and 443 feet.
Fresh water at 71 feet; sulphur water at 93, 185, and 201 feet.

AJAX OIL AND GAS CO., LTD.

T. House No. 1, lot 22, E.½, R.R., Tuscarora tp.
Completed August 12, 1938.
Producing gas well.
Rock pressure: 92 lbs.

Formation	Thickness, ft.
Surface	27
Salina	24
Guelph and Niagara	287
Rochester	43
Clinton	34
Red Medina	12
Cabot Head	66
White Medina	13
Red shale	50
Total depth	556

Gas at 382, 499, and 506 feet.
Sulphur water at 30 feet.

Elgin County

S. CARSON

J. J. Johnston No. 1, lot 4, con. III, Aldborough tp.
Completed October 14, 1938.
Dry hole.

Formation	Thickness, ft.
Sand	15
Clay	80
Sand and gravel	95
Clay	23
Hardpan	120
Lime	163
Total depth	496

Fresh water at 15 and 95 feet; salt water at 495 feet.

WALKER AND DRAKE

A. McMillan No. 1, lot 12, con. VI, Aldborough tp.
Completed October 13, 1938.
Dry hole.

Formation	Thickness, ft.
Sand	13
Clay	52
Hardpan and gravel	196
Soap and hard streaks	65
Black streak	6
Big lime	173
Total depth	505

Show of gas at 294 feet.
Fresh water at 70 feet; salt water at 505 feet.

CENTRAL PIPE LINE CO., LTD.

G. Berdan No. 1, lot 1, E.½, con. X, Bayham tp.
Completed October 19, 1938.
Producing gas well.
Rock pressure: 441 lbs.

Formation	Thickness, ft.
Surface	167
Brown lime	28
Blue lime	175
Sharp sand	150
Lime and shale	39
Brown lime	310
Lime and shale	21
Guelph lime	30
Total depth	920

Gas at 895, 910, 915, and 920 feet.
Fresh water at 87 feet; sulphur water at 166 feet.

CENTRAL PIPE LINE CO., LTD.

C. Turner No. 1, lot 2, E.½, con. X, Bayham tp.
Completed November 3, 1938.
Producing gas well.
Rock pressure: 433 lbs.

Formation	Thickness, ft.
Surface	192
Lime and shale	16
Brown lime	32
Grey lime	40
Brown lime	60
Black lime	50
Lime and chert	70
Blue shale	40
Black shale	5
Lime	75
Lime and shale	27
Brown lime	36
Black shale	86
Blue shale	18
Grey and brown lime	43
Blue lime	12
Black shale	25
Brown lime	53
Black shale	8
Grey and brown lime	24
Guelph lime	33
Total depth	945

Gas at 912, 923, 935, and 941 feet.
Fresh water at 204 feet; salt water at 220 feet.

DEAN GAS SYNDICATE

C. Ball No. 1, lot 28, con. VIII, Bayham tp.
Completed February 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	214
Lime and shale	186
Flint	125
Shale and lime	375
Niagara	330
Shale	45
Clinton	26
Red Medina	1
Total depth	1,302

Black water at 220 feet.

DEAN GAS SYNDICATE

C. Ball No. 2, lot 28, con. VIII, Bayham tp.

Completed December 12, 1938.
Producing gas well.
Rock pressure: 330 lbs.

Formation	Thickness, ft.
Surface	183
Lime and shale	217
Flint	125
Lime and shale	375
Niagara	290
Shale	55
Clinton	28
Red Medina	15
Shale	17
Total depth	1,315

Gas at 1,257 to 1,260 feet.
Fresh water at 190 feet; sulphur water at 235 feet.

KIDD-ADAMS

E. A. Cheeseman No. 1, lot 1, N.W.¼, con. IX, Bayham tp.

Completed October 12, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	197
Brown lime	168
Grey lime	20
Lime and chert	100
Grey lime	50
Brown lime	35
Shale	75
Brown lime	35
Shale and brown lime	15
Brown lime	15
Grey and brown lime	70
Shale	20
Grey lime	30
Brown lime	35
Grey and brown lime	35
Brown lime	25
Guelph	20
Total depth	945

Gas at 930, 940, and 945 feet.
Fresh water at 197 feet; sulphur water at 350 feet.

KIDD-ADAMS

E. A. Cheeseman No. 2, lot 1, N.W.¼, con. IX, Bayham tp.

Completed November 27, 1938.
Producing gas well.
Rock pressure: 427 lbs.

Formation	Thickness, ft.
Surface	195
Brown lime	50
Brown and grey lime	35
Brown lime	25
White and brown lime	75
Lime and chert	100
Grey lime	50
Shale	105
Brown and grey lime	10
Brown lime and shale	10
Brown lime	70
Brown and grey lime	20
Shale	40
Shale and lime	40
Brown lime	15
Dark-grey lime	37
Brown lime	13
Guelph	41
Total depth	946

Gas at 920 and 945 feet.
Fresh water at 195 feet; sulphur water at 305 feet.

KIDD-ADAMS

E. A. Cheeseman No. 1, lot 1, con. X, Bayham tp.

Completed July 29, 1938.
Producing gas well.
Rock pressure: 431 lbs.

Formation	Thickness, ft.
Surface	162
Brown and grey lime	48
Brown lime	119
Grey lime	17
Lime and chert	110
Brown and grey lime	54
Shale	13
Brown lime	7
Shale	13
Brown lime	7
Shale	80
Brown lime	15
Shale	5
Shale and lime	20
Shale	10
Brown lime	20
Shale	10
Brown lime	20
Shale	6
Grey and brown lime	19
Brown lime	21
Shale and brown lime	10
Shale	9
Shale and brown lime	24
Shale	17
Brown lime	22
Grey lime	32
Brown lime	17
Guelph	37
Total depth	917

Gas at 885, 890, 903, 905 to 909, 912, and 917 feet.
Fresh water at 160 and 165 feet; sulphur water at 212, 320, and 540 feet.

KIDD-ADAMS

E. A. Cheeseman No. 2, lot 1, con. X, Bayham tp.

Completed September 7, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	167
Grey lime	16
Brown lime	36
Brown and grey lime	21
Brown lime	62
Grey and brown lime	53
Lime and chert	109
Brown and grey lime	50
Blue shale	10
Brown lime	12
Blue shale	86
Shale and lime	17
Brown lime	11
Blue shale	86
Shale and lime	17
Brown lime	11
Blue shale	20
Brown lime	16
Blue shale	5
Grey and brown lime	29
Brown lime and blue shale	12
Blue shale	39
Brown lime	5
Blue shale	11
Brown lime and blue shale	15
Blue shale	12
Brown lime	30
Blue shale	27
Grey lime	14
Guelph	39
Total depth	924

Gas at 898, 908, 911, 917, 921, and 924 feet.
Fresh wate: at 170, 194, and 260 feet.

NEW EDEN NATURAL GAS CO., LTD.

C. E. Wilson No. 4, lot 23, con. VIII, Bayham tp.

Completed February 5, 1938.
Producing gas well.
Rock pressure: 330 lbs.

Formation	Thickness, ft.
Surface	250
Lime and shale	179
Flint	133
Lime and shale	376
Guelph lime	40
Niagara lime	261
Rochester shale	60
Clinton sand	28
Red Medina sand	8
Queenston shale	33
Total depth	1,368

Gas at 1,321 to 1,327 feet.
Fresh water at 200 feet; black water at 260 feet.

NEW EDEN NATURAL GAS CO., LTD.

C. E. Wilson No. 5, lot 23, con. VIII, Bayham tp.

Completed April 5, 1938.
Producing gas well.
Rock pressure: 296 lbs.

Formation	Thickness, ft.
Surface	248
Lime and shale	180
Flint	133
Lime and shale	376
Niagara	298
Shale	54
Clinton	29
Red Medina	42
Total depth	1,360

Gas at 1,307 feet.
Fresh water at 220 feet; black water at 300 and 935 feet.

GEO. OLDRIEVE

J. Silverthorne No. 1, lot 2, con. X, Bayham tp.

Completed February 28, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	174
Sharp grey lime	35
Brown lime	100
Grey and brown lime	91
Flint	90
Hard grey lime	50
Shale	100
Brown lime and shale	80
Shale	30
Brown lime and shale	147
Guelph lime	33
Total depth	930

Gas at 897, 916, and 920 to 929 feet.
Show of oil at 312 feet.
Fresh water at 175 feet; sulphur water at 425 feet.

GEO. OLDRIEVE

J. Silverthorne No. 2, lot 2, con. X, Bayham tp.

Completed May 4, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	191
Sharp grey and brown lime	54
Hard grey lime	15
Brown and grey lime	130
Flint	80
Grey lime and shale	40
Shale	105
Brown lime and shale	125
Shale	90
Hard grey and brown lime	80
Guelph lime	36
Total depth	946

Gas at 915, 920, 926, 936, 941, and 945 feet.
Show of oil at 330 feet.
Fresh water at 224 and 245 feet; sulphur water at 460 feet.

REID-ADAMS DEVELOPMENT CO., LTD.

J. Holtby No. 1, lot 6, con. VIII, Bayham tp.

Completed January 3, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	236
Lime	224
Flint	130
Lime	50
Shale	85
Brown lime	105
Shale	70
Lime	130
Niagara lime	225
Shale	50
Clinton	45
Shale	5
Red Medina	10
Shale	25
White Medina	35
Grey shale	12
Red shale	7
Total depth	1,444

Show of gas at 1,085 feet.
Show of oil at 1,045 feet.
Fresh water at 236 and 630 feet; sulphur water at 1,035 to 1,040 feet.

RODGERS AND HOLMES

F. Cook No. 1, lot 11, con. X, Bayham tp.

Completed January 13, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	182
Brown and grey lime	203
Flint	123
Brown and grey lime	62
Shale and gypsum	119
Brown and grey lime	56
Shale	165
Brown lime	48
Niagara	10
Total depth	968

Fresh water at 60 feet; sulphur water at 184 feet; black water at 515 feet; salt water at 960 feet.

A. M. SMITH

H. Downing No. 4, lot 5, con. X, Bayham tp.

Completed January 6, 1938.
Producing gas well.
Rock pressure: 455 lbs.

Formation	Thickness, ft.
Surface	210
Grey lime	40
Brown lime	30
Grey lime	140
Flint	130
Brown lime	45
Grey lime and gypsum	145
Brown lime	20
Grey lime	80
Brown and grey lime	108
Niagara	31
Total depth	979

Gas at 935 and 942 feet.
Fresh water at 214 feet; salt water at 960 feet.

WESTERN ONTARIO NATURAL GAS CO., LTD.

H. Clark No. 1, lot 2, con. IX, Bayham tp.

Completed August 18, 1938.
Producing gas well.
Rock pressure: 439 lbs.

Formation	Thickness, ft.
Surface	198
Brown lime	25
Lime and shale	125
Lime	50
Lime and chert	100
Brown lime	50
Shale and gypsum	77
Brown lime and shale	145
Shale	55
Grey and brown lime	105
Guelph lime	7
Total depth	937

Gas at 930 to 937 feet.

UNION GAS CO. OF CANADA, LTD.

A. J. Halpin No. 1, lot 16, W.½, con. XII, Dunwich tp.

Completed July 12, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	158
Grey lime	24
Brown lime	205
Brown lime and gypsum	18
Brown lime	37
Brown lime and gypsum	12
Brown and grey lime	11
Sharp grey lime	225
Grey and brown lime	54
Brown lime and gypsum	12
Brown and grey lime	46
Blue and brown lime and gypsum	150
Blue and brown lime	203
Brown lime and salt	6
Salt	18
Brown lime and salt	18
Salt	48
Brown, grey, and blue lime	73
Brown lime	273
Brown and grey lime	24
Rochester blue shale	46
Grey Clinton	29
Cabot Head grey and red shale	109
Queenston red shale	6
Total depth	1,805

Fresh water at 75 feet; sulphur water at 150 feet.

UNION GAS CO. OF CANADA, LTD.

C. A. Pfeffer No. 1, lot A, S.W.¾, con. XI, Dunwich tp.

Completed October 19, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	270
Grey lime	52
Grey and brown lime	66
Brown lime	88
Brown lime and gypsum	12
Brown and grey lime	54
Sharp grey lime	216
Brown and grey lime	99
Blue lime and gypsum	18
Brown and blue lime	12
Blue lime and gypsum	24
Blue, grey, and brown lime	269
Brown lime	55
Grey and brown lime	18
Brown lime	274
Grey lime	15
Rochester grey shale	30
Clinton shale and dolomite	48
Cabot Head red and grey shale	78
White Medina (Manitoulin dolomite)	30
Queenston red shale	6
Total depth	1,734

Fresh water at 240 and 270 feet.

REID-ADAMS DEVELOPMENT CO., LTD.

M. Hemstreet No. 1, lot 33, N.½, con. VIII, Malahide tp.

Completed April 29, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	228
Brown lime	207
Flint	90
Brown lime	25
Shale	15
Brown lime	20
Shale	15
Brown lime	12
Shale	88
Brown lime	110
Shale	90
Brown lime	36
Shale	29
Guelph	29
Total depth	994

Show of gas at 980 feet.
Fresh water at 228 feet; sulphur water at 435 and 994 feet.

UNION GAS CO. OF CANADA, LTD.

E. Bowan No. 1, lot 21, N.½, con. V, Malahide tp.

Completed December 1, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	269
Hamilton shale and lime shell	21
Brown and grey lime	40
Brown lime	190
Sharp grey lime	120
Grey lime	15
Grey lime and gypsum	45
Brown lime	15
Grey lime and gypsum	35
Grey and brown lime	115
Grey lime	105
Brown and grey lime	80
Brown lime	28
Brown and grey lime	102
Brown lime	170
Rochester grey shale	48
Cabot Heat red and grey shale	71
White Medina (Manitoulin)	29
Queenston red shale	4
Total depth	1,525

Gas at 1,075 to 1,078, 1,083, and 1,131 feet.
Sulphur water at 280 feet; salt water at 1,133 and 1,152 feet.

UNION GAS CO. OF CANADA, LTD.

Collver No. 1, lot 25, S.pt., con. VII, Malahide tp.

Completed August 4, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	287
Hamilton black shale	8
Brown lime	175
Sharp grey lime	185
Grey lime	10
Grey and brown lime and gypsum	120
Grey and brown lime	120
Grey lime	95
Brown and grey lime	40
Grey lime and shale	10
Grey and brown lime	41
Grey sand (lime)	20
Brown lime	105
Grey and brown lime	82
Grey shale, some lime	51
Clinton shale and dolomite	22
Cabot Head blue and red shale	82
White Medina (Manitoulin)	24
Queenston red shale	8
Total depth	1,526

Show of gas at 1,104, 1,148, 1,398, and 1,407 feet; small amount of gas at 1,412 feet.
Fresh water at 165 feet; salt water at 1,104 feet.

UNION GAS CO. OF CANADA, LTD.

F. McIntyre No. 1, lot 8, N.½, con. VII, South Dorchester tp.

Completed November 9, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	215
Sharp grey lime	45
Soft brown and grey lime	40
Hard brown lime	80
Soft brown and grey lime	20
Hard brown lime	30
Flint (cherty lime)	150
Hard grey and brown lime	75
Total depth	655

Fresh water at 218 feet; sulphur water at 470 and 600 feet.

UNION GAS CO. OF CANADA, LTD.

H. G. Martyn No. 1, lot 3, N.W.¼, con. XI, South Dorchester tp.

Completed September 13, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	256
Grey and sharp grey lime	40
Grey and brown lime	70
Brown lime	60
Grey and brown lime	15
Grey and brown lime and gypsum	35
Flint (cherty lime)	135
Brown lime	30
Shale	30
Brown lime and shale	20
Shale and gypsum	25
Shale	45
Brown lime and shale	95
Shale and grey lime	125
Brown and grey lime	60
Guelph-Lockport dolomite	275
Rochester shale	35
Clinton	25
Red Medina	30
Shale	35
White Medina	25
Queenston red shale	5
Total depth	1,471

Show of gas at 318 feet.
Show of oil at 356 to 366 feet.
Fresh water at 140 feet; sulphur water at 290, 440, and 610 feet.

UNION GAS CO. OF CANADA, LTD.

H. V. Southwold No. 1, lot 5, N.T.R., Southwold tp.

Completed December 6, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	276
Grey lime	53
Brown lime	162
Brown and grey lime	66
Sharp grey lime	228
Brown and grey lime	91
Blue lime and gypsum	18
Brown lime	12
Blue lime and gypsum	62
Blue and brown lime	152
Blue lime	78
Brown lime	349
Grey lime	15
Rochester shale	41
Clinton	24
Grey shale	48
Red and grey shale	37
White Medina	36
Queenston red shale	6
Total depth	1,754

Fresh water at 260 feet.

GEORGE OLDRIEVE

A. Miller No. 1, lot 12, N.½, con. X, Yarmouth tp.

Completed February 1, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	263
Shale and grey lime	40
Soft brown lime	50
Hard brown lime	120
Soft grey and brown lime	70
Hard grey lime	10
Flint	130
Brown lime	47
Hard grey lime	10
Brown lime and shale	20
Shale	90
Brown lime and shale	20
Hard brown lime	25
Shale and brown lime	10
Brown lime	15
Brown lime and shale	20
Shale	105
Hard brown lime	30
Grey lime	45
Niagara	250
Total depth	1,370

Fresh water at 270 and 553 feet; sulphur water at 740 feet.

Essex County

H. B. SMITH

Big Creek Club No. 1, lot 56, con. IV, Malden tp.

Completed June 11, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	54
Grey lime	9
Sylvania sand	26
Grey lime (sharp sand)	66
Hard grey lime	30
Grey and brown lime	156
Blue-grey lime and shale	24
Blue-grey lime and gypsum	53
Dark lime and quartz	18
Light-brown lime	149
Grey and white lime and shale	50
Brown and grey lime	55
Brown lime	65
Grey lime	25
Grey and white lime	15
Light-brown lime	40
Grey lime	5
White lime	55
Blue and grey lime	180
Hard brown lime	30
Hard grey lime	100
White lime	40
Grey lime	15
Soft grey shale	10
Grey lime	10
Total depth	1,280

Small show of oil at 725 to 755 feet.
Sulphur water at 249 and 332 feet; salt water at 830 and 865 feet.

HARRY KIFF

A. Wilkinson No. 1, lot 10, con. VI, Mersea tp.

Completed October 15, 1938.
Producing gas well.

Formation	Thickness, ft.
Surface	90
Hard brown lime	31
Brown lime	166
Grey lime	78
Sharp brown lime	21
Sharp brown and grey lime	32
Sharp sand	21
Brown lime	48
Hard brown lime	26
Grey lime	44
Hard brown lime	38
Hard brown lime and gypsum	6
Hard brown lime	19
Grey lime	43
Hard brown lime	177
Grey lime	110
Brown lime	38
Grey lime	48
Brown lime	19
Guelph lime	12
Water sand	2
Total depth	1,069

Gas at 1,055 feet.
Fresh water at 92 feet; sulphur water at 471 feet; black water at 513 feet; salt water at 1,064 feet.

POVEC GAS AND OIL SYNDICATE

W. N. Reid No. 2, lot 10, W.½, con. VII, Mersea tp.

Completed March 24, 1938.
Producing gas well.
Rock pressure: 280 lbs.

Formation	Thickness, ft.
Surface	91
Hard brown lime	266
Hard sharp brown lime	28
Hard brown and grey lime	37
Brown and grey lime and very sharp sand	26
Brown lime	21
Grey lime	32
Brown hard lime	41
Brown and grey lime	47
Gypsum	3
Gypsum and lime	11
Hard grey lime	126
Hard brown lime	17
Grey lime	13
Hard brown lime	54
Grey lime	86
Hard brown lime	14
Grey lime and slate	53
Hard brown lime	28
Hard grey lime	37
Brown lime	17
Guelph lime	9
Water sand	4
Total depth	1,061

Gas at 92 and 1,048 feet.
Fresh water at 93 feet; sulphur water at 385 feet; black water at 535 feet; salt water at 1,059 feet.

Haldimand County

F. AND H. ROTH

B. Bowden No. 1, lot 18, Haldimand tract, Dunn tp.

Completed December 21, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	5
Lime and shale	390
Niagara	220
Shale	45
Clinton	33
Red Medina	35
Shale	60
White Medina	15
Red shale	45
Total depth	848

Show of gas at 800 feet.
Fresh water at 60 feet.

HOUK, BARTLETT, FRY AND ROSS

R. Root No. 1, Town of Dunnville, Moulton tp.

Completed October 6, 1938.
Producing gas well.
Rock pressure: 120 lbs.

Formation	Thickness, ft.
Surface	83
Lime and shale	205
Niagara	223
Shale	61
Clinton	28
Red Medina	38
Shale	59
White Medina	14
Red shale	52
Total depth	763

Gas at 577 and 618 feet.
Fresh water at 110 feet.

UNION GAS CO. OF CANADA, LTD.

J. R. Doyle No. 1, lot 17, S.½, con. I, N.T.R., North Cayuga tp.

Completed December 22, 1938.
Producing gas well.
Rock pressure: 165 lbs.

Formation	Thickness, ft.
Surface	60
Brown lime, sand, and shale	15
Shale and gypsum	200
Grey and brown dolomite	225
Rochester shale	55
Clinton	30
Red Medina	35
Grey shale	65
White Medina	10
Queenston red shale	25
Total depth	720

Gas at 585, 600, and 692 feet.

UNION GAS CO. OF CANADA, LTD.

W. A. Oster No. 3, lot 24, S.½, con. I, N.T.R., North Cayuga tp.

Completed November 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	43
Brown lime and shale	92
Shale and gypsum	100
Shale	15
Shale and gypsum	30
Grey and brown dolomite	225
Rochester shale	50
Clinton	25
Red Medina	40
Grey shale	60
White Medina	10
Queenston red shale	25
Total depth	715

Small amount of gas at 560 and 687 feet.

IDEAL GAS SYNDICATE

N. Kiefer No. 1, lot 8, con. IV, Rainham tp.

Completed March 8, 1938.
Producing gas well.
Rock pressure: 335 lbs.

Formation	Thickness, ft.
Surface	26
Flint	75
Lime and shale	349
Niagara	239
Shale	53
Clinton	27
Red Medina	35
Shale	60
White Medina	8
Red shale	5
Total depth	877

Gas at 770 and 805 feet.
Fresh water at 50 feet.

IDEAL GAS SYNDICATE

N. Kiefer No. 2, lot 8, con. IV, Rainham tp.

Completed March 30, 1938.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Thickness, ft.
Surface	20
Flint	70
Lime and shale	360
Niagara	230
Shale	45
Clinton	27
Red Medina	35
Shale	60
White Medina	11
Red shale	5
Total depth	863

Gas at 740 and 782 feet.
Fresh water at 48 feet.

IDEAL GAS SYNDICATE

N. Kiefer No. 3, lot 8, con. IV, Rainham tp.

Completed May 21, 1938.
Producing gas well.
Rock pressure: 340 lbs.

Formation	Thickness, ft.
Surface	22
Flint	70
Lime and shale	380
Niagara	234
Shale	41
Clinton	27
Red Medina	35
Shale	60
White Medina	12
Red shale	5
Total depth	886

Gas at 747 and 794 feet.
Fresh water at 35 feet.

IDEAL GAS SYNDICATE

N. Kiefer No. 4, lot 8, con. IV, Rainham tp.

Completed June 16, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	20
Flint	80
Lime and shale	365
Niagara	241
Shale	45
Clinton	27
Red Medina	40
Shale	60
White Medina	12
Red shale	5
Total depth	895

Fresh water at 45 feet.

IDEAL GAS SYNDICATE

K. Schumacher No. 1, lot 9, con. IV, Rainham tp.

Completed January 5, 1938.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Thickness, ft.
Surface	10
Flint	85
Lime and shale	360
Niagara	235
Shale	53
Clinton	27
Red Medina	44
Grey shale	68
White Medina	11
Red shale	4
Total depth	897

Gas at 760 and 783 feet.
Fresh water at 30 feet; black water at 80 feet.

IDEAL GAS SYNDICATE

K. Schumacher No. 2, lot 9, con. IV, Rainham tp.

Completed February 2, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	12
Flint	85
Lime and shale	345
Niagara	235
Shale	57
Clinton	27
Red Medina	48
Grey shale	58
White Medina	8
Red shale	1
Total depth	876

Sulphur water at 60 feet.

IDEAL GAS SYNDICATE

K. Schumacher No. 3, lot 9, con. IV, Rainham tp.

Completed July 8, 1938.
Producing gas well.
Rock pressure: 330 lbs.

Formation	Thickness, ft.
Surface	14
Flint	60
Lime and shale	392
Niagara	234
Shale	42
Clinton	27
Red Medina	40
Shale	60
White Medina	12
Red shale	5
Total depth	886

Gas at 742 and 757 feet.
Fresh water at 42 feet.

LAKE ERIE GAS SYNDICATE

W. Austin No. 1, lot 25, E.½, con. I, Rainham tp.

Completed July 9, 1938.
Producing gas well.
Rock pressure: 382 lbs.

Formation	Thickness, ft.
Surface	13
Flint	49
Lime and shale	368
Niagara	245
Rochester shale	40
Clinton	28
Red Medina	31
Red shale	11
Grey shale	63
White Medina	18
Total depth	866

Gas at 746 and 865 feet.
Fresh water at 49 feet.

LAKE ERIE GAS SYNDICATE

H. Booker No. 1, lot 16, W.½, con. III, Rainham tp.
Completed April 15, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	11
Flint	66
Lime and shale	380
Niagara	232
Rochester shale	51
Clinton	27
Red Medina	33
Red shale	13
Grey shale	60
White Medina	9
Red shale	3
Total depth	885

Fresh water at 38 feet.

LAKE ERIE GAS SYNDICATE

H. Booker No. 2, lot 16, W.½, con. III, Rainham tp.
Completed May 12, 1938.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	10
Flint	58
Lime and shale	380
Niagara	239
Rochester shale	49
Clinton	29
Red Medina	34
Red shale	7
Grey shale	62
White Medina	9
Red shale	4
Total depth	881

Gas at 745, 768, and 789 feet.
Fresh water at 39 feet.

LAKE ERIE GAS SYNDICATE

J. Daley No. 1, lot 16, S.W.¼, con. I, Rainham tp.
Completed February 21, 1938.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	10
Flint	60
Lime and shale	383
Niagara	245
Rochester shale	50
Clinton	23
Red Medina	40
Red shale	6
Grey shale	61
White Medina	11
Red shale	3
Total depth	892

Gas at 780 feet.
Fresh water at 48 feet.

LAKE ERIE GAS SYNDICATE

W. Evans No. 1, lot 24, E.½, con. I, Rainham tp.
Completed June 15, 1938.
Producing gas well.
Rock pressure: 410 lbs.

Formation	Thickness, ft.
Surface	7
Flint	63
Lime and shale	365
Niagara	245
Rochester shale	40
Clinton	30
Red Medina	25
Red shale	21
Grey shale	56
White Medina	10
Red shale	3
Total depth	865

Gas at 750 feet.
Fresh water at 16, 18, and 40 feet.

LAKE ERIE GAS SYNDICATE

W. Evans No. 2, lot 24, E.½, con. I, Rainham tp.
Completed August 26, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	4
Flint	91
Lime and shale	336
Niagara	249
Rochester shale	36
Clinton	30
Red Medina	8
Red shale	32
Grey shale	62
White Medina	12
Red shale	3
Total depth	863

Fresh water at 25 feet.

LAKE ERIE GAS SYNDICATE

W. Evans No. 1, lot 24, W.½, con. I, Rainham tp.
Completed July 5, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	14
Flint	56
Lime and shale	370
Niagara	235
Rochester shale	42
Clinton	28
Red Medina	25
Red shale	21
Grey shale	56
White Medina	13
Red shale	4
Total depth	864

Fresh water at 28 feet.

LAKE ERIE GAS SYNDICATE

W. Evans No. 2, lot 24, W.½, con. I, Rainham tp.
Completed August 2, 1938.
Producing gas well.
Rock pressure: 390 lbs.

Formation	Thickness, ft.
Surface	18
Flint	52
Lime and shale	370
Niagara	245
Rochester shale	35
Clinton	30
Red Medina	25
Red shale	15
Grey shale	60
White Medina	15
Red shale	3
Total depth	868

Gas at 724, 765, and 770 feet.
Fresh water at 40 feet.

LAKE ERIE GAS SYNDICATE

W. Evans No. 3, lot 24, W.½, con. I, Rainham tp.
Completed September 15, 1938.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	10
Flint	80
Lime and shale	345
Niagara	250
Rochester shale	33
Clinton	30
Red Medina	8
Red shale	32
Grey shale	66
White Medina	10
Red shale	2
Total depth	866

Gas at 723 and 768 feet.
Fresh water at 40 feet.

LAKE ERIE GAS SYNDICATE

W. Evans No. 4, lot 24, W.½, con. I, Rainham tp.

Completed November 14, 1938.
Producing gas well.
Rock pressure: 395 lbs.

Formation	Thickness, ft.
Surface	16
Flint	79
Lime and shale	331
Niagara	234
Rochester shale	50
Clinton	32
Red Medina	20
Red shale	16
Grey shale	66
White Medina	9
Red shale	2
Total depth	855

Gas at 759 feet.
Fresh water at 30 feet.

LAKE ERIE GAS SYNDICATE

W. Evans No. 5, lot 24, W.½, con. I, Rainham tp.

Completed December 17, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	8
Flint	87
Lime and shale	335
Niagara	200
Rochester shale	85
Clinton	28
Red Medina	42
Grey shale	63
White Medina	10
Red shale	6
Total depth	864

Fresh water at 20 feet.

LAKE ERIE GAS SYNDICATE

C. Gee No. 1, lot 17, con. I, Rainham tp.

Completed January 28, 1938.
Producing gas well.
Rock pressure: 405 lbs.

Formation	Thickness, ft.
Surface	10
Lime and chert	60
Lime and shale	387
Niagara	245
Rochester shale	50
Clinton	23
Red Medina	40
Red shale	6
Grey shale	61
White Medina	11
Red shale	3
Total depth	896

Gas at 783 feet.
Fresh water at 49 feet.

STANDARD GAS AND OIL SYNDICATE

C. Harris No. 5, lot 1, S.½, con. VI, Rainham tp.

Completed January 6, 1939.
Dry hole.

Formation	Thickness, ft.
Surface	10
Lime and flint	77
Lime and shale	370
Niagara lime	238
Rochester shale	57
Clinton (soft)	40
Grey shale	53
White Medina	14
Red shale	3
Total depth	888

Sulphur water at 47 feet.

ELGIN STEWART

F. Bier No. 1, lot 3, con. VII, Rainham tp.

Completed April 1, 1938.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Thickness, ft.
Surface	38
Flint	60
Lime and shale	377
Niagara	265
Shale	56
Clinton	25
Red Medina	45
Grey shale	60
White Medina	18
Red shale	20
Total depth	964

Gas at 800, 839, and 942 feet.
Fresh water at 65 feet; sulphur water at 500 feet.

UNION GAS CO. OF CANADA, LTD.

J. Benner No. 2, lot 3, S. pt., con. III, Rainham tp.

Completed November 6, 1938.
Producing gas well.
Rock pressure: 370 lbs.

Formation	Thickness, ft.
Surface	15
Flint (lime and chert)	100
Lime and shale	355
Grey and brown dolomite	240
Rochester shale	55
Clinton	28
Red Medina	35
Grey shale	75
White Medina	8
Queenston red shale	2
Total depth	913

Gas at 770, 780, 790, 809, and 813 feet.
Fresh water at 35 feet; sulphur water at 50 feet.

UNION GAS CO. OF CANADA, LTD.

F. Held No. 1, lot 3, N.½, con. III, Rainham tp.

Completed August 30, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	10
Flint (lime and chert)	110
Shale	120
Lime	477
Rochester shale	55
Clinton	26
Red Medina	39
Grey shale	63
White Medina	10
Queenston red shale	4
Total depth	914

Small amount of gas at 789, 817, and 835 feet.
Sulphur water at 590 feet.

UNION GAS CO. OF CANADA, LTD.

J. O. Hoover No. 1, lot 2, S.W. pt., con. II, Rainham tp.

Completed September 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	9
Flint (lime and chert)	121
Lime and shale	370
Grey and brown lime	260
Rochester shale	57
Clinton	27
Red Medina	45
Shale	56
White Medina	8
Queenston red shale	4
Total depth	957

Show of gas at 822 and 870 feet.
Sulphur water at 42 feet.

UNION GAS CO. OF CANADA, LTD.

F. Reu No. 1, lot 4, N.W.¼, con. II, Rainham tp.

Completed October 7, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	15
Flint (cherty lime)	90
Lime	50
Lime and shale	145
Lime	35
Lime and shale	185
Rochester shale	41
Clinton	29
Red Medina	41
Grey shale	57
White Medina	16
Queenston red shale	6
Total depth	924

Small amount of gas at 818 feet.
Show of gas at 777 and 790 feet.
Sulphur water at 40 feet.

UNION GAS CO. OF CANADA, LTD.

M. Reu No. 1, lot 4, con. VI, Rainham tp.

Completed December 24, 1938.
Producing gas well.
Rock pressure: 325 lbs.

Formation	Thickness, ft.
Surface	16
Flint (cherty lime)	66
Lime and shale	368
Grey and brown dolomite	240
Rochester shale	56
Clinton	25
Red Medina	43
Shale	60
White Medina	12
Queenston red shale	27
Total depth	913

Gas at 749, 769, and 880 feet.
Fresh water at 35 feet.

UNION GAS CO. OF CANADA, LTD.

C. Rhora No. 1, lot 1, W.¾ of N.½, con. III, Rainham tp.

Completed August 31, 1938.
Producing gas well.
Rock pressure: 425 lbs.

Formation	Thickness, ft.
Surface	9
Flint (cherty lime)	126
Lime and shale	365
Grey and brown lime	240
Rochester shale	62
Clinton	25
Red Medina	42
Shale	60
White Medina	14
Queenston red shale	3
Total depth	946

Gas at 807, 819, and 847 feet.
Sulphur water at 60 feet.

UNION GAS CO. OF CANADA, LTD.

W. Schumacher No. 1, lot 5, N.½, con. V, Rainham tp.

Completed November 25, 1938.
Producing gas well.
Rock pressure: 410 lbs.

Formation	Thickness, ft.
Surface	12
Flint (cherty lime)	68
Lime and shale	375
Rochester shale	56
Clinton	26
Red Medina	40
Shale	60
White Medina	10
Queenston red shale	3
Total depth	890

Gas at 756, 771, and 800 feet.
Sulphur water at 40 feet.

UNION GAS CO. OF CANADA, LTD.

J. W. Schweyer No. 1, lot 4, S.E.¼, con. III, Rainham tp.

Completed December 7, 1938.
Producing gas well.
Rock pressure: 360 lbs.

Formation	Thickness, ft.
Surface	29
Flint (cherty lime)	85
Lime and shale	360
Grey and brown dolomite	240
Rochester shale	60
Clinton	29
Red Medina	40
Grey shale	65
White Medina	7
Queenston red shale	2
Total depth	918

Gas at 800 and 834 feet.

BROADWAY GAS SYNDICATE

E. Field No. 1, lot 20, S.½, con. VI, Walpole tp.

Completed October 12, 1938.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Thickness, ft.
Surface	36
Lime and flint	74
Lime and shale	350
Niagara	230
White lime	47
Rochester shale	38
Clinton	25
Red Medina	40
Grey shale	53
White Medina	12
Red shale	1
Total depth	906

Gas at 818 feet.
Fresh water at 80 feet.

BROADWAY GAS SYNDICATE

J. W. McBurney No. 2, lot 19, N.½, con. V, Walpole tp.

Completed November 15, 1938.
Producing gas well.
Rock pressure: 360 lbs.

Formation	Thickness, ft.
Surface	31
Lime and flint	100
Lime and shale	339
Niagara	220
White lime	80
Rochester shale	33
Clinton	23
Red Medina	45
Grey shale	52
White Medina	12
Red shale	1
Total depth	936

Gas at 853 feet.
Fresh water at 95 feet.

WM. MCKILLOP

A. E. Evans No. 1, lot 13, con. II, Walpole tp.

Completed June 25, 1938.
Producing gas well.
Rock pressure: 430 lbs.

Formation	Thickness, ft.
Surface	16
Flint	129
Lime and shale	380
Niagara	285
Shale	40
Clinton	30
Red Medina	35
Blue shale	70
White Medina	16
Red shale	4
Total depth	1,005

Gas at 853 and 892 to 904 feet.
Fresh water at 89 feet; black water at 116 feet.

WM. MCKILLOP

A. E. Evans No. 2, lot 13, con. II, Walpole tp.

Completed September 17, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	22
Flint	107
Lime and shale	396
Niagara	305
Rochester shale	35
Clinton	26
Red Medina	35
Blue shale	60
White Medina	9
Red shale	3
Total depth	998

Fresh water at 110 feet.

FRED REICHELD

J. B. McKenzie No. 3, lot 4, E.½, con. IV, Walpole tp.

Completed January 20, 1938.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	25
Lime and flint	140
Lime and shale	375
Niagara	260
Rochester shale	50
Clinton	27
Red Medina	12
Red shale	25
Grey shale	56
White Medina	12
Red shale	1
Total depth	983

Gas at 895 feet.
Fresh water at 80 feet.

FRED REICHELD

L. Mitchell No. 2, lot 6, con. V, Walpole tp.

Completed November 18, 1938.
Producing gas well
Rock pressure: 425 lbs.

Formation	Thickness, ft.
Surface	29
Flint	126
Lime and shale	360
Niagara	268
Shale	52
Clinton	32
Red Medina	40
Shale	55
White Medina	10
Red shale	1
Total depth	973

Gas at 857 feet.
Fresh water at 75 feet.

FRED REICHELD

R. Parkinson No. 2, lot 4, con. V, Walpole tp.

Completed December 23, 1938.
Producing gas well.
Rock pressure: 415 lbs.

Formation	Thickness, ft.
Surface	33
Flint	119
Lime and shale	367
Niagara	265
Shale	51
Clinton	28
Red Medina	40
Shale	56
White Medina	10
Red shale	1
Total depth	970

Gas at 838, 843, and 844 feet.
Fresh water at 128 feet.

STANDARD GAS AND OIL SYNDICATE

W. Rutherford No. 1, lot 23, con. III, Walpole tp.

Completed July 13, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	26
Flint	104
Lime and shale	363
Niagara	249
Shale	55
Clinton	27
Red Medina	42
Grey shale	60
White Medina	18
Red shale	4
Total depth	948

Sulphur water at 42 to 80 feet.

STANDARD GAS AND OIL SYNDICATE

W. Rutherford No. 2, lot 23, N.½, con. III, Walpole tp.

Completed October 5, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	17
Lime and chert	103
Lime and shale	350
Niagara	248
Shale	62
Clinton	29
Red Medina	44
Grey shale	56
White Medina	18
Red shale	5
Total depth	932

Sulphur water at 62 feet.

W. E. STANLEY

J. Voakes No. 1, lot 1, con. X, Walpole tp.

Completed September 3, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	5
Flint	135
Grey lime	35
Brown lime	10
Shale and gypsum	50
Gypsum and brown lime	265
Niagara	245
Guelph lime	45
Shale	40
Clinton	23
Red Medina	40
Shale	65
White Medina	15
Red shale	10
Total depth	983

Fresh water at 60 and 135 feet.

STEWART AND STEWART

A. Stewart No. 5, lot 18, con. V, Walpole tp.

Completed February 2, 1938.
Producing gas well.
Rock pressure: 385 lbs.

Formation	Thickness, ft.
Surface	8
Flint	140
Lime and shale	347
Niagara	215
Shale	15
Guelph lime	20
Rochester shale	55
Clinton	28
Red Medina	40
Grey shale	58
White Medina	12
Red shale	35
Total depth	973

Gas at 822 and 844 feet.
Fresh water at 85 feet; sulphur water at 595 feet.

UNION GAS CO. OF CANADA, LTD.

A. Haller No. 1, lot 10, E.½, con. XIV, Walpole tp.
Completed October 22, 1938.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Thickness, ft.
Surface	77
Shale and gypsum	33
Shale and brown lime	170
Shale and gypsum	30
Brown lime and shale	50
Grey and brown dolomite	250
Rochester shale	55
Clinton	33
Red Medina	22
Shale	54
White Medina	16
Queenston red shale	25
Total depth	815

Gas at 96, 668, 685, 690, and 780 to 785 feet.
Fresh water at 85 feet; sulphur water at 140 feet.

UNION GAS CO. OF CANADA, LTD.

H. Hopper No. 1, lot 10, W.½, con. XIV, Walpole tp.
Completed November 11, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	55
Shale and gypsum	10
Brown lime and shale	105
Brown lime	40
Shale, gypsum, and brown lime	100
Shale	50
Grey and brown dolomite	250
Rochester shale	55
Clinton	33
Red Medina	27
Shale	50
White Medina	14
Queenston red shale	4
Total depth	793

Fresh water at 49 feet; sulphur water at 135 feet.

UNION GAS CO. OF CANADA, LTD.

H. Hopper No. 2, lot 10, W.½, con. XIV, Walpole tp.
Completed December 3, 1938.
Producing gas well.
Rock pressure: 225 lbs.

Formation	Thickness, ft.
Surface	70
Shale	10
Shale and gypsum	50
Brown lime and hard shale	30
Shale	25
Brown lime	55
Shale and brown lime	100
Shale and gypsum	38
Grey and brown dolomite	252
Rochester shale	58
Clinton	37
Red Medina	25
Shale	45
White Medina	15
Queenston red shale	5
Total depth	815

Gas at 690 and 698 feet.
Fresh water at 68 feet; sulphur water at 124 feet.

WALPOLE GAS SYNDICATE

F. Bier No. 1, lot 20, E.½, con. VIII, Walpole tp.
Completed September 15, 1938.
Producing gas well.
Rock pressure: 390 lbs.

Formation	Thickness, ft.
Surface	20
Lime and flint	71
Lime and shale	361
Niagara	261
Rochester shale	57
Clinton	28
Red Medina	24
Red shale	17
Grey shale	59
White Medina	9
Red shale	4
Total depth	911

Gas at 787 and 811 feet.
Fresh water at 59 feet.

WALPOLE GAS SYNDICATE

L. Keen No. 1, lot 21, S.½, con. VIII, Walpole tp.
Completed October 7, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	21
Lime and flint	66
Lime and shale	359
Niagara	269
Rochester shale	56
Clinton	24
Red Medina	22
Red shale	17
Grey shale	59
White Medina	11
Red shale	4
Total depth	908

Fresh water at 74 feet.

WALPOLE GAS SYNDICATE

W. Laidlaw No. 1, lot 19, S.W.¼, con. VIII, Walpole tp.
Completed November 16, 1938.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Thickness, ft.
Surface	19
Flint	70
Lime and shale	359
Niagara	266
Casing shale	54
Clinton	28
Red Medina	26
Red shale	14
Grey shale	61
White Medina	9
Red shale	3
Total depth	909

Gas at 776, 785, and 819 feet.
Fresh water at 38 feet.

WALPOLE GAS SYNDICATE

J. W. McBurney No. 6, lot 18, con. VII, Walpole tp.

Completed August 2, 1938.
Producing gas well.
Rock pressure: 385 lbs.

Formation	Thickness, ft.
Surface	17
Lime and flint	90
Lime and shale	343
Niagara	210
White lime	78
Rochester shale	38
Clinton	25
Red Medina	40
Grey shale	57
White Medina	12
Red shale	1
Total depth	911

Gas at 798 and 819 feet.
Fresh water at 60 feet.

WALPOLE GAS SYNDICATE

A. Porter No. 4, lot 17, S.½, con. VII, Walpole tp.

Completed August 31, 1938.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Thickness, ft.
Surface	14
Lime and flint	96
Lime and shale	340
Niagara	210
White lime	89
Rochester shale	40
Clinton	28
Red Medina	40
Grey shale	53
White Medina	12
Total depth	922

Gas at 817 feet.
Fresh water at 70 feet.

Kent County

MCCRIE AND MCGAFFEY

A. McDonald No. 2, lot 6, con XI, Camden tp.

Completed May 16, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	45
Black shale	27
Top rock	54
Soap	50
Shell	2
Soap	23
Shell	3
Soap	56
Shell	2
Soap	33
Middle lime	13
Lower soap	27
Dark streak	8
Soap	2
Lower lime	10
Total depth	365

Oil at 360 feet.
Fresh water at 40 and 82 feet.

E. A. ROTH

D. Wallace No. 1, lot 9, con. II, Camden tp.

Completed January 26, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	70
Top rock	37
Top soap	92
Shell	5
Middle lime	20
Lower soap	74
Lower lime	88
Total depth	386

Oil at 308 feet.
Fresh water at 65 feet; salt water at 308 feet.

E. A. ROTH

D. Wallace No. 2, lot 9, con. II, Camden tp.

Completed February 23, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	112
Top rock	5
Top soap	123
Hard streak	5
Lower soap	55
Black hard streak	4
Lower lime	126
Total depth	430

Fresh water at 60 feet; salt water at 430 feet.

E. A. ROTH

D. Wallace No. 3, lot 9, con. II, Camden tp.

Completed March 12, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	70
Black shale	36
Top rock	4
Soap	128
Middle lime	20
Lower soap	33
Black streak	4
Lower lime	44
Total depth	340

Oil at 312 feet.
Fresh water at 57 feet; salt water at 312 feet.

E. A. ROTH

D. Wallace No. 4, lot 9, con. II, Camden tp.

Completed April 23, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	128
Top soap	166
Black streak	4
Lower lime	120
Total depth	418

Oil at 338 to 343 feet.
Fresh water at 65 feet; salt water at 338 to 343 feet.

E. A. ROTH

D. Wallace No. 5, lot 9, con. II, Camden tp.

Completed June 15, 1938.
Dry hole.

Formation	Thickness, ft.
Sand	8
Clay	37
Hardpan	15
Top rock	40
Soap	197
Dark streak	2
Lower lime	119
Total depth	418

Fresh water at 95 feet; salt water at 370 feet.

W. E. STANLEY

A. Baxter No. 1, lot 5, con. II, Camden tp.

Completed October 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	68
Black shale	14
Top rock	18
Soap and lime	190
Middle lime	7
Lime and soap streaks	81
Lower lime	114
Total depth	492

Small show of oil at 385 feet.

G. E. AND F. C. WILLITS

Taylor Estate No. 1, lot 9, con. I, Camden tp.

Completed April 20, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	80
Top rock	3
Top soap	176
Middle lime	10
Lower soap	21
Black streak	3
Lower lime	135
Total depth	428

Show of oil at 356 to 358 feet.
Fresh water at 60 feet; black salt water at 428 feet.

G. E. AND F. C. WILLITS

Van Horne No. 1, lot 1, con. X, Camden tp.

Completed April 28, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	81
Top rock	3
Top soap	127
Hard shell	6
Top soap	38
Middle lime	8
Lower soap	24
Black streak	4
Lower lime	93
Total depth	384

Oil at 309, 336, and 359 feet.
Fresh water at 75 feet; salt water at 309, 336, and 359 feet.

G. E. AND F. C. WILLITS

Van Horne No. 2, lot 10, con. I, Camden tp.

Completed May 11, 1938.
Dry hole.

Formation	Thickness, ft.
Sand	8
Clay	45
Hardpan	20
Gravel	24
Soap	106
Top rock	5
Soap	40
Middle lime	20
Lower soap	23
Lower lime	122
Total depth	413

Fresh water at 60 feet.

E. P. ROWE

R. Barron No. 1, lot 9, con. I, Chatham tp.

Completed January 8, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	59
Black shale and soap	44
Top rock	23
Shell and soap	137
Middle lime	5
Shell and soap	36
Lower lime	189
Total depth	493

Show of gas at 126, 350 to 357, and 444 to 453 feet.
Fresh water at 58 to 59 feet; salt water at 403 and 473 to 480 feet.

E. P. ROWE

A. Rosseel No. 1, lot 7, W.½, con. I, Chatham tp.

Completed September 20, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	67
Black shale	39
Top rock	4
Grey lime	4
Soap	54
Lime shell	3
Soap	35
Lime shell	5
Soap	15
Lime shell	2
Soap	8
Lime shell	10
Soap	11
Lime shell	3
Soap	26
Lime	86
Lime and chert	8
Lime	51
Total depth	431

Show of oil at 350 to 353 and 431 feet.
Show of gas at 288, 295, 318, and 372 to 380 feet.
Fresh water at 66 feet; salt water at 350 to 353 and 426 to 431 feet.

E. P. ROWE

A. Rosseel No. 2, lot 7, con. I, Chatham tp.

Completed November 11, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	73
Black shale	22
Top rock	19
Grey lime shell	3
Soap	51
Shell	4
Soap	69
Shell and soap	12
Middle lime	11
Lower soap	28
Lime	96
Lime and chert	8
Lime	57
Total depth	453

Show of gas at 406 feet.
Show of oil at 253 to 264 feet.
Fresh water at 73 feet.

E. P. ROWE

J. Slater No. 1, lot 7, W.½, con. I, Chatham tp.

Completed March 5, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	67
Black shale	41
Total depth	108

Show of gas at 63 feet.

E. P. ROWE

W. Slater No. 1, lot 8, con. I, Chatham tp.

Completed March 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	72
Black shale	26
Lime and shale	193
Lime	119
Silica sand	4
Brown lime	27
Total depth	441

Show of gas at 123 and 403 feet.
Fresh water at 65 to 72 feet.

E. P. Rowe

H. Stewart No. 1, lot 6, con. I, Chatham tp.

Completed October 25, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	77
Black shale	29
Top rock	12
Soap	10
Lime shell	3
Soap	47
Shell	4
Soap	53
Shell	3
Soap	28
Shell	17
Soap	26
Lime	95
Lime and chert	8
Total depth	412

Show of gas at 238 and 364 feet.
Show of oil at 381 to 386, 393, and 398 to 404 feet.
Fresh water at 77 feet.

E. P. Rowe

G. Warnock No. 1, lot 7, con. I, Chatham tp.

Completed February 26, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	53
Hardpan	15
Black shale	21
Top rock	27
Soap	52
Shell	3
Soap	32
Shell	5
Soap	4
Shell	9
Hard soap	27
Middle lime	18
Lower soap	25
Lime	87
Lime and chert	16
Lime	10
Oriskany sand	6
Lime	26
Brown lime	10
Total depth	446

Show of gas at 294 to 300 and 402 feet.
Show of oil at 364 to 378 feet.
Fresh water at 51 and 89 feet; black salt water at 436 feet.

Luke Smith

M. McFadden No. 1, lot 12, N.½, con. IX, Chatham tp.

Completed June 20, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	45
Top lime	50
Soap and lime streaks	200
Light-buff lime with grey streaks	90
Sharp grey rock	20
Total depth	405

Oil at 295 to 300 and 380 to 385 feet.
Fresh water at 52 feet; salt water at 405 feet.

Prairie Gas and Oil Co., Ltd.

H. C. Thomas No. 1, lot 5, con. III, Dover tp.

Completed August 10, 1938.
Producing gas well.
Rock pressure: 960 lbs.

Formation	Thickness, ft.
Surface	70
Huron brown shale	15
Hamilton lime and shale	216
Brown lime	199
Brown lime and gypsum	200
Sharp lime	265
Grey lime	150
Lime shell and gypsum	285
Blue shale, lime and gypsum	100
Hard brown lime	220
Grey and brown lime	200
Blue shale	20
Clinton lime	5
Red Medina	40
Blue shale	85
White Medina	40
Queenston	290
Blue shale	260
Grey shale	100
Brown shale	110
Trenton lime	404
Total depth	3,274

Gas at 2,930, 2,950, 2,955, 2,960, 2,970, 2,975, 2,980, 2,990, 2,995, 3,000, 3,002, 3,005, 3,020, 3,034, 3,045, 3,059, 3,118, 3,127, and 3,137 feet.
Show of oil at 3,225 feet.
Fresh water at 65 feet; black water at 450 feet; salt water at 1,670, 1,705, and 3,225 feet.

E. P. Rowe

G. Ackert No. 1, lot 6, con. I, Harwich tp.

Completed July 15, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	70
Black shale	26
Top rock	21
Soap	37
Hard soap	2
Soap	14
Hard shell	2
Soap	36
Hard shell	9
Soap	24
Middle lime	6
Lower soap	45
Lime	81
Lime and chert	8
Soft lime	2
Lime	82
Total depth	488

Gas at 298, 344, and 391 feet.

E. P. Rowe

W. Krieger No. 1, lot 7, con. I, Harwich tp.

Completed April 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	78
Black shale	22
Grey shale	2
Top rock	23
Soap	93
Shell	12
Soap	38
Middle lime	5
Lower soap	29
Lime	92
Lime and chert	12
Sharp sand	8
Grey and brown lime	4
Lime	29
Sharp sand	5
Brown shale	4
Grey lime	29
Sharp sand	5
Brown shale	4
Grey lime	11
Brown lime and water	9
Total depth	472

Show of gas and oil at 364 to 394 feet.
Fresh water at 64 to 78 feet.

E. P. Rowe

W. Krieger No. 2, lot 7, con. I, Harwich tp.

Completed August 27, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	69
Black shale	27
Top rock	16
Soap	6
Hard grey shell	6
Soap	50
Hard shell	3
Soap	39
Lime shell	8
Soap	17
Lime shell	6
Soap	18
Middle lime	6
Lower soap	25
Lime	85
Brown cherty lime	8
Blue cherty lime	3
Hard grey lime	12
Total depth	404

Show of oil at 355 to 360 feet.
Fresh water at 69 feet.

J. B. Fitzpatrick

J. Lather No. 1, lot 20, con. XVI, Orford tp.

Completed October 26, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	204
Lime shell	1
Soap	19
Middle lime	6
Lower soap	9
Hard shell	1
Soap	12
Black streak	10
Lower lime	163
Total depth	425

Oil at 265 and 400 feet.
Fresh water at 70 feet; salt water at 400 feet.

Olga Gas Limited

J. Cochrane No. 1, lot 59, N.T.R., Orford tp.

Completed November 24, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	153
Hamilton lime and shale	345
Grey lime	122
Sharp sand	70
Grey lime	35
Sharp sand	110
Grey and blue lime	140
Grey and brown lime	160
Brown and grey lime	167
Blue and brown lime	75
Grey and brown lime	91
Grey lime	82
Brown and grey lime	30
Brown lime	70
Grey and brown lime	50
Dolomite (water sand)	10
Total depth	1,710

Show of gas at 1,677 feet.
Show of oil at 1,677 to 1,695 feet.
Sulphur water at 995 feet; salt water at 1,710 feet.

E. A. Roth

H. Dickson No. 1, lot 21, con. XII, Orford tp.

Completed January 3, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	160
Soap	160
Middle lime	15
Lower soap	29
Lower lime	167
Total depth	531

Fresh water at 100 feet; salt water at 531 feet.

Gas Producers Syndicate

G. L. Pardo No. 4, lot 139, E.½, N.T.R., Raleigh tp.

Completed January 26, 1938.
Producing gas well.
Rock pressure: 490 lbs.

Formation	Thickness, ft.
Surface	193
Lime and shale	151
Grey lime	203
Lime	15
Brown lime	95
Grey lime	163
Brown and grey lime	50
Brown lime	165
Grey and brown lime	25
Blue lime	65
Brown and blue lime	11
Brown and grey lime	164
Blue lime	35
Brown and grey lime	55
Salt	25
Brown lime	62
Brown and grey lime	48
Grey lime	39
Tota l depth	1,564

Gas at 1,458, 1,505, and 1,518 to 1,525 feet.
Sulphur water at 540 feet; sulphur and salt water at 800 feet.

E. P. Rowe

L. Bruette No. 4, lot 5, S.W.½, con. II, Raleigh tp.
Completed November 4, 1938.
Producing gas well.
Rock pressure: 745 lbs.

Formation	Thickness, ft.
Surface	75
Brown shale	25
Hamilton lime and shale	210
Onondaga grey lime	135
Sharp brown lime	75
Brown lime and gypsum	190
Sharp lime	255
Grey lime and gypsum	145
Blue lime, shale and gypsum	360
Hard brown lime	390
Niagara grey lime	52
Rochester blue shale	16
Clinton grey lime	7
Blue shale	5
Red shale	30
Blue shale	90
White Medina	45
Blue shale	5
Queenston	275
Hudson River blue shale	225
Grey shale	135
Brown shale	130
Trenton	444
Total depth	3,319

Gas at 2,975, 2,990, 2,995, 3,000, 3,010, 3,015, 3,020, 3,025, 3,035, 3,039, 3,055, 3,060, 3,065, 3,070, 3,075, 3,080, 3,090, 3,095, 3,100, 3,145, and 3,150 feet.
Show of oil at 3,165, 3,180, 3,205, and 3,300 to 3,319 feet.
Fresh water at 52 feet; salt water at 390 feet; sulphur water at 480 and 495f eet; salt water at 3,165 and 3,300 to 3,319 feet.

Union Gas Co. of Canada, Ltd.

J. Clayton No. 1, lot 17, W.½ of S.½, con. XV, Raleigh tp.
Completed May 17, 1938.
Producing gas well.
Rock pressure: 520 lbs.

Formation	Thickness, ft.
Surface	182
Lime and shale	108
Grey lime	110
Brown lime	172
Grey and brown lime	28
Sharp grey lime	229
Brown, and grey and brown lime	161
Grey lime	71
Blue lime	36
Brown and grey lime	183
Grey and blue lime	99
Grey and brown lime	18
Brown lime	33
Grey and brown lime	57
Grey lime	63
Total depth	1,550

Gas at 1,397 to 1,412, 1,499 to 1,542, 1,544, 1,548, and 1,550 feet.
Fresh water at 240 feet; sulphur water at 405, 500, and 540 feet.

Union Gas Co. of Canada, Ltd.

C. C. Bragg Estate No. 1, lot 164, N.T.R., Raleigh tp.
Completed December 27, 1938.
Producing gas well.
Rock pressure: 228 lbs.

Formation	Thickness, ft.
Surface	155
Hamilton shale and lime shell	165
Grey lime	75
Brown and grey lime	54
Brown lime	141
Sharp brown and grey lime	100
Brown lime	53
Brown and grey lime	78
Grey lime	57
Blue and grey lime	196
Grey and brown lime	134
Grey lime	57
Total depth	1,405

Gas at 1,258, 1,310, 1,318, 1,363, 1,369, 1,375, and 1,380 feet.
Sulphur water at 535, 660, 690, and 1,405 feet.

Union Gas Co. of Canada, Ltd.

C. T. Coatsworth No. 1, lot 159, W.½, N.T.R., Raleigh tp.
Completed March 30, 1938.
Producing gas and oil well.
Rock pressure: 425 lbs.

Formation	Thickness, ft.
Surface	158
Hamilton shale and lime shell	184
Grey lime	234
Brown lime	49
Sharp grey lime	155
Brown and grey lime	102
Brown and blue lime and gypsum	6
Brown and blue lime	6
Brown and blue lime and gypsum	14
Brown and grey lime	41
Grey and brown lime and gypsum	30
Blue and brown lime and gypsum	81
Brown lime	28
Brown and blue lime and gypsum	12
Brown lime	66
Brown and blue lime and gypsum	6
Brown and blue lime	88
Brown lime	88
Grey, and brown and blue lime	46
Grey lime	54
Total depth	1,448

Gas at 1,305, 1,318, 1,365 to 1,370, 1,415, and 1,431 to 1,433 feet.
Oil at 1,430 to 1,433 feet.
Sulphur water at 560, 590, and 780 feet.

UNION GAS CO. OF CANADA, LTD.

J. Coatsworth No. 1, lot 160, W.½, N.T.R., Raleigh tp.

Completed January 29, 1938.
Producing gas well.
Rock pressure: 337 lbs.

Formation	Thickness, ft.
Surface	156
Hamilton shale and lime shell	179
Grey lime	290
Sharp grey lime	140
Brown lime	101
Grey and brown lime	65
Brown and blue lime and gypsum	92
Blue and brown lime	18
Brown lime	118
Blue lime	83
Brown lime	82
Grey lime	34
Brown lime	24
Grey lime	48
Total depth	1,430

Gas at 1,294, 1,318, 1,387 to 1,393, 1,399, 1,411, 1,417, 1,423, and 1,425 feet.
Fresh water at 156 feet; sulphur water at 525 and 765 feet; salt water at 865 feet.

UNION GAS CO. OF CANADA, LTD.

H. D'Clute No. 1, lot 146, E.½ of W.½, N.T.R., Raleigh tp.

Completed August 23, 1938.
Producing gas well.
Rock pressure: 460 lbs.

Formation	Thickness, ft.
Surface	182
Lime and shale	103
Grey lime	113
Brown lime	162
Sharp brown and grey lime	134
Fine sharp white lime	6
Sharp grey lime	45
Grey and brown lime	202
Brown lime and gypsum	24
Brown and grey lime	41
Grey and blue lime	18
Brown lime	46
Blue, and grey and brown lime	151
Brown and blue lime	150
Brown lime	67
Grey lime	54
Brown lime	40
Light-grey lime	16
Total depth	1,554

Gas at 1,456, 1,516 to 1,528, 1,532 to 1,544, and 1,551 feet; small amount of sweet gas at 1,414 and 1,425 feet.
Fresh water at 175 feet; sulphur water at 305 feet.

UNION GAS CO. OF CANADA, LTD.

J. D'Clute No. 1, lot 146, W.½ of W.½, N.T.R., Raleigh tp.

Completed February 26, 1938.
Producing gas well.
Rock pressure: 430 lbs.

Formation	Thickness, ft.
Surface	190
Lime and shale	73
Grey lime	81
Brown lime	54
Grey and brown lime	167
Sharp grey lime	181
Brown and grey lime	94
Brown lime	94
Grey and blue lime	99
Brown lime	6
Grey lime	50
Blue and grey lime	67
Brown and grey lime	54
Blue, brown, and grey lime	170
Brown lime	52
Grey lime	52
Brown lime	29
Grey lime	35
Total depth	1,548

Gas at 1,412 to 1,414, 1,431, 1,467, 1,515 to 1,519, 1,522, 1,526 to 1,527, 1,532, 1,536, and 1,540 to 1,542 feet.
Sulphur water at 300 and 667 feet.

UNION GAS CO. OF CANADA, LTD.

F. E. Guyett No. 1, lot 144, S.½, N.T.R., Raleigh tp.

Completed January 22, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	200
Hamilton shale	105
Grey lime	70
Brown lime	200
Grey lime	41
Sharp grey lime	214
Brown and grey lime	115
Brown lime	85
Blue and grey lime	33
Brown, blue, and grey lime	144
Brown and grey lime	72
Brown lime	49
Blue and brown lime	107
Brown lime	46
Grey lime	38
Brown lime	40
Grey lime	29
Total depth	1,588

Gas at 1,575 and 1,580 feet; show of gas at 1,564 feet.
Fresh water at 195 and 230 feet; sulphur water at 587 and 812 feet; salt water at 1,580 feet.

UNION GAS CO. OF CANADA, LTD.

Hornby No. 1, lot 147, E.½, N.T.R., Raleigh tp.

Completed September 26, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	180
Shale	90
Grey lime	71
Brown lime	209
Sharp brown and grey lime	150
Grey lime	108
Brown and grey lime	81
Brown lime	193
Blue, and brown and blue lime	71
Brown lime	63
Blue, and brown and blue lime	193
Brown lime	42
Grey lime	41
Brown lime	35
Grey lime	6
Total depth	1,533

Show of gas at 1,428 to 1,451 feet.
Sulphur water at 620 feet; salt water at 1,530 feet.

UNION GAS CO. OF CANADA, LTD.

Hughson and Bragg No. 1, lot 164, W.½, S.T.R., Raleigh tp.

Completed November 16, 1938.
Producing gas well.
Rock pressure: 275 lbs.

Formation	Thickness, ft.
Surface	157
Hamilton shale and lime shell	161
Grey lime	80
Brown and grey lime	182
Sharp grey lime	110
Grey and brown lime	110
Grey lime and gypsum	8
Grey lime	47
Grey and blue lime	102
Brown and grey lime	134
Blue lime	140
Grey and brown lime	114
Grey lime	81
Grey and brown lime	12
Total depth	1,438

Gas at 1,293, 1,357, 1,369, 1,383, 1,397, and 1,408 feet; show of sulphur gas at 150 feet; show of sweet gas at 1,255 feet.
Fresh and sulphur water at 150 feet; sulphur water at 618 and 698 feet.

UNION GAS CO. OF CANADA, LTD.

C. and J. J. Kendall No. 1, lot 160, N.E.½, N.T.R., Raleigh tp.

Completed March 2, 1938.
Producing gas well.
Rock pressure: 490 lbs.

Formation	Thickness, ft.
Surface	157
Hamilton lime and shale	178
Grey lime	91
Brown lime	72
Grey lime	74
Brown lime	53
Sharp grey lime	135
Brown lime	41
Grey and brown lime	112
Brown and blue lime	33
Grey lime	42
Brown and blue lime	36
Brown lime	135
Blue lime	67
Blue and brown lime	24
Brown lime	65
Grey lime	47
Brown lime	24
Grey lime	45
Total depth	1,431

Gas at 1,294 to 1,300, 1,418 to 1,423, and 1,428 feet; surface gas at 150 feet.
Show of oil at 1,423 feet.
Fresh water at 155 feet; sulphur water at 465, 535, and 578 feet; salt water at 1,423 and 1,428 feet.

UNION GAS CO. OF CANADA, LTD.

J. D. Johnson No. 1, lot 158, W.½, N.T.R., Raleigh tp.

Completed May 19, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	160
Hamilton lime and shale	185
Grey lime	212
Brown lime	76
Grey lime	27
Sharp grey lime	120
Brown lime	53
Grey and brown lime	100
Blue, grey, and brown lime	30
Blue lime and gypsum	62
Blue and brown lime	36
Brown lime	28
Blue and brown lime	107
Blue lime	66
Blue and brown lime	30
Brown and grey lime	108
Grey lime	47
Brown and grey lime	33
Total depth	1,480

Gas at 1,405 to 1,416, 1,443 to 1,447, and 1,457 to 1,463 feet; show of gas at 1,310 and 1,418 feet.
Fresh water at 158 feet; sulphur water at 550 feet; salt water at 1,418 and 1,480 feet.

UNION GAS CO. OF CANADA, LTD.

R. A. Moore Estate No. 1, lot 142, W.½ of E.½, N.T.R., Raleigh tp.

Completed December 3, 1938.
Producing gas well.
Rock pressure: 495 lbs.

Formation	Thickness, ft.
Surface	210
Lime and shale	118
Grey lime	72
Brown lime	245
Sharp brown and grey lime	180
Grey and brown lime	104
Brown and grey lime and gypsum	37
Brown and grey lime	103
Brown and blue lime	77
Brown lime	56
Brown and blue lime	174
Brown lime	58
Grey lime	36
Brown lime	58
Grey lime	20
Total depth	1,548

Gas at 1,399, 1,405, 1,410 to 1,416, 1,470 to 1,475, 1,484, 1,504 to 1,510, 1,532 to 1,541 feet; show of gas at 1,210, 1,220, 1,260, and 1,265 feet.
Fresh water at 205 feet; sulphur water at 585 feet.

UNION GAS CO. OF CANADA, LTD.

W. J. Seney No. 1, lot 13, con. XV, Raleigh tp.

Completed November 2, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	185
Lime and shale	103
Grey lime	79
Brown lime	54
Grey and brown lime	84
Brown lime	70
Sharp grey lime	153
Grey lime	78
Brown and grey lime	59
Brown lime	111
Grey lime and gypsum	6
Brown lime	102
Blue and brown lime	111
Brown lime	30
Brown and blue lime	42
Brown lime	33
Blue and brown lime	107
Brown lime	55
Grey lime	28
Brown lime	42
Grey lime	23
Total depth	1,555

Gas at 1,433, 1,439, 1,537, 1,538 to 1,550 feet; show of gas at 250 and 1,537 feet.
Fresh water at 172 feet; sulphur water at 250 and 320 feet.

UNION GAS CO. OF CANADA, LTD.

Union Gas Company No. 1, lot 157, E.½, S.T.R., Raleigh tp.

Completed April 7, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	164
Hamilton shale	202
Grey lime	173
Brown lime	106
Sharp brown and grey lime	145
Brown lime	74
Brown and grey lime	51
Brown and blue lime and gypsum	6
Grey lime	63
Blue and grey lime	86
Grey and brown lime	136
Grey lime	35
Blue lime	42
Grey and brown lime	65
Grey lime	42
Brown lime	30
Grey lime	43
Grey, and grey and brown lime	16
Total depth	1,479

Gas at 1,433, 1,436, 1,441, 1,456, and 1,467 feet; show of sweet gas at 1,336 feet; show of sulphur gas at 1,427 feet.
Sulphur water at 565 and 630 feet; salt water at 1,473 feet.

UNION GAS CO. OF CANADA, LTD.

G. E. Brown No. 3, lot 181, N.T.R., Romney tp.

Completed August 22, 1938.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	174
Hamilton shale	30
Grey and brown lime	128
Brown lime	133
Sharp grey lime	102
Brown and grey lime	113
Grey and blue lime and gypsum	18
Blue lime and gypsum	13
Grey and blue lime	78
Grey and brown lime	147
Blue lime	118
Grey lime	203
Total depth	1,275

Gas at 1,078, 1,128 to 1,131, 1,143, 1,153 to 1,160, 1,180, 1,228, 1,235, 1,242, and 1,254 feet.
Sulphur water at 460 and 574 feet.

UNION GAS CO. OF CANADA, LTD.

Mrs. A. W. Byrum No. 10, lot 183, N.T.R., Romney tp.

Completed October 17, 1938.
Producing gas well.
Rock pressure: 160 lbs.

Formation	Thickness, ft.
Surface	175
Hamilton shale	20
Grey lime	95
Brown and grey lime	87
Brown lime	54
Grey lime	39
Sharp grey lime	130
Grey lime and gypsum	62
Grey lime	48
Grey lime and gypsum	14
Blue and brown lime	39
Brown and grey lime	30
Blue and grey lime	76
Grey and brown lime	138
Blue lime	90
Grey and brown lime	68
Grey lime	67
Brown lime	6
Grey lime	62
Total depth	1,300

Gas at 1,153 to 1,159, 1,165, 1,185, 1,212, 1,254, 1,264, and 1,270 feet.
Fresh water at 170 feet; sulphur water at 540 and 605 feet.

UNION GAS CO. OF CANADA, LTD.

B. Fletcher No. 9, lot 180, E.½, N.T.R., Romney tp.

Completed July 20, 1938.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	172
Hamilton shale	35
Grey and brown lime	146
Brown lime	127
Sharp grey lime	97
Brown and grey lime	113
Grey lime and gypsum	59
Brown and grey lime	196
Brown and blue lime and gypsum	12
Blue lime	98
Brown and blue lime	30
Brown lime	49
Grey lime	61
Brown lime	14
Grey lime	64
Total depth	1,273

Gas at 1,116 to 1,122, 1,140 to 1,158, 1,225 to 1,232, and 1,255 to 1,264 feet.
Show of gas at 939 and 1,060 feet.
Fresh water at 170 feet; sulphur water at 390 feet.

UNION GAS CO. OF CANADA, LTD.

B. Fletcher No. 10, lot 180, E.½, N.T.R., Romney tp.

Completed July 25, 1938.
Producing gas well.
Rock pressure: 165 lbs.

Formation	Thickness, ft.
Surface	175
Hamilton shale	35
Grey lime	60
Brown lime	179
Grey lime	12
Sharp grey lime	124
Grey lime	100
Brown lime	18
Grey and blue lime and gypsum	44
Brown, blue, and grey lime	86
Grey and brown lime	153
Blue lime	84
Grey and blue lime	43
Grey lime	12
Brown and grey lime	94
Grey lime	54
Total depth	1,273

Gas at 1,137 to 1,150, 1,170, 1,216, 1,239, 1,245, and 1,254 feet.
Fresh water at 170 feet; sulphur water at 405, 600, and 612 feet.

UNION GAS CO. OF CANADA, LTD.

R. Whillan No. 10, lot 179, S.¾, N.T.R., Romney tp.

Completed September 15, 1938.
Producing gas well.
Rock pressure: 228 lbs.

Formation	Thickness, ft.
Surface	179
Hamilton shale	48
Grey lime	94
Brown lime	24
Grey lime	92
Brown and grey lime	78
Sharp grey lime	111
Brown and grey lime	116
Blue lime and gypsum	21
Blue, grey, and brown lime	21
Grey and blue lime	105
Grey and brown lime	122
Blue and grey lime	39
Blue lime	66
Grey and brown lime	54
Grey lime	130
Total depth	1,300

Gas at 1,181, 1,204, 1,273 [illegible],275, 1,280, 1,286, and 1,294 feet.
Sulphur water at 350 and 630 feet.

UNION GAS CO. OF CANADA, LTD.

Canada Company No. 1, lot 11, N.W.¼ of S.E.½ con. XI, Tilbury East tp.

Completed June 21, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	152
Hamilton shale and lime shell	55
Grey lime	77
Brown lime	43
Grey lime	108
Brown lime	30
Grey lime	196
Grey and brown lime	79
Brown and blue lime and gypsum	12
Brown and grey lime	91
Blue lime	42
Blue and brown lime	96
Brown lime	67
Blue lime	127
Brown lime	90
Grey and brown lime	71
Grey lime	54
Total depth	1,390

Small amount of gas at 1,230 to 1,236 and 1,241 to 1,247 feet; show of gas at 940 to 946 feet.
Fresh water at 150 feet; sulphur water at 350 and 675 feet; salt water at 1,375 feet.

UNION GAS CO. OF CANADA, LTD.

J. Phelps No. 1, lot 9, N.E.¼, con. XV, Tilbury East tp.

Completed July 23, 1938.
Producing gas well.
Rock pressure: 160 lbs.

Formation	Thickness, ft.
Surface	170
Hamilton shale and shell	100
Grey lime	68
Brown lime	91
Grey and brown lime	91
Sharp brown and grey lime	181
Grey and brown lime	97
Grey lime and gypsum	25
Grey and brown lime	48
Grey and blue lime	89
Grey and brown lime	140
Blue and grey lime	71
Grey and brown lime	62
Brown lime	50
Grey and brown lime	60
Grey lime	31
Total depth	1,374

Gas at 1,290, 1,350, and 1,368 feet; show of gas at 1,247 feet.
Fresh water at 140 feet; sulphur water at 430, 495, and 655 feet.

WM. GUEST

L. G. Herbert No. 1, lot 5, con. I, Zone tp.

Completed January 5, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	47
Hardpan	15
Soft shale	18
Upper soap	177
Middle lime	8
Lower soap	25
Black streak	7
Lower lime	123
Water sand	4
Total depth	424

Show of oil at 300 feet.
Fresh water at 46 and 64 feet; salt water at 424 feet.

WM. GUEST

L. G. Herbert No. 2, lot 5, con. I, Zone tp.

Completed January 31, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	58
Upper soap	172
Middle lime	8
Lower soap	25
Black streak	5
Soap streak	2
Lower lime	125
Oriskany sand	10
Light-grey lime	60
Brown and grey shale and gypsum	285
Total depth	750

Fresh water at 52 and 112 feet; salt water at 325 feet.

MCCRIE AND WILLITS

D. B. Granger No. 1, lot 4, con. VI, Zone tp.

Completed February 20, 1938.
Dry hole.

Formation	Thickness. ft.
Surface	50
Hardpan	42
Soap	113
Middle lime	12
Lower soap	47
Dark streak	12
Lower lime	150
Total depth	426

Salt water at 426 feet.

REVEREND FATHER MCHUGH

Reverend McHugh No. 1, lot 6 A, S.T.R., Zone tp.
Completed May 20, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	70
Hardpan	53
Gravel	38
Hardpan	14
Top soap	66
Middle lime	8
Lower soap	28
Lower lime	133
Total depth	410

Fresh water at 12 feet.

MARTIN AND GIBSON

R. Jones No. 4, lot 5, con. V, Zone tp.
Completed January 9, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	60
Hardpan	70
Gravel	30
Top soap	42
Middle lime	10
Lower soap	38
Lower lime	146
Total depth	395

Show of oil at 325 feet.
Fresh water at 130 feet.

MARTIN AND GIBSON

R. Jones No. 5, lot 5, con. V, Zone tp.
Completed January 21, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	45
Hardpan	62
Gravel	53
Soap and lime streak	45
Middle lime	10
Lower soap	41
Lower lime	124
Total depth	380

Oil at 323 feet.
Fresh water at 140 feet.

E. A. ROTH

A. Cruickshank No. 1, lot 5, con. II, Zone tp.
Completed July 13, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	58
Hardpan	18
Top rock	9
Top soap	198
Middle lime	7
Lower soap	35
Lower lime	132
Total depth	457

Fresh water at 70 feet; salt water at 455 feet.

E. A. ROTH

A. Cruickshank No. 1, lot 6, con. IV, Zone tp.
Completed January 31, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	50
Hardpan	45
Top soap	105
Middle lime	12
Lower soap	24
Lower lime	167
Total depth	403

Fresh water at 50 feet; salt water at 403 feet.

J. VON BERG

H. Brewer No. 7, lot 19, N.L.R., Zone tp.
Completed July 2, 1938.
Small producing oil well.

Formation	Thickness, ft.
Sand	18
Clay	45
Gravel and sand	138
Lower lime	186
Total depth	387

Oil at 230 and 370 feet.
Fresh water at 18 and 63 feet; salt water at 230 and 360 feet.

Lambton County

W. BURBANK

L. Mater No. 1, lot 28, W.½, con. XI, Dawn tp.
Completed November 9, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	102
Top rock	61
Upper soap	131
Middle lime	16
Lower soap	21
Black streak	7
Lower lime	137
Total depth	475

Fresh water at 58 feet; black water at 470 feet.

LITTLE KLONDYKE GAS AND OIL SYNDICATE

R. Currie No. 1, lot 19, con. XIII, Dawn tp.
Completed September 28, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	29
Top rock	16
Soap	135
Middle lime	12
Lower soap	23
Big lime	111
Total depth	326

Oil at 314 feet.
Fresh water at 35 feet.

LITTLE KLONDYKE GAS AND OIL SYNDICATE

McClintock No. 1, lot 19, con. XII, Dawn tp.

Completed October 12, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	35
Top rock	19
Soap	133
Middle lime	14
Lower soap	24
Big lime	125
Total depth	350

Oil at 319 feet.
Fresh water at 40 feet.

LITTLE KLONDYKE GAS AND OIL SYNDICATE

H. D. McLennan No. 1, lot 18, W.½, con. XIII, Dawn tp.

Completed September 10, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	20
Ipperwash lime	9
Hardpan	6
Upper soap with beds of lime	137
Middle lime	8
Lower soap	25
Big lime	106
Water lime	6
Total depth	327

Oil at 250 to 255, 261 to 262, and 310 to 321 feet.
Sulphur water at 25 feet.

UNION GAS CO. OF CANADA, LTD.

E. Hartwick No. 1, lot 25, S.W.¼, con. XII, Dawn tp.

Completed November 10, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	45
Brown shale	95
Lime and shale	247
Grey and brown lime	63
Grey lime	100
Brown lime	255
Sharp grey lime	300
Brown lime	90
Brown and blue lime	145
Brown lime	40
Brown and blue lime	15
Brown lime	60
Brown and blue lime	100
Brown lime	75
Blue and brown lime	55
Grey lime	20
Brown lime	80
Grey lime	40
Brown lime	65
Grey lime	6
Total depth	1,896

Small amount of gas at 1,695 to 1,700 feet.
Show of oil at 1,710 feet.
Fresh water at 45 feet; sulphur water at 430 feet; salt water at 1,675 and 1,840 feet.

UNION GAS CO. OF CANADA, LTD.

Mrs. J. McKinnon No. 1, lot 24, E.½, con. IV, Dawn tp.

Completed September 17, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	80
Black shale	180
Lime and shale	310
Grey lime	140
Brown and grey lime	40
Brown lime	225
Grey lime	40
Sharp grey lime	105
Brown lime	100
Brown and blue lime	45
Blue lime	30
Blue and brown lime	15
Blue lime	80
Brown and blue lime	135
Blue lime	50
Brown and blue lime	50
Brown lime	86
Brown, blue, and grey lime	49
Brown lime	117
Grey and brown lime	45
Grey lime	16
Total depth	1,938

Show of gas at 1,424 to 1,430, 1,461 to 1,466, and 1,635 to 1,660 feet.
Show of oil at 1,635 to 1,660 feet.
Fresh water at 70 feet; sulphur water at 625 and 660 feet; salt water at 1,500 feet.

UNION GAS CO. OF CANADA, LTD.

H. and T. Mawlam No. 1, lot 23, E.½, con. XIV, Dawn tp.

Completed July 18, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	42
Brown shale	73
Lime and shale	250
Brown and grey lime	130
Sharp lime	30
Brown lime	280
Grey and brown lime	10
Sharp grey lime	195
Brown lime	90
Brown, blue, and grey lime	75
Blue lime	80
Brown and blue lime	140
Blue lime	40
Brown and blue lime	53
Salt	32
Brown and grey lime	95
Blue and grey lime	25
Brown lime	85
Grey lime	20
Brown lime	125
Grey lime	45
Grey shale	7
Total depth	1,922

Show of gas at 1,647 feet.
Sulphur water at 470 and 495 feet; salt water at 1,675 feet.

W. J. HUSSEY

W. J. Hussey No. 1, lot 11, con. XI, Enniskillen tp.

Completed March 21, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	100
Top rock	40
Top soap	120
Middle lime	15
Lower soap	45
Onondaga lime	150
Total depth	470

Show of oil at 455 to 468 feet.
Fresh water at 108 and 450 feet.

W. E. Stanley

W. W. Johnson No. 1, lot 18, con. IX, Euphemia tp.
Completed March 18, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	82
Hardpan	11
Top rock	47
Top soap	142
Middle lime	12
Lower soap	16
Black streak	4
Lower lime	86
Total depth	400

Fresh water at 87 feet; salt water at 331 feet.

Union Gas Co. of Canada, Ltd.

Mrs. M. Bilton No. 1, lot 22, con. I, Euphemia tp.
Completed June 1, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	52
Brown shale	53
Lime and shale	277
Grey lime	123
Sharp grey lime	48
Brown lime	258
Sharp brown and grey lime	189
Brown lime	92
Brown and blue lime	6
Brown and blue lime and gypsum	6
Blue lime	6
Brown and blue lime and gypsum	24
Blue lime	18
Brown lime and gypsum	6
Brown lime	6
Blue lime	90
Brown and blue lime	250
Brown lime and salt	6
Brown lime	60
Brown, blue, and grey lime	72
Brown and grey lime	90
Brown lime	114
Grey lime	65
Grey shale	9
Total depth	1,920

Show of gas at 1,540 feet.
Sulphur water at 500 feet.

Union Gas Co. of Canada, Ltd.

J. L. and C. Elliott No. 1, lot 22, W.½, con. II, Euphemia tp.
Completed April 6, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	33
Brown shale	37
Lime and shale	240
Grey and brown lime	105
Sharp grey lime	33
Grey lime	12
Brown lime	240
Brown and grey lime	24
Sharp brown and grey lime	156
Brown lime	91
Brown and blue lime and gypsum	12
Blue and brown lime	30
Brown lime, and blue lime and gypsum	62
Brown and blue lime	108
Brown lime	72
Blue lime	66
Blue and grey lime	9
Salt	158
Brown lime	122
Grey and brown lime	86
Brown lime	135
Grey lime	62
Blue shale	12
Total depth	1,905

Show of gas at 108 feet.
Fresh water at 35 feet; sulphur water at 415 feet; salt water at 1,860 feet.

D. H. Wood

D. Dobbyn No. 1, lot 27, con. IV, Euphemia tp.
Completed May 8, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	12
Hard white rock	4
Soft white rock	4
Hardpan	5
Upper soap	165
Middle lime	20
Lower soap	20
Lower lime	110
Total depth	340

Oil at 337 feet.
Fresh water at 23 feet.

W. N. Alley

M. Kadey No. 1, lot 21, con. V, Warwick tp.
Completed November 30, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	89
Black shale	18
Hardpan	15
Mixed lime and soap	48
Soap	148
Middle lime	22
Lower soap	33
Lower lime	69
Oil sand	1½
Total depth	343½

Oil at 442 feet.
Fresh water at 88 feet.

W. N. Alley

M. Kadey No. 2, lot 21, E.½ of W.½, con. V, Warwick tp.
Completed December 20, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	86
Black shale	18
Hardpan	13
Mixed lime and soap	61
Lime	4
Soap	130
Middle lime	18
Soap	42
Lower lime	72
Total depth	444

Oil at 382, 439, and 444 feet.

Douglas Banks

A. Brush No. 1, lot 30, E.½, con. V, Warwick tp.
Completed November 13, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	109
Top rock	41
Top soap	130
Middle lime	26
Lower soap	34
Lower lime	170
Total depth	510

Show of gas at 150 feet.
Fresh water at 90 feet; salt water at 443 feet.

DOUGLAS BANKS

A. Brush No. 2, lot 30, con. V, Warwick tp.

Completed December 15, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	108
Top rock	22
Top soap	148
Middle lime	25
Lower soap	36
Lower lime	265
Total depth	604

Fresh water at 80 feet; salt water at 452 feet.

BURCHELL AND HEAL

S. Burchell No. 1, lot 27, con. V, Warwick tp.

Completed November 1, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	123
Lime	2
Lime and soap	12
Lime	10
Lime and soap	23
Hard lime	8
Soap	137
Middle lime	17
Lower soap	34
Dark lime	7
Grey lime	3
Total depth	376

Oil at 375 and 376 feet.
Fresh water at 120 to 123 feet.

BURCHELL AND HEAL

S. Burchell No. 2, lot 27, con. V, Warwick tp.

Completed November 16, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	122
Lime	2
Grey shale	6
Lime	1
Grey shale and lime	5
Lime	12
Lime and soap	22
Hard lime	7
Soap	138
Middle lime	18
Lower soap	31
Dark lime	9
Grey lime	7
Total depth	382

Oil at 374 feet.
Fresh water at 122 feet; sulphur water at 320 feet.

BUSBY AND FERGUSON

R. Chambers No. 1, lot 27, con. IV, Warwick tp.

Completed November 1, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	124
Top rock	63
Top soap	134
Middle lime	23
Lower soap	27
Black streak	7
Lower lime	149
Total depth	527

Oil at 440 feet.
Fresh water at 124 feet; salt water at 490 to 495 feet.

BUSBY AND FERGUSON

J. O'Neill No. 1, lot 28, con. IV, Warwick tp.

Completed November 22, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	132
Top rock	60
Top soap	130
Middle lime	26
Lower soap	27
Black streak	6
Lower lime	147
Total depth	528

Show of oil at 466 and 480 feet.
Fresh water at 120 feet; salt water at 528 feet.

T. W. COOPER

L. McLean No. 1, lot 23, con. V, Warwick tp.

Completed September 6, 1938.
Producing oil well.

Formation	Thickness, ft.
Clay	106
Hardpan	14
Grey shale	34
Hard streaks	31
Soap	145
Middle lime	12
Lower soap	38
Corniferous lime	120
Total depth	500

Oil at 385, 423, and 490 to 497 feet.
Fresh water at 107 feet.

COREY, HUSSEY AND BULLEN

Mrs. L. Chambers No. 1, lot 22, W.½ of E.½, con. V, Warwick tp.

Completed November 19, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	94
Top rock	55
Top soap	140
Middle lime	20
Lower soap	51
Lower lime	105
Total depth	465

Oil at 428 feet.
Fresh water at 100 feet.

THOMAS DRAPER

W. Redman No. 1, lot 23, E.½ of W.½, con. IV, Warwick tp.

Completed December 23, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	98
Top rock	102
Top soap	115
Middle lime	30
Lower soap	25
Lower lime	139
Total depth	509

Fresh water at 105 feet.

D. DURAND

E. Davidson No. 1, lot 26, E.½, con. VI, Warwick tp.
Completed December 7, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	130
Top rock	47
Soap	143
Middle lime	13
Soap	37
Lime	114
Total depth	484

Fresh water at 122 feet; salt water at 475 feet.

D. DURAND

T. Westgate, Sr., No. 1, lot 23, W.½ of E.½, con. V, Warwick tp.
Completed October 25, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	108
Top rock	62
Soap	143
Middle lime	14
Lower soap	38
Corniferous lime	105
Total depth	470

Oil at 442 to 449 feet; show of oil at 367 and 380 feet.
Show of gas at 405 feet.
Fresh water at 100 feet; salt water at 300 feet.

D. DURAND

T. Westgate, Sr., No. 2, lot 23, W.½ of E.½, con. V, Warwick tp.
Completed November 14, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	113
Top rock	64
Soap	141
Middle lime	14
Soap	39
Lime	119
Total depth	480

Oil at 404 and 434 feet.
Fresh water at 100 feet; salt water at 305 feet.

ALBERT E. GIBSON

J. Westgate No. 1, lot 23, con. IV, Warwick tp.
Completed October 3, 1938.
Producing oil well.

Formation	Thickness, ft.
Clay	78
Hardpan	9
Dark shale	12
Top rock	80
Soap	131
Lime and soap	10
Middle lime	12
Lower soap	38
Lime	110
Total depth	480

Oil at 425 feet.
Fresh water at 85 and 98 feet.

F. HAMBLY

Mrs. T. Westgate, Sr., No. 1, lot 24, W.¼, con. IV, Warwick tp.
Completed November 3, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	95
Lime and shale	80
Soap	131
Lime and soap	10
Middle lime	10
Lower soap	32
Dark lime	4
Mud vein	3
Lower lime	151
Total depth	516

Show of oil at 360 to 365 feet.
Fresh water at 95 feet; salt water at 475 feet.

HUSSEY AND DALE

W. Wood No. 1, lot 21, E.½ of E.½, lot 21, con. IV, Warwick tp.
Completed November 25, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	90
Soap and lime	40
Soap	160
Middle lime	10
Soap and lime	40
Lower soap	37
Lower lime	83
Total depth	460

Oil at 410 feet.
Fresh water at 80 feet; salt water at 410 feet.

HUSSEY, MCCLUSKEY AND BERG

T. Westgate, Sr., No. 1, lot 22, W.½ of E.½, con. V, Warwick tp.
Completed December 30, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	100
Black shale	15
Top rock	35
Top soap	160
Middle lime	20
Lime and soap	15
Lower soap	40
Lower lime	11
Total depth	396

Oil at 387 feet.
Fresh water at 100 feet.

F. R. MACINTOSH

A. S. Cameron No. 1, lot 25, S.W.¼, con. IV, Warwick tp.
Completed November 6, 1938.
Dry hole.

Formation	Thickness ft.
Surface	120
Grey shale	45
Mixed hard streaks	12
Soap	88
Brown lime	2
Soap	8
Mixed soap and shale	10
Soap	22
Mixed lime and soap	8
Middle lime	18
Lower soap	27
Lower lime	62
Yellow sand	33
Lime	30
Total depth	503

Show of gas at 419 feet.
Show of oil at 429 feet.
Fresh water at 105 feet; salt water at 430 and 473 feet.

A. E. McKercher

F. W. Short No. 1, lot 19, E.½, con. VI, Warwick tp.
Completed December 19, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	106
Black shale	6
Grey shale	8
Top rock	78
Upper soap	137
Middle lime	21
Lower soap	29
Black streak	8
Lower lime	94
Total depth	487

Fresh water at 101 feet.

H. P. Rose

H. Rivers No. 1, lot 29, con. IV, Warwick tp.
Completed November 21, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	125
Top rock	21
Middle lime	174
Lower soap	12
Lower lime	37
Lime	131
Total depth	500

Fresh water at 120 feet; salt water at 500 feet.

Shaw and Smith

E. Shaw No. 1, lot 28, W.½, con. V, Warwick tp.
Completed November 30, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	123
Top rock	7
Soap	10
Lime	10
Soap	15
Lime	10
Soap	108
Lime	7
Soap	22
Lime	26
Soap	29
Lime	103
Total depth	470

Oil at 380 and 430 feet.
Fresh water at 30, 65, and 118 feet.

A. Trelhaven

W. Morgan No. 1, lot 26, E.½, con. IV, Warwick tp.
Completed November 5, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	118
Top rock	75
Soap	125
Lime	20
Soap	39
Lime	127
Total depth	506

Fresh water at 118 to 120 feet; salt water at 465 and 491 feet.

J. von Berg

L. Eastabrook No. 1, lot 26, W.½, con. V, Warwick tp.
Completed October 25, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	140
Top rock	7
Top soap	168
Middle lime	15
Lower soap	38
Black streak	2
Lower lime	75
Total depth	445

Oil at 368 and 440 feet.
Fresh water at 100 and 305 feet.

J. von Berg

L. Eastabrook No. 2, lot 26, W.½, con. V, Warwick tp.
Completed December 2, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	135
Top rock	10
Top soap	25
Hard streak	5
Soap	10
Hard streak	5
Hard shell	70
Soap	76
Middle lime	22
Lower soap	36
Lower lime	78
Total depth	442

Oil at 364 feet.
Fresh water at 125 feet; salt water at 190 feet.

J. von Berg

L. Eastabrook No. 4, lot 26, W.½, con. V, Warwick tp.
Completed December 28, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	117
Top rock	28
Hard streak and soap	25
Top soap	133
Middle lime	18
Lower soap	39
Lower lime	10
Total depth	370

Oil at 340 to 345 and 360 feet.
Fresh water at 22 feet.

J. von Berg

J. Henderson No. 1, lot 22, con. IV, Warwick tp.
Completed December 22, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	90
Black shale	14
Grey shale	2
Soap and lime	44
Hard rock	15
Top soap	155
Middle lime	20
Lower soap	33
Lower lime	75
Total depth	448

Oil at 385 and 420 feet.
Fresh water at 90 feet.

B. Wilson

A. G. Brown No. 1, lot 24, E.½, con. VI, Warwick tp.
Completed December 16, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	123
Grey shale	2
Lime	35
Grey shale	16
Lime	9
Grey shale	103
Lime	8
Grey shale and lime	21
Lime	25
Grey shale and lime	27
Lime	6
Grey shale	4
Total depth	477

Oil at 380, 410, 422, and 444 feet.
Fresh water at 101 and 133 feet.

Wilson and Sullivan

L. Eastabrook No. 3, lot 26, W.½, con. V, Warwick tp.
Completed December 9, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	119
Shell	59
Hamilton shale	138
Middle lime	18
Lower shale	36
Onondaga	99
Total depth	469

Oil at 371 and 397 feet.
Show of gas at 180 feet.
Fresh water at 114 feet.

Wilson and Sullivan Development Company

L. Marley No. 1, lot 26, W.½ of E.½, con. V, Warwick tp.
Completed December 15, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	130
Soap	10
Hardpan	5
Top rock	7
Soap	22
Lime streak	6
Soap	137
Middle lime	20
Lower soap	30
Soft black lime	6
Grey lime	85
Total depth	458

Show of oil at 378 and 390 feet.
Fresh water at 122 and 145 feet.

J. W. G. Winnett

A. Westgate No. 1, lot 28, E.½, con. V, Warwich tp.
Completed November 4, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	124
Top rock	40
Top soap	150
Middle lime	11
Lower soap	50
Lower lime	111
Total depth	486

Oil at 435 feet.
Fresh water at 124 feet.

J. W. G. Winnett

A. Westgate No. 2, lot 28, E.½, con. V, Warwich tp.
Completed November 22, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	104
Top rock	50
Soap	140
Middle lime	11
Lower soap	40
Lower lime	113
Total depth	458

Oil at 355 and 425 to 430 feet.
Fresh water at 108 and 140 feet; salt water at 458 feet.

F. Yerks

T. Westgate No. 1, lot 24, con. IV S., Warwick tp.
Completed December 11, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	84
Hardpan	1
Gravel	1
Grey shale	10
Brown shale	1
Lime	8
Soft shale	4
Shale and lime streaks	73
Soap	66
Lime	4
Soap	52
Middle lime	27
Lower soap	34
Lower lime	53
Total depth	418

Oil at 367 and 408 to 418 feet.
Show of gas at 407 feet.
Fresh water at 86 feet; salt water at 408 to 418 feet

Lincoln County

Grimsby Natural Gas Co., Ltd.

I. S. Killens No. 2, lot 4, con. III, Caistor tp.
Completed September 15, 1938.
Producing gas well.
Rock pressure: 87 lbs.

Formation	Thickness, ft.
Surface	77
Lime	15
Niagara	185
Shale	40
Clinton	30
Red Medina	35
Shale	65
White Medina	12
Shale	40
Total depth	499

Gas at 452, 457, and 459 feet.

Grimsby Natural Gas Co., Ltd.

T. Beamer No. 1, lot 1, W.¼, con. II, Gainsborough tp.
Completed October 26, 1938.
Producing gas well.
Rock pressure: 75 lbs.

Formation	Thickness, ft.
Surface	79
Lime	20
Niagara	184
Shale	50
Clinton	30
Red Medina	40
Shale	55
White Medina	12
Shale	40
Total depth	520

Gas at 478 feet.
Sulphur water at 84 feet.

GRIMSBY NATURAL GAS CO., LTD.
T. Beamer No. 2, lot 1, W.¼, con. II, Gainsborough tp.
Completed November 14, 1938.
Producing gas well.
Rock pressure: 75 lbs.

Formation	Thickness, ft.
Surface	91
Lime	15
Niagara	191
Shale	50
Clinton	35
Red Medina	40
Shale	60
White Medina	12
Shale	40
Total depth	534

Gas at 493 feet.
Sulphur water at 93 feet.

Manitoulin District

SAULT STE. MARIE SYNDICATE
J. Marshall No. 1, lot 44, con. I, Assiginack tp.
Completed September 27, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	15
Dolomite	124
Grey shale	225
Brown shale	59
Black shale	21
Trenton lime	43
Total depth	487

Oil at 470 feet.

SAULT STE. MARIE SYNDICATE
J. Marshall No. 2, lot 44, con. I, Assiginack tp.
Completed October 27, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	26
Dolomite	114
Grey shale	235
Brown shale	52
Black shale	21
Trenton lime	42
Total depth	490

Oil at 480 to 485 feet.

SAULT STE. MARIE SYNDICATE
J. Marshall No. 3, lot 44, con. I, Assiginack tp.
Completed November 30, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	8
Richmond lime	142
Grey shale	185
Brown shale	88
Black shale	19
Trenton	43
Total depth	485

Oil at 453 feet; gas and oil at 471 to 485 feet.

SAULT STE. MARIE SYNDICATE
W. F. McCrae No. 1, lot 5, con. XI, Gordon tp.
Completed August 6, 1938.
Dry hole.

Formation	Thickness, ft.
Grey lime	167
Blue shale	145
Grey lime	1
Blue shale	144
Black shale	13
Trenton lime	140
Total depth	610

Salt water at 597 feet.

Middlesex County

DOUGLAS BANKS
F. Richardson No. 1, lot 3, W.½, con. IV, Adelaide tp.
Completed December 10, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	85
Top rock	40
Top soap	135
Middle lime	20
Lower soap	28
Black streak and soap	7
Lower lime	161
Total depth	476

Oil at 367 and 373 feet.
Fresh water at 80 feet; salt water at 367 to 373 feet.

CAMERON AND LETT
R. Waltham No. 1, lot 1, E.½, con. V, Adelaide tp.
Completed December 15, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	85
Lime and shale	60
Upper soap	135
Middle lime	20
Lower soap	30
Lower lime	120
Total depth	445

Oil at 340 and 385 feet.
Fresh water at 85 feet.

UNION GAS CO. OF CANADA, LTD.
F. Poole No. 1, lot 10, con. II, Delaware tp.
Completed October 11, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	192
Hamilton black shale	6
Grey and brown lime	47
Brown lime	245
Sharp grey lime	153
Brown and grey lime	114
Brown lime and shale (slate)	6
Shale and gypsum	144
Lime and shale	15
Brown lime, shale and gypsum	12
Brown lime and shale	18
Black shale and gypsum	6
Brown lime and shale	67
Brown lime and gypsum	23
Grey lime and shale	73
Brown lime	6
Brown and grey lime and shale	57
Brown and grey lime	97
Niagara lime	22
Total depth	1,303

Fresh water at 153 feet; sulphur water at 730 feet; salt water at 1,295 feet.

JAMES A. BEATTIE

J. Brigham No. 1, lot 5, N.W.¼, con. II, Metcalfe tp.
Completed December 10, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	100
Soap	13
Shell	1
Soap	170
Middle lime	16
Soap	12
Dark streak	8
Lower lime	50
Total depth	370

Oil at 331 and 340 feet.
Fresh water at 97 to 100 feet; salt water at 289 feet.

J. A. DE WITT

J. Harold No. 1, lot 18, con. I, N.T.R., Mosa tp.
Completed March 8, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	136
Top rock	6
Top soap	135
Middle lime	4
Shell and lower soap	89
Lower lime	17
Total depth	387

Fresh water at 110 feet.

J. A. DE WITT

Henderson No. 1, lot 17, con. I S., Mosa tp.
Completed January 7, 1938.
Dry hole.

Formation	Thickness, ft.
Sand	16
Clay	36
Hardpan, gravel and sand	80
Top rock	3
Top soap	157
Black streak	4
Soap	5
Lower lime	99
Total depth	400

Fresh water at 90 feet.

DOMINION PETROLEUM CO., LTD.

N. Gillies No. 11, lot 7, con. VI, Mosa tp.
Completed August 26, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	90
Upper soap	125
Middle lime	20
Lower soap	20
Lower lime	100
Soft lower lime	45
Total depth	400

Oil at 350 feet.
Fresh water at 83 feet.

DOMINION PETROLEUM CO., LTD.

N. Gillies No. 12, lot 7, con. VI, Mosa tp.
Completed September 15, 1938.
Producing oil well.

Formation	Thickness, ft.
Surface	90
Upper soap	125
Middle lime	20
Lower soap	20
Lower lime	100
Soft lower lime	40
Total depth	395

Oil at 345 feet.
Fresh water at 90 feet.

DOMINION PETROLEUM CO., LTD.

N. Gillies No. 13, lot 7, con. VI, Mosa tp.
Completed October 6, 1938.
Producing oil well.

Formation	Thickness, ft.
Clay	75
Gravel	10
Upper soap	135
Middle lime	20
Lower soap	20
Lower lime	100
Soft lower lime	40
Total depth	400

Oil at 345 feet.
Fresh water at 85 feet.

DOMINION PETROLEUM CO., LTD.

N. Gillies No. 14, lot 7, con. VI, Mosa tp.
Completed October 24, 1938.
Producing oil well.

Formation	Thickness, ft.
Clay	72
Gravel	13
Upper soap	135
Middle lime	20
Lower soap	20
Lower lime	80
Soft lower lime	40
Total depth	380

Oil at 345 feet.
Fresh water at 85 feet.

DOMINION PETROLEUM CO., LTD.

I. Secord No. 10, lot 6, con. VI, Mosa tp.
Completed July 28, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	87
Upper soap	138
Middle lime	20
Lower soap	20
Hard lower lime	75
Soft lower lime	25
Lower lime	15
Total depth	380

Oil at 340 feet.
Fresh water at 80 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 23, lot 6, con. VI, Mosa tp.

Completed January 7, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	245
Hard grey lime	40
Soft grey lime	5
Hard grey lime	45
Soft grey lime	15
Soft grey lime (oil sand)	20
Total depth	370

Oil at 350 feet.
Fresh water at 78 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 24, lot 6, con. VI, Mosa tp.

Completed March 24, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	87
Petrolia shale (upper soap)	113
Widder lime (middle lime)	20
Olentangy shale (lower soap)	25
Delaware and Onondaga lime:	
Hard grey lime	45
Soft lime	10
Hard grey lime	55
Lime (oil sand)	15
Total depth	370

Oil at 355 to 370 feet.
Fresh water at 80 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 25, lot 6, con. VI, Mosa tp.

Completed June 23, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	87
Petrolia shale (upper soap)	113
Widder lime (middle lime)	20
Olentangy shale (lower soap)	30
Delaware and Onondaga lime:	
Soft lime (oil sand)	30
Hard lime	75
Lime (oil sand)	25
Total depth	380

Oil at 270 to 280 and 360 to 380 feet.
Fresh water at 80 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 26, lot 6, con. VI, Mosa tp.

Completed May 3, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	96
Petrolia shale (upper soap)	113
Widder lime (middle lime)	21
Olentangy shale (lower soap)	25
Delaware and Onondaga lime:	
Hard lime	75
Soft lime	10
Hard lime	10
Lime (oil sand)	26
Total depth	376

Oil at 330 and 350 feet.
Fresh water at 80 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 27, lot 6, con. VI, Mosa tp.

Completed June 17, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	80
Petrolia shale (upper soap)	133
Widder lime (middle lime)	20
Olentangy shale (lower soap)	20
Delaware and Onondaga lime:	
Lower lime	100
Soft lower lime	20
Total depth	380

Oil at 265 and 355 feet.
Fresh water at 80 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 28, lot 6, con. VI, Mosa tp.

Completed May 23, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	80
Petrolia shale (upper soap)	7
Widder lime (middle lime)	20
Olentangy shale (lower soap)	20
Delaware and Onondaga lime:	
Hard lime	85
Lime (oil sand)	30
Total depth	375

Oil at 345 feet.
Fresh water at 87 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 29, lot 6, con. VI, Mosa tp.

Completed June 10, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	87
Petrolia shale (upper soap)	133
Widder lime (middle lime)	25
Olentangy shale (lower soap)	15
Delaware and Onondaga lime:	
Lower lime	101
Lime (oil sand)	20
Total depth	381

Oil at 345 feet.
Fresh water at 87 feet.

DOMINION PETROLEUM CO., LTD.

J. A. Walker No. 30, lot 6, con. VI, Mosa tp.

Completed July 7, 1938.
Small producing oil well.

Formation	Thickness, ft.
Surface	80
Petrolia shale (upper soap)	128
Widder lime (middle lime)	20
Olentangy shale (lower soap)	20
Delaware and Onondaga lime:	
Lower lime	100
Soft lime	20
Total depth	375

Oil at 345 feet.
Fresh water at 80 feet.

McGILL AND WILLITS

C. Davis No. 1, lot 14, S.L.R., Mosa tp.

Completed July 22, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	40
Hardpan and gravel	89
Top rock	59
Soap	103
Shale and soap	38
Total depth	329

Fresh water at 128 feet.

ALOKA OIL CO., LTD.

W. F. Duffin No. 1, lot 10, con. IV, West Nissouri tp.

Completed October 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	140
Grey lime	35
Brown lime	30
Grey lime	70
Brown lime	75
Lime and chert	190
Grey lime	20
Brown lime	70
Grey shale	120
Lime and shale	250
Guelph-Lockport	300
Blue shale	30
Clinton	20
Shale	20
Red Medina	20
Shale	20
Lime and shale	35
Total depth	1,445

Fresh water at 4 feet; salt water at 1,145, 1,175, and 1,295 feet.

VOLCANIC GAS AND OIL CO., LTD.

S. Davis No. 1, lot 34, S.E.¼, con. VII, West Nissouri tp.

Completed February 10, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	75
Buff, brown, and grey lime	448
Grey and brown lime, shale and gypsum	417
Grey-brown lime	30
Dark-grey shaly lime	40
Grey and grey-brown lime	70
Grey-buff lime	30
Total depth	1,110

Fresh water at 110 feet; salt water at 1,050 feet.

Norfolk County

H. SERLES

H. Serles No. 1, lot 5, con. IV, Windham tp.

Completed June 25, 1938.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Thickness, ft.
Surface	145
Lime and chert	30
Brown and grey lime	55
Lime and gypsum	90
Brown and grey lime	90
Lime and gypsum	45
Grey lime	65
Brown lime	5
Grey lime	40
Niagara lime	257
Grey lime	23
Lime and shale	15
Grey shale	27
Clinton	18
Red shale	10
Red and grey shale	15
Blue and grey shale	57
White Medina	11
Red shale	17
Total depth	1,016

Gas at 890 to 900 and 996 feet.
Fresh water at 145, 170, and 175 feet.

ECONOMY NATURAL GAS SYNDICATE

W. F. Colbe No. 1, lot 11, Town of Port Dover, Woodhouse tp.

Completed February 19, 1938.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	43
Flint	155
Lime and shale	449
Niagara	249
Shale	34
Clinton	26
Red Medina	35
Blue shale	65
White Medina	14
Red shale	50
Total depth	1,120

Gas at 989 and 1,067 feet.
Fresh water at 96 feet; black water at 254 feet.

UNION GAS CO. OF CANADA, LTD.

M. K. Fletcher No. 1, lot 23, N.W. pt., con. I, Woodhouse tp.

Completed October 28, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	29
Flint (cherty lime)	140
Lime	36
Lime and shale	345
Grey and brown lime	290
Rochester shale	67
Clinton	27
Red Medina	44
Blue shale	57
White Medina	14
Queenston red shale	3
Total depth	1,052

Show of gas at 944 and 1,039 feet.

WALTER GAS SYNDICATE, LTD.

P. O. Austin No. 1, lot 12, N.E.¼, con. IV, Woodhouse tp.

Completed October 31, 1938.
Producing gas well.
Rock pressure: 520 lbs.

Formation	Thickness, ft.
Surface	41
Flint	95
Lime and shale	359
Niagara lime	335
Grey shale	44
Clinton	20
Red Medina	35
Blue shale	70
Grey sand	10
Total depth	1,009

Gas at 900 and 917 feet.
Fresh water at 62 feet; sulphur water at 80 feet.

WALTER GAS SYNDICATE, LTD.

I. Hewitt No. 1, lot 11, con. V, Woodhouse tp.

Completed April 13, 1938.
Producing gas well.
Rock pressure: 500 lbs.

Formation	Thickness, ft.
Surface	50
Flint	95
Lime and shale	380
Niagara lime	317
Shale	39
Clinton	29
Red Medina	40
Blue shale	50
White Medina	10
Total depth	1,010

Gas at 883 and 899 feet.
Fresh water at 15 feet; sulphur water at 100 feet.

WALTER GAS SYNDICATE, LTD.

J. C. King No. 1, lot 12, S.½, con. V, Woodhouse tp.

Completed July 20, 1938.
Producing gas well.
Rock pressure: 520 lbs.

Formation	Thickness, ft.
Surface	58
Flint	105
Lime and shale	382
Niagara lime	300
Grey shale	60
Clinton	25
Red Medina	35
Blue shale	50
Total depth	1,015

Gas at 907 feet.
Fresh water at 75 feet; sulphur water at 170 feet.

Oxford County

AIKENS AND ADAMS

L. J. Brown No. 2, lot 27, con. XII, Dereham tp.

Completed February 12, 1938.
Producing gas well.
Rock pressure: 443 lbs.

Formation	Thickness, ft.
Surface	168
Lime and shale	140
Brown lime	50
Flint	110
Lime and shale	175
Brown and grey shale	105
Shale	50
Grey and brown lime	75
Brown lime	35
Guelph lime	27
Total depth	935

Gas at 908 and 917 to 935 feet.
Fresh water at 180 feet; sulphur water at 240 feet.

ALOKA-MCNEVIN

L. J. Brown No. 2, lot 26, con. XII, Dereham tp.

Completed February 14, 1938.
Producing gas well.
Rock pressure: 445 lbs.

Formation	Thickness, ft.
Surface	175
Top rock	10
Lime and shale	15
Brown and grey lime	165
Flint	118
Brown lime	75
Shale and streaks of gypsum	97
Brown lime	105
Shale and streaks of lime	75
Grey lime	60
Brown lime	37
Total depth	932

Gas at 920 and 928 feet.
Fresh water at 200 feet.

ALOKA-MCNEVIN-SCANLON No. 4

A. P. Scanlon No. 6, lot 25, con. XI, Dereham tp.

Completed January 4, 1938.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Thickness, ft.
Surface	166
Shale and lime	44
Brown lime	40
Brown and grey lime	115
Cherty lime	100
Grey lime	35
Brown and grey lime	65
Shale and gypsum	35
Grey shale	45
Brown lime	70
Grey lime	165
Brown and white lime	5
Brown lime	20
Grey lime	35
Total depth	940

Gas at 905 to 940 feet.
Fresh water at 206 feet.

ALOKA-MCNEVIN-SCANLON No. 5

A. P. Scanlon No. 7, lot 25, con. XI, Dereham tp.

Completed February 7, 1938.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Thickness, ft.
Surface	170
Shale and grey lime	45
Brown lime	150
Grey lime	20
Cherty lime	100
Grey lime	90
Shale and gypsum	65
Brown lime	70
Shale	5
Grey lime	35
Shale and grey lime	70
Brown and white lime	60
Brown lime	30
Grey lime	36
Total depth	946

Gas at 913 to 946 feet.
Fresh water at 80 and 170 feet.

ALOKA OIL CO., LTD.

Waterworth No. 9, lot 24, N. ½, con. XII, Dereham tp.

Completed February 8, 1938.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Thickness, ft.
Surface	172
Brown lime	28
Grey lime	15
Brown lime	65
Grey lime	60
Brown lime	30
Brown-grey flint	100
Brown lime	70
Lime, shale, and gypsum	120
Brown lime	80
Grey lime and shale	120
Grey shale	20
Grey lime	10
Brown lime	20
Grey lime	18
Total depth	928

Gas at 908 and 928 feet.
Fresh water at 172 feet.

ALOKA OIL CO., LTD.

Waterworth No. 10, lot 24, con. XII, Dereham tp.

Completed April 17, 1938.
Producing gas well.
Rock pressure: 441 lbs.

Formation	Thickness, ft.
Surface	171
Brown lime	24
Grey lime	25
Brown lime	70
Grey lime	35
Brown lime	45
Lime and chert	110
Brown lime	15
Grey lime	45
Lime, shale, and gypsum	125
Brown lime	75
Lime and shale	125
Grey shale	20
Grey lime	20
Brown lime	30
Total depth	935

Gas at 908 and 935 feet.
Fresh water at 171 feet.

ALOKA OIL CO., LTD.

Waterworth No. 11, lot 24, con. XII, Dereham tp.

Completed June 6, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	171
Brown lime	19
Grey lime	30
Brown lime	65
Grey lime	45
Brown lime	40
Lime and chert	115
Brown lime	10
Grey lime	50
Lime, shale, and gypsum	125
Brown lime	70
Lime and shale	120
Grey shale	25
Grey lime	15
Brown lime	35
Total depth	935

Gas at 907 and 935 feet.
Fresh water at 171 feet.

CENTRAL PIPE LINE CO., LTD.

A. Berdan No. 1, lot 24, con. XII, Dereham tp.

Completed December 2, 1938.
Producing gas well.
Rock pressure: 432 lbs.

Formation	Thickness, ft.
Surface	174
Brown lime	20
Blue lime	30
Grey lime	66
Blue lime	40
Brown lime	40
Blue lime	15
Lime and flint	90
Blue and red shale and lime shell	420
Guelph lime	27
Total depth	922

Gas at 895, 905, 917, and 922 feet.
Fresh water at 190 feet; salt water at 210 feet.

CENTRAL PIPE LINE CO., LTD.

T. R. Farrow No. 1, lot 26, con. XII, Dereham tp.

Completed February 16, 1938.
Producing gas well.
Rock pressure: 445 lbs.

Formation	Thickness, ft.
Surface	175
Top lime	1
Grey lime	39
Brown lime	35
Grey and brown lime	55
Brown lime	95
Grey sharp lime	10
Lime and chert	75
Brown lime	20
Grey lime	40
Mixed lime	45
Grey lime	45
Mixed lime	30
Grey lime	110
Grey shale and lime	10
Grey lime	152½
Total depth	937½

Gas at 913, 920, 922 to 925, 928 to 937½ feet.
Fresh water at 108 and 220 feet.

REID-ADAMS DEVELOPMENT CO., LTD.

R. Hawkins Estate No. 2, lot 25, con. XII, Dereham tp.

Completed April 23, 1938.
Producing gas well.
Rock pressure: 441 lbs.

Formation	Thickness, ft.
Surface	170
Brown lime and shale	25
Grey lime	170
Lime and chert	105
Brown lime	75
Lime, shale, and gypsum	125
Lime and shale	85
Grey lime	70
Lime and shale	65
Brown lime	40
Total depth	930

Gas at 905 and 930 feet.
Fresh water at 172 feet.

REID-ADAMS DEVELOPMENT CO., LTD.
R. Hawkins Estate No. 3, lot 25, con. XII, Dereham tp.

Completed July 15, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	178
Brown lime	42
Grey lime	110
Brown lime	45
Lime and chert	85
Brown lime	30
Grey lime	50
Lime, shale, and gypsum	125
Brown lime	75
Shale and lime	125
Grey shale	20
Grey lime	20
Brown lime	31
Total depth	936

Gas at 915 and 936 feet.
Fresh water at 220 feet.

REID-ADAMS DEVELOPMENT CO., LTD.
T. M. Moore No. 2, lot 27, N.E.¼, con. XII, Dereham tp.

Completed January 3, 1938.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Thickness, ft.
Surface	178
Brown lime	52
Grey lime	20
Brown lime	40
Grey lime	75
Grey-brown flint	105
Brown lime	25
Lime, shale, and gypsum	50
Brown lime	115
Grey lime and shale	90
Grey shale	115
Grey lime	25
Brown lime	15
Grey lime	30
Total depth	935

Gas at 905 and 930 feet.
Fresh water at 175 feet.

REID-ADAMS DEVELOPMENT CO., LTD.
T. M. Moore No. 3, lot 27, N.E.¼, con. XII, Dereham tp.

Completed February 15, 1938.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Thickness, ft.
Surface	174
Brown lime	41
Grey lime	30
Brown lime	40
Grey lime	85
Brown-grey flint	95
Brown lime	120
Grey lime and shale	85
Grey shale	120
Grey lime	20
Brown lime	25
Grey lime	21
Total depth	936

Gas at 912 and 936 feet.
Fresh water at 174 feet.

A. SMITH
N. Jensen No. 1, lot 15, con. XI, Dereham tp.

Completed October 21, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	179
Brown lime	75
Grey lime	150
Lime and flint	128
Brown lime	45
Grey lime and gypsum	143
Brown lime	95
Grey lime and shale	40
Brown and grey lime	93
Niagara	234
Rochester shale	50
Clinton	24
Red Medina	23
Shale	45
White Medina	21
Red shale	10
Total depth	1,373

Fresh water at 67 and 210 feet.

WESTERN ONTARIO NATURAL GAS CO., LTD.
W. Lucas No. 1, lot 21, con. XII, Dereham tp.

Completed July 7, 1938.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Thickness, ft.
Surface	203
Lime and shale	140
Brown lime	62
Flint	125
Lime and shale	150
Brown and grey lime	100
Shale	50
Grey and brown lime	75
Brown lime	25
Guelph lime	36
Total depth	966

Gas at 960 feet.
Fresh water at 220 feet.

VOLCANIC GAS AND OIL CO., LTD.
S. J. Greason No. 1, lot 21, S.W.¼, con. XVIII, East Nissouri tp.

Completed May 21, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	87
Grey and brown lime	458
Buff and grey lime with some gypsum	85
Grey shale, brown lime, and some gypsum	350
Dark-grey lime	35
Grey and grey-buff lime	35
Grey-brown and brown lime	20
Grey shaly lime	15
Grey-brown lime	15
Total depth	1,100

Fresh water at 95 feet; salt water at 1,062 feet.

Perth County

VOLCANIC GAS AND OIL CO., LTD.

R. J. Sparling No. 1, lot 21, S.W.¼, con. XVIII, Blanshard tp.

Completed April 6, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	23
Brown, grey, and grey-buff lime	492
Shale and shaly lime and gypsum	230
Grey-brown lime, shale and gypsum	120
Grey shaly lime and shale with a little gypsum	95
Brown and grey-brown lime	70
Buff and grey-buff lime	45
Dark-grey lime	10
Total depth	1,085

Fresh water at 42 feet; salt water at 1,025 feet.

Prince Edward County

MCNINCH AND DEVINE

A. B. Calnan No. 1, lot 697, Town of Picton, Hallowell tp.

Completed January 25, 1938.
Producing gas well.
Rock pressure: 90 lbs.

Formation	Thickness, ft.
Surface	18
Shale	175
Trenton	332
Total depth	525

Gas at 350, 390, and 495 feet.
Fresh water at 180 feet.

PICTON NATURAL GAS CO., LTD.

W. Brown No. 1, lot 430, con. I, Hallowell tp.

Completed December 16, 1938.
Producing gas well.
Rock pressure: 90 lbs.

Formation	Thickness, ft.
Soft shaly lime	200
Lime and shale	30
Brown lime	50
Hard black and brown lime	150
Very hard brown lime	60
Hard black and brown lime	13
Total depth	503

Gas at 276, 294, 390, and 470 feet.
Fresh water at 45 feet; salt water at 160 feet.

PICTON NATURAL GAS CO., LTD.

M. Gilmore No. 1, lot 290, con. I, Hallowell tp.

Completed October 3, 1938.
Producing gas well.
Rock pressure: 90 lbs.

Formation	Thickness, ft.
Soft lime and shale	190
Hard brown lime	60
Brown lime	40
Hard brown lime	150
Very hard brown lime	56
Total depth	496

Gas at 225 and 350 feet.
Fresh water at 31 feet; sulphur water at 206 feet.

Welland County

CORONATION GAS SYNDICATE

I. S. Eby No. 2, lot 8, con. XIV, N.R., Bertie tp.

Completed November 14, 1938.
Producing gas well.
Rock pressure: 250 lbs.

Formation	Thickness, ft.
Surface	58
Salina	284
Guelph and Niagara	203
Rochester	64
Clinton	33
Red Medina	62
Manitoulin	36
White Medina	14
Queenston	90
Total depth	844

Gas at 679 and 749 feet.
Fresh water at 80 feet.

HALDIMAND GAS SYNDICATE

P. Rhinehardt No. 1, lot 4, con. X, Bertie tp.

Completed November 8, 1938.
Producing gas well.
Rock pressure: 310 lbs.

Formation	Thickness, ft.
Surface	50
Lime and shale	275
Niagara	200
Grey shale	100
Clinton	32
Red Medina	75
Grey shale	32
White Medina	8
Red shale	11
Total depth	783

Gas at 702 and 707 feet.
Sulphur water at 50 feet.

HALDIMAND NATURAL GAS SYNDICATE

R. Winger No. 3, lot 3, con. X, Bertie tp.

Completed August 5, 1938.
Producing gas well.
Rock pressure: 65 lbs.

Formation	Thickness, ft.
Surface	30
Lime and shale	295
Niagara	200
Grey shale	100
Clinton	32
Red Medina	75
White Medina	40
Red shale	75
Total depth	847

Gas at 633, 697, 717, and 767 feet.
Fresh water at 32 feet.

E. J. HAWKINS

E. J. Hawkins No. 1, lot 12, con. XII, N.R., Bertie tp.

Completed December 30, 1938.
Producing gas well.
Rock pressure: 175 lbs.

Formation	Thickness, ft.
Surface	37
Salina	233
Guelph and Niagara	215
Rochester	54
Clinton	26
Red Medina	60
Manitoulin	48
White Medina	15
Queenston	10
Total depth	698

Gas at 599 feet.
Sulphur water at 37 and 45 feet.

CHARLES C. HOUSE

A. and M. Baker No. 1, lot 9, con. XIII, N.R., Bertie tp.

Completed May 24, 1938.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	29
Salina	278
Guelph and Niagara	238
Rochester	52
Clinton	30
Red Medina	72
Manitoulin	28
White Medina	10
Queenston	14
Total depth	751

Gas at 600 and 636 feet.

F. AND H. ROTH

J. Barnhardt No. 1, lot 8, con. XIII, Bertie tp.

Completed September 13, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	62
Lime and shale	255
Niagara	237
Shale	60
Clinton	30
Red Medina	65
Shale	41
White Medina	18
Red shale	4
Total depth	772

Fresh water at 62 and 120 feet.

F. AND H. ROTH

A. Johnstone No. 1, lot 8, W.½, con. XII, Bertie tp.

Completed August 8, 1938.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	45
Lime and shale	255
Niagara	224
Shale	60
Clinton	29
Red Medina	58
Shale	60
White Medina	8
Red shale	5
Total depth	744

Gas at 628 feet.
Fresh water at 46 feet; black water at 108 feet.

F. AND H. ROTH

H. Pirson No. 1, lot 8, con. XII, Bertie tp.

Completed August 22, 1938.
Producing gas well.
Rock pressure: 320 lbs.

Formation	Thickness, ft.
Surface	45
Lime and shale	255
Niagara	244
Shale	62
Clinton	30
Red Medina	35
Total depth	671

Gas at 661 feet.
Fresh water at 45 feet.

F. AND H. ROTH

H. Pirson No. 2, lot 7, con. XII, Bertie tp.

Completed October 20, 1938.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	50
Lime and shale	290
Niagara	234
Shale	60
Clinton	30
Red Medina	63
Shale	40
White Medina	10
Red shale	40
Total depth	817

Gas at 684 and 774 feet.
Fresh water at 130 feet.

F. AND H. ROTH

K. F. Sullivan No. 1, lot 9, con. XII, Bertie tp.

Completed November 12, 1938.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Thickness, ft.
Surface	44
Lime and shale	241
Niagara	225
Shale	51
Clinton	35
Red Medina	60
Shale	42
White Medina	18
Red shale	30
Total depth	746

Gas at 681 feet.
Fresh water at 44 feet.

WELLAND COUNTY GAS SYNDICATE

F. Schier No. 4, lot 16, con. XII, N.R., Bertie tp.

Completed June 29, 1938.
Producing gas well.
Rock pressure: 65 lbs.

Formation	Thickness, ft.
Surface	28
Salina	252
Guelph and Niagara	200
Rochester	60
Clinton	33
Red Medina	67
Manitoulin	33
White Medina	12
Queenston	65
Total depth	750

Gas at 596, 624, and 682 feet.
Fresh water at 44 feet.

L. EMERSON

L. Emerson No. 1, lot 22, con. IV, Wainfleet tp.

Completed March 18, 1938.
Producing gas well.
Rock pressure: 215 lbs.

Formation	Thickness, ft.
Surface	143
Shale	110
Niagara	215
Shale	45
Clinton	35
Red Medina	50
Shale	50
White Medina	18
Red shale	100
Total depth	766

Sulphur water at 80 feet.

JACKSON AND GRAFF SYNDICATE No. 2

A. Brawn No. 1, lot 19, con. XX, Wainfleet tp.

Completed June 16, 1938.
Producing gas well.
Rock pressure: 215 lbs.

Formation	Thickness, ft.
Surface	135
Lime and gypsum	40
Gypsum and shale	135
Grey lime	20
Niagara	200
Shale	62
Clinton	35
Red Medina	45
Shale	45
White Medina	15
Red shale	10
Total depth	742

Gas at 612 and 620 feet.
Fresh water at 135 feet.

JACKSON AND GRAFF SYNDICATE No. 2

A. Dayboll No. 1, lot 20, con. IV, Wainfleet tp.

Completed July 11, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	145
Lime and gypsum	165
Grey lime	20
Niagara	200
Shale	35
Clinton	31
Red Medina	50
Shale	43
White Medina	15
Red shale	10
Total depth	734

Fresh water at 145 feet; black water at 310 feet.

J. ORDIATO

J. Ordiato No. 1, lot 21, con. IV, Wainfleet tp.

Completed June 2, 1938.
Producing gas well.
Rock pressure: 195 lbs.

Formation	Thickness, ft.
Surface	150
Shale	110
Niagara	220
Shale	47
Clinton	40
Red Medina	50
Shale	50
White Medina	12
Red shale	50
Total depth	729

Fresh water at 78 feet.

J. PALMER

J. Palmer No. 1, lot 16, con. IV, Wainfleet tp.

Completed June 12, 1938.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Thickness, ft.
Surface	160
Shale	90
Niagara	225
Shale	50
Clinton	40
Red Medina	50
Shale	50
White Medina	10
Red shale	50
Total depth	725

Fresh water at 75 feet.

BERTIE TOWNSHIP GAS AND OIL SYNDICATE

F. Schier No. 2, lot 26, con. XX, Willoughby tp.

Completed August 5, 1938.
Producing gas well.
Rock pressure: 65 lbs.

Formation	Thickness, ft.
Surface	50
Salina	226
Guelph and Niagara	179
Rochester	62
Clinton	30
Red Medina	69
Manitoulin	20
White Medina	26
Queenston	63
Total depth	725

Gas at 525, 596, and 662 feet.
Fresh water at 47 and 67 feet.

BERTIE TOWNSHIP GAS AND OIL SYNDICATE

F. Schier No. 3, lot 26, con. XX, Willoughby tp.

Completed September 20, 1938.
Producing gas well.
Rock pressure: 65 lbs.

Formation	Thickness, ft.
Surface	52
Salina	225
Guelph and Niagara	180
Rochester	60
Clinton	31
Red Medina	70
Manitoulin	21
White Medina	23
Queenston	64
Total depth	726

Gas at 527, 592, and 660 feet.
Fresh water at 48 feet.

JACKSON AND GRAFF SYNDICATE No. 2

C. King No. 2, lot 3, con. IV, Willoughby tp.

Completed February 17, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	54
Lime and shale	150
Niagara	231
Rochester shale	46
Clinton	26
Red Medina	60
Shale	20
White Medina	18
Red shale	30
Total depth	635

Fresh water at 54 and 60 feet; black water at 290 feet.

JACKSON AND GRAFF SYNDICATE No. 2

J. Ortt No. 1, lot 2, con. IV, Willoughby tp.

Completed April 16, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	53
Lime and shale	200
Niagara	154
Shale	56
Clinton	22
Shale	15
Red Medina	55
Shale	25
White Medina	18
Red shale	5
Total depth	598

Fresh water at 57 feet; black water at 230 feet.

W. C. Patterson Gas Co., Ltd.
Ruch No. 1, lot 1, con. V, Willoughby tp.
Completed November 24, 1938.
Dry hole.

Formation	Thickness, ft.
Surface	73
Shale and lime	152
Niagara	218
Shale	56
Clinton	40
Red Medina	65
Shale	26
White Medina	15
Red shale	1
Total depth	646

Fresh water at 60 feet; sulphur water at 95 and 315 feet.

W. C. Patterson Gas Co., Ltd.
C. E. Sauer No. 1, lot 2, con. V, Willoughby tp.
Completed October 5, 1938.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Thickness, ft.
Surface	67
Shale and lime	150
Niagara	220
Shale	55
Clinton	40
Red Medina	65
Shale	28
White Medina	20
Red shale	50
Total depth	695

Gas at 625 to 645 feet.
Fresh water at 55 feet; sulphur water at 91 and 170 feet.

PETROLEUM IN 1938

By R. B. Harkness

General

A history of the oil production of Ontario by fields for the past twenty years is a chapter in the lives of those producers who succeed year after year in maintaining and in some cases exceeding the annual production of past years from wells that yield a mere pittance, a few pennies, each day. The Petrolia field, which is still operating, was "brought in" in 1866. The increase shown in the Bothwell field is from wells drilled between the years 1862 and 1866. In the case of the Bothwell field, all the wells were completed by the end of 1866, while in Petrolia with its thousands of wells, it took some years to completely drill the field. The Oil Springs wells have been in continuous operation since 1881 or 1882. Wells in Bothwell and Petrolia that were drilled 72 years or more ago are being pumped to-day and return a profit to their owners. The Bothwell wells were dormant for a number of years, but the Petrolia wells have been continuously in operation. This production cannot be said to be a gift of nature, it has been achieved only by the skill and the dogged determination and fight in the operators to keep this field alive. This is not an easy matter where new equipment, pipe, pumps, tubing, and rods had to be bought when the price of oil was at rock bottom. The operators have learned through long experience to salvage equipment, get the most use out of it, and, by skill in applied mechanics, to reduce the cost of operation by pumping wells from one centrally located power. Thus has the production from these fields been increased.

In the past year or two the wells drilled by Lick in 1862 have been cleaned out and are pumping oil. Hand-made casing, a bailer, wooden pump rods, wooden drill poles, and various relics of the early sixties have been recovered. The Pepper well will again be in operation when the corn field in which it is located is harvested. The Victoria well, which in 1866 was one of the "kings of the field," is now ignominously buried under a pig pen, but a nearby well of the same date is in operation. A well very near the site of the first well to be started (but not finished) in Ontario in 1857 had been reclaimed at the time of writing (September, 1939).

Table II gives a comparative statement of production for the past eight years. From this it will be seen that the increased production in 1938 is due to the bringing in of a small field in Warwick township, Lambton county, and a revival in the Mosa township field. This last field has been in operation since 1917, and in 1937 some 13 new wells were drilled, which gave the results noted. A number of old wells were "acidized."

Twenty-eight drilling rigs were in operation in 1938; these represent a capital investment of $47,633. Fifty-eight men were employed in drilling and were paid $30,389 in wages. Dry holes drilled numbered 41 with a footage of 19,805, and producing wells number 56 with a footage of 22,459, a total footage of 41,264.

The capital invested in producing crude petroleum is $988,179; the number of employees is 267; these were paid $157,922 in wages and salaries. These items were kindly furnished by the Dominion Bureau of Statistics and include the drilling statistics mentioned above.

TABLE I—OIL WELLS AND THEIR PRODUCTION, 1938

Field	Wells			Wells drilled		Production[1]		Gain or loss in 1938[2]	
	Operating	Not Operating	Abandoned	Producing	Dry			Gain	Loss
						bbls.	gals	bbls.	bbls.
Petrolia and Enniskillen	721	663	8	.....	1	58,270	7	310	.....
Oil Springs	827	236	1	.....	.....	32,298	25	.....	1,554
Moore tp.	45	39	.....	.....	.....	1,398	1	.....	855
Sarnia tp.	52	41	1	.....	.....	594	31	150	.....
Plympton tp.	25	6	.....	.....	.....	191	2	.....	45
Bothwell and Thamesville	252	96	9	8	15	42,419	15	1,312	.....
Dover	3	.....	.....	.....	.....	8,800	32	.....	1,698
Raleigh and Tilbury East tps.	1	.....	.....	.....	.....	206	22	.....	2,265
Onondaga tp.	7	29	.....	.....	.....	886	11	158	.....
Mosa tp.	104	31	1	13	3	13,526	24	4,841	.....
Euphemia and Dawn tps.	38	96	4	4	2	5,416	6	.....	473
Dunwich tp.	3	87	.....	.....	.....	194	23	.....	109
Brooke tp.	1	6	3	.....	.....	101	12	.....	671
Chatham tp.	3	1	.....	3	5	26	27	26	.....
Warwick tp.	[3]25	.....	.....	25	11	8,309	30	8,309	.....
Other fields	[4]3	[5]1	[5]1	[4]1	[6]4	.....	.....	.....	.....
Total	2,110	1,331	28	56	41	172,641	23	15,106	7,670

[1]Information from the Imperial Oil Refineries, Limited.
[2]Net gain, 7,437 barrels.
[3]2 in Adelaide township and 1 in Metcalfe township are included in these figures.
[4]Assiginack township, district of Manitoulin.
[5]Bosanquet township.
[6]3 in Bosanquet township; 1 in Gordon township, district of Manitoulin.

TABLE II—OIL PRODUCTION BY FIELDS, 1931–1938

Field	1931	1932	1933	1934	1935	1936	1937	1938
	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.
Petrolia and Enniskillen	57,515	58,871	57,298	57,938	59,282	59,092	57,960	58,270
Oil Springs	30,792	31,438	31,343	29,863	31,646	31,795	33,853	32,299
Moore tp.	3,739	3,272	2,192	2,963	3,263	3,200	2,253	1,398
Sarnia tp.	1,466	1,227	2,181	825	870	584	445	595
Plympton tp.	296	274	211	202	237	248	237	191
Bothwell	18,024	19,460	22,935	32,133	34,715	36,534	40,426	40,430
Tilbury East tp.	.....	.....	.....	.....	.....	.....	2,471	206
Dover tp.	891	453	763	558	13,117	15,536	10,498	8,801
Raleigh tp.	.....	.....	239	264	195	1,125	.....	.....
Onondaga tp.	34	543	946	601	431	262	728	886
Mosa tp.	8,517	8,429	8,168	9,031	8,788	8,182	8,686	13,527
Thamesville	462	534	847	614	428	458	683	1,990
Euphemia tp.	121	496	510	189	[1]	[1]	425	406
Dunwich tp.	507	285	346	283	408	307	303	195
Brooke tp.	.....	.....	.....	1,941	122	.....	773	101
Dawn tp.	.....	5,061	8,079	3,980	11,538	8,171	5,464	5,010
Warwick tp.	.....	.....	.....	.....	.....	.....	.....	8,310
Chatham tp.	.....	.....	.....	.....	.....	.....	.....	27
Total	122,364	130,343	136,058	141,385	165,040	165,494	165,205	172,642
Value	$219,993	$247,468	$253,486	$299,874	$346,156	$348,767	$356,558	$359,268
Average price	$1.80	$1.89	$1.86	$2.12	$2.10	$2.11	$2.15	$2.08

[1]Included in Dawn township.

Petroleum Refining Operations

The five petroleum refineries in operation in Ontario in 1938 had a total capacity of 42,000 barrels daily:—

Company	Location of refinery	Head office address
British American Oil Co., Ltd....	Foot of Cherry St., Toronto...	Royal Bank Bldg., Toronto.
Canadian Oil Companies, Ltd....	Petrolia.....	12 Strachan Ave., Toronto.
Goodrich Refining Co., Ltd.....	Port Credit.....	Port Credit.
Imperial Oil Refineries, Ltd.....	Sarnia.....	56 Church St., Toronto.
McColl-Frontenac Oil Co., Ltd....	Foot of Cherry St., Toronto...	Royal Bank Bldg., Montreal, Que.

TABLE III—PETROLEUM REFINING OPERATIONS, 1933–1938[1]

Schedule	Unit of measure	1933	1934	1935	1936	1937	1938
Imported crude distilled.	Gallons[2] ...	314,058,338	307,717,332	331,461,390	348,300,428	376,028,891	373,264,992
	Value.....	$14,904,715	$16,110,251	$16,624,472	$18,694,141	$21,451,421	$20,734,242
Imported crude oil distilled not in its natural state.	Gallons....	14,815,049	27,871,946	1,629,805	33,658	.....	.....
	Value.....	$966,409	$1,723,943	$140,091	$2,250	.....	.....
Canadian crude distilled.	Gallons....	4,823,639	4,289,702	6,321,891	5,702,053	5,789,224	5,889,667
	Value.....	$299,793	$274,888	$408,366	$576,953	$375,181	$373,404
Percentage of total...	.....	1.45	1.26	1.87	1.63	1.52	1.55
Total value of crude	.....	$16,170,917	$18,109,082	$17,172,929	$19,273,344	$21,826,602	$21,107,646
PRODUCTS							
Gasoline: Straight run.....	Gallons....	89,429,293	81,307,756	85,698,897	85,931,630	96,886,558	91,181,862
	Selling value	$7,793,607	$6,231,050	$6,439,916	$6,438,292	$8,050,734	$7,580,782
By cracking process.	Gallons....	70,519,864	71,949,582	93,901,122	98,060,814	106,605,308	113,698,597
	Selling value	$5,736,708	$4,754,529	$6,745,372	$7,408,888	$8,319,617	$8,948,251
Kerosene.....	Gallons....	26,499,830	14,208,236	10,424,545	14,209,536	8,404,621	9,845,912
	Selling value	$2,022,408	$1,109,504	$814,344	$1,033,418	$619,542	$777,121
Lubricating oil.....	Gallons....	16,299,872	17,638,490	16,785,539	18,380,505	21,508,488	20,076,765
	Selling value	$2,854,787	$3,695,083	$3,342,280	$3,589,956	$3,766,191	$3,826,829
Engine distillate.....	Gallons....	8,384,517	6,636,041	8,567,840	6,575,545	4,083,648	2,259,027
	Selling value	$490,728	$340,237	$452,774	$390,889	$277,227	$152,495
Solvent naphtha.....	Gallons....			4,003,104	3,518,964	4,174,508	2,780,821
	Selling value			$282,672	$241,622	$313,585	$205,128
Light fuel oils.....	Gallons....	93,255,072	109,379,721	97,660,669	97,744,619	95,630,935	53,563,988
	Selling value	$8,739,400	$5,512,168	$3,158,588	$4,060,529	$4,166,432	$2,560,754
Residual fuel oils.....	Gallons....						53,742,967
	Selling value						$1,997,347
Tar.....	Gallons....	.....	130,641	12,132,400	.....	1,381,625	624,708
	Selling value	.....	$49,977	$48,529	.....	$55,265	$27,764
Grease.....	Pounds.....	8,342,446	8,571,927	9,898,844	9,652,267	11,993,124	11,289,256
	Selling value	$357,316	$509,271	$459,595	$455,281	$430,584	$567,688
Paraffin wax and candles.	Pounds.....	8,978,068	10,656,115	11,237,665	10,345,569	11,696,221	4,055,298
	Selling value	$355,323	$476,928	$434,921	$377,928	$391,428	$182,495
Petroleum coke.....	Short tons..	62,601	49,011	53,845	55,667	56,166	59,010
	Value.....	$344,686	$268,821	$320,004	$349,777	$355,907	$369,184
Still gas.....	M cu. ft....	1,574,451	1,498,379	2,122,091	2,334,401	2,407,572	2,439,581
	Value.....	$306,984	$281,524	$468,765	$459,587	$523,821	$553,868
Asphalt.....	Gallons....	6,494,707	7,946,775	6,977,781	8,738,564	9,384,628	9,697,675
	Selling value	$524,532	$712,468	$600,229	$775,198	$737,725	$727,326
Miscellaneous.....	Value.....	$50,498	$56,971	$95,350	.....	$155,661	$5,090
Total value of refined products..	.....	$24,824,977	$23,998,621	$24,664,342	$25,581,365	$28,163,719	$28,482,122
Employees.....	Average No.	2,036	2,047	2,012	2,004	2,065	1,936
	Wages paid.	$2,752,718	$2,637,213	$2,970,360	$2,994,706	$3,272,974	$3,276,492
Capital invested.....	.....	$22,947,812	$23,579,481	$21,367,847	$20,441,809	$20,032,311	$21,685,644

[1]Information furnished by the Dominion Bureau of Statistics, Ottawa.
[2]Gallons refer to Imperial gallons.

There is little change in refining operations from 1937. Imported crude distilled shows a slight reduction, which is reflected in the products recovered. The proportion of cracked gasoline to straight run is greater in the past year.

Refined Products Imported into Ontario

In Table IV will be seen a comparative statement of the petroleum and refined products imported into Ontario in 1937 and 1938. There is a general increase that seems to be annual with a major increase in some products that is not explained by the description of the items.

TABLE IV—PETROLEUM AND REFINED PRODUCTS IMPORTED IN 1937 AND 1938

Import	1937		1938	
	Imperial gallons	Value	Imperial gallons	Value
CRUDE PETROLEUM FOR REFINING:				
Petroleum, 0.790 specific gravity or heavier, for refining	345,531,186	$12,920,242	318,137,000	$11,510,474
REFINED PETROLEUM:				
For use in concentrating ores	17,334	$8,474	20,416	$19,392
Gasoline lighter than 0.669 specific gravity (casing-head)	2,303,621	128,686	2,922,747	137,678
Gasoline lighter than 0.8235 specific gravity	8,138,586	660,507	8,966,424	642,169
Crude petroleum, n.o.p.	24,929	3,079	.....	.....
Kerosene and illuminating oils	634,861	42,301	506,474	32,335
Products of petroleum, n.o.p., 0.8235 specific gravity and heavier	565,888	64,654	6,801,362	177,184
Engine distillate heavier than 0.8017 specific gravity	463,038	29,255	164,542	12,277
Lubricating oils, consisting wholly or in part of petroleum, costing less than 25 cents a gallon	5,188,200	806,533	6,724,583	958,618
Lubricating oils, all other	2,103,982	772,778	1,304,527	534,740
All other oils	80,648	35,758	110,199	45,624
Total	19,521,087	$2,552,025	27,521,274	$2,560,017
PETROLEUM PRODUCTS:				
Petroleum grease and lubricating grease, n.o.p. lbs.	3,507,474	$171,441	2,881,066	$109,555
Vaseline, toilet and medicinal petroleum	.....	140,385	.....	128,470
Paraffin wax lbs.	1,353,924	67,745	5,824,166	192,438
Paraffin wax candles lbs.	113,718	18,186	104,595	18,492
Other petroleum products lighter than 0.8235 specific gravity gals.	2,771,931	243,984	2,881,056	227,838
Total	.....	$641,741	.....	$676,793
Total value	.....	$16,114,008	.....	$14,747,284
Total net value of petroleum and refined products imported[1]		$16,114,008		$14,747,284
Duty paid on the above, calculated on the existing tariff schedule		463,037		485,829
Sales tax at 8 per cent		1,326,164		1,212,649
Freight, approximately		1,100,000		1,000,000
Total value delivered in Ontario		$19,003,209		$17,445,763

[1]These statistics are compiled from information furnished through the courtesy of the Department of Customs and Excise.

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PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PAUL LEDUC, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

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Geology of the Keezhik-Miminiska Lakes Area

By

V. K. PREST

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KEY MAP

Key map showing the location of the Keezhik-Miminiska Lakes area 1

COLOURED GEOLOGICAL MAP

(In pocket at back of report)

Map No. 48e—Keezhik-Miminiska Lakes Area, District of Kenora (Patricia Portion), Ontario. Scale, 1 mile to the inch.



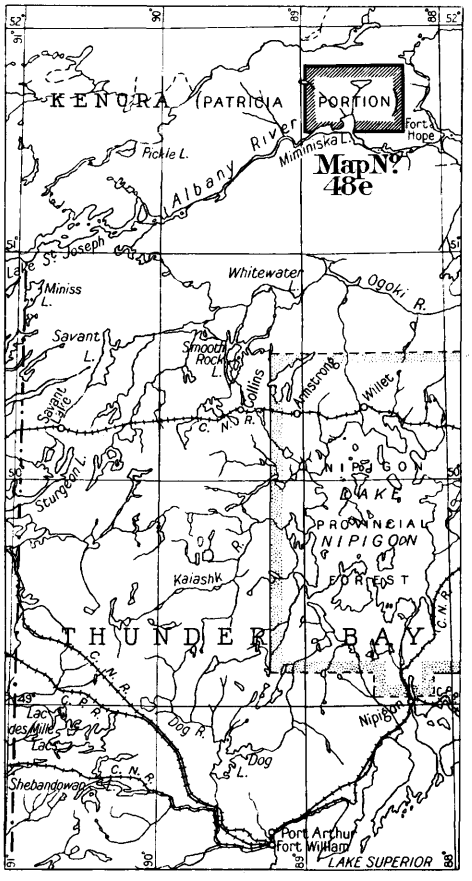
View looking up Ferguson creek towards Ferguson and Seagreen lakes, showing the typical flat, drift-covered nature of the Keezhik-Miminiska Lakes area.

Geology of the Keezhik-Miminiska Lakes Area

By V. K. Prest

INTRODUCTION

The area surrounding Keezhik, Miminiska, and Troutfly lakes, which was geologically examined during the summers of 1937 and 1938, has an extent of about 550 square miles. Miminiska lake is an expansion of the Albany river and is situated 90 miles due north of Lake Nipigon. The area surrounding this lake



Key map showing the location of the Keezhik-Miminiska Lakes area.
Scale, 60 miles to the inch.

was mapped during the summer of 1937 and the work pushed northward to Keezhik lake, a quite unexplored section, where an interesting series of lavas, tuffs, sediments, and basic intrusives were encountered. This section was mapped in more detail in 1938 and the work continued westward towards Troutfly lake. It was thought that the Keezhik-Troutfly section might represent the continuation of the Crow River belt, but a large granitic area was found to intervene.

The only mineral prospect worked during the summer of 1937 was a gold-quartz vein on Keezhik creek. In this section some thirty claims were staked along the strike of the "break," approximately N. 50° E. Visible gold was observed in one vein, but values were reported as being low. At the mouth of Keezhik creek, bodies of pyrite occur near the sedimentary-volcanic contact; pyrite and quartz with traces of gold have also been reported. Drilling here did not warrant further exploration. Prospecting in the Keezhik lake section uncovered a network of quartz stringers in a mineralized rhyolite porphyry, which gave a low gold assay, but nothing was done beyond blasting a small prospect pit. Several prospectors visited these areas in 1937, but there was no activity the following summer.

The geology was compiled from shore-line examination and pace-and-compass traverses. In the Miminiska lake section the shores often provided good exposures, but outcrops inland were scarce and hard to find. When outcrops were discovered, traverses were run along the strike to pick up further outcrops and obtain all possible information. Around Keezhik lake shore-line exposures are very scarce, and most of the rock was encountered far inland.

General Description and Access

Miminiska lake lies in an east-west trending belt of sediments, which pinch out approximately 4 miles west of the entrance of the Albany river into Miminiska lake, but continue eastward to the Fort Hope area, where they have been described by E. M. Burwash.[1] This belt of sediments at its widest part is about 8 miles across and is bounded on both sides by intermediate to basic volcanics. The Miminiska rocks are separated from the Keezhik belt of volcanics by granitic intrusives, which extend some distance east of Keezhik creek.

The greater part of Keezhik lake lies in a belt of volcanics with some sediments, into which a series of basic rocks have been intruded. Beyond the west end of Keezhik lake the belt narrows greatly, owing to the intrusive granitic masses and tighter folding, and around Troutfly lake granite is the prevalent rock type. The belt is similarly narrowed east of Keezhik lake where the granite contact curves toward the southeast. As the drift hills strike approximately N. 65° E. in this section, there is only a relatively small area of volcanic exposures beyond Keezhik lake.

The area can be conveniently reached by airplane from either Collins or Sioux Lookout on the Canadian National railway. The most travelled canoe route to Miminiska lake and also to the Hudson's Bay post at Fort Hope is from Ombabika, a flag station on the C. N. R., east of the north end of Lake Nipigon. This route runs due north to the Albany river and then westward to Miminiska lake or northwest to Fort Hope. Keezhik lake can be reached either by a northerly route from Fort Hope or by Miminiska lake and Keezhik creek. The canoe route from Pickle lake to Troutfly lake or the northwest end of the area requires a long trip via the Crow (Kawinogans), Otoskwin, and Trading rivers. This section of the area however holds less economic interest.

The canoe route from Ombabika to Miminiska lake has some 18 portages, the longest of which is three-quarters of a mile, and takes about eight days with moderate loads, but this time can be cut down by the use of a small motor. Transportation by plane is highly advisable, as Miminiska is only an hour's flight from Collins and an hour and a half from Sioux Lookout.

[1]E. M. Burwash, "Geology of the Fort Hope Gold Area, District of Kenora (Patricia Portion)," Ont. Dept. Mines, Vol. XXXVIII, 1929, pt. 2, pp. 12, 25-38.

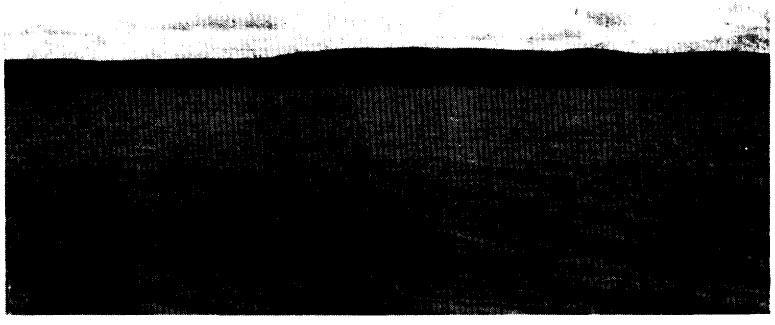
Acknowledgments

The party was accorded many courtesies and much assistance by the several prospectors in the area during the summer of 1937. Special thanks are due to P. G. A. Curry and J. Bresnahan, who were quite familiar with the area and able to supply the party with valuable information. Frank Trethewey tendered the party many favours during his frequent visits to the area.

H. W. Salter, J. W. Britton, and J. J. Ivan were members of the field party in 1937, and J. W. Britton, J. H. Douglas, and J. S. Talbot in 1938. These men performed their share of the work in a very efficient manner, which the writer greatly appreciates.

Previous Geological Work

In 1886 Robert Bell reported on part of the Albany river, including the section around Miminiska lake, for the Geological Survey of Canada.[1] In 1926



Drift hills on the portage route to Nesting lake, seen from Keezhik lake.

H. S. Wilson mapped a large area for the Nipissing Mining Company, including the region around Miminiska lake and part way up Keezhik creek. In 1928 E. M. Burwash[2] mapped the Fort Hope area and entered Miminiska lake from the east. Some of the geology around Miminiska lake was reported on by W. S. Dyer[3] in 1933.

Topography

The area is generally flat-lying and covered with a heavy drift mantle. Keezhik and Troutfly lakes are at a much higher elevation than Miminiska lake, which is 951 feet above sea-level. Miminiska lake is divided into two parts by a large peninsula, which contains a few quite prominent outcrops but is generally low-lying. The southern side of both parts of the lake is bordered by a region of high drift hills, some of which are reported as being from 300 to 400 feet in height.[4]

[1]Robt. Bell, Geol. Surv. Can., Vol. II, 1886, pt. G, pp. 15, 16.
[2]E. M. Burwash, op. cit.
[3]W. S. Dyer, "Geology of the Pashkokogan-Misehkow Area," Ont. Dept. Mines, Vol. XLII, 1933, pt. 6, pp. 8, 9, 15, 17.
[4]E. M. Burwash, op. cit., p. 21.
W. S. Dyer, op. cit., p. 3.

These morainic hills die out eastward toward Wottam lake, but continue westward to Snake falls on the Albany river and westward for many miles. Similar groups of high drift hills occur along the south shore of the East arm and the western part of Keezhik lake and at the south end of Troutfly lake. With the exception of the two last-mentioned localities, all the drift features in the area trend at approximately N. 70° E. In these two exceptions, the hills have a curved ground plan, which suggests that they may have been formed near a small lobe of the ice-sheet that once covered the country.

A well-developed esker in the Wottam lake section was traced intermittently for over 3 miles. Extensive tracts are covered with drift, which forms a blanket-like deposit. There are no deposits of clay within the boundaries of the map area. With the exception of the northwestern corner of the area, the drainage is toward the Albany river.

Natural Resources

Most of the area that is not drift-covered is low-lying and swampy, generally with much black spruce, which seldom reaches a diameter of 8 inches. The drift sections around Miminiska lake are covered with second-growth jack pine, but around Troutfly lake they support great stands of white spruce, frequently with diameters of 2 to 3 feet. Birch and white and black poplar are also found in these sections, and elsewhere in the area, with a maximum diameter of 16 inches. This mixed growth occurs in all the woodland sections indicated on the map accompanying this report. Balsam and cedar are locally abundant. A few dwarfed black ash occur along the Albany river where it enters Miminiska lake. Wild berries are rather scarce. The only recent burn of any magnitude is around Trading and Talbot lakes.

Game is not abundant, although several Indian families derive a fair living from hunting and trapping. Fish are plentiful and include pike, pickerel, whitefish, sturgeon, suckers, brook trout, and lake trout. Bird life is surprisingly abundant, some 60 species being noticed each summer. Warblers, flycatchers, sparrows, and thrushes are the most common types nesting in the area.

The climate of the area in general has been well summarized by E. M. Burwash.[1] Prospectors report that it is quite variable from year to year. The summer of 1937 was rather hot and moderately dry, whereas 1938 was very wet and comparatively cool. Thunderstorms were very frequent. Growth was well advanced by June 1, and the leaves had fallen from the birch and poplar before the beginning of October.

Abundant water power is available from two falls on the Albany river. Snake falls, south of the southwest corner of the area, has a drop of 9 feet and runs through a narrow rock gorge. Miminiska falls, at the outlet of Miminiska lake, has a drop of 10 feet. In the "List of Water Powers" of Ontario[2] it is stated that Miminiska falls has an estimated capacity, at 80 per cent. efficiency, of 12,087 horse-power at ordinary 6 months' flow. Similarly Snake falls has an estimated 4,676 horse-power.

GENERAL GEOLOGY

The consolidated rocks of the area are all pre-Cambrian. The oldest rocks present are the interbedded dark-green to black volcanics and tuffs bordering the Algoman granite batholith north of the East arm of Keezhik lake. Overlying

[1] E. M. Burwash, op. cit., pp. 17, 18.

[2] L. V. Rorke, "List of Water Powers in the Province of Ontario," Ont. Dept. Surveys, 1931, p. 14.

these basic volcanics is a mixed series of fresher-looking volcanics, bedded tuffs, and sediments. Of approximately the same age, is a variable series of paler-coloured volcanics, which are best exposed around the North bay of Keezhik lake. These volcanics are usually acidic in composition. Overlying this series and exposed in South bay, Keezhik lake, and east of Nesting lake is a thick conglomerate band containing quartz, iron formation, and volcanic and porphyry boulders. Younger greenstones of andesitic composition overlie the conglomerate, and these may be continuous with the volcanic belt extending southward to Miminiska lake.

Volcanic rocks form the borders of the basin of Miminiska lake and may be older than the sediments (Timiskaming?) that fill it. A conglomerate occurs at the contact of these two rock types north of the western part of Miminiska lake, continuing through to Howell's lake and southwest to the Albany river at the nose of the major fold. Where best exposed, the sedimentary and volcanic contacts appear to be conformable. The volcanics on the south side of the sedimentary belt appear to have been thrust over the sediments from the south. Basic and ultrabasic intrusives have come in along this faulted section and further metamorphosed these rocks.

Various granitic rocks are intrusive into the volcanic and sedimentary belts of the whole area, and while they are mostly of Algoman age, some of the porphyries may be Keewatin. Keweenawan diabase and gabbroic dikes cut directly across the strike of the volcanics and sediments.

The sediments of the basin of Miminiska lake are remarkably fresh, but eastwards in the Wottam lake section, they have been metamorphosed to schists. The sediments are so folded that their true thickness is not known, but it is probably not great.

Table of Formations

QUATERNARY	
PLEISTOCENE:	Sand, gravel.
PRE-CAMBRIAN	
KEWEENAWAN:	Olivine diabase, diabase and gabbro dikes.
	Intrusive contact
ALGOMAN:	Quartz, feldspar, and granite porphyries. Biotite granite and quartz diorite. Porphyritic and pegmatitic granite and syenite.
	Intrusive contact
PRE-ALGOMAN:	Hornblendite, gabbro, and diorite.
	Intrusive contact
TIMISKAMING(?):	Slate, greywacke, arkose, feldspathic sandstone, conglomerate, quartzite, iron formation. Derived schists, including garnet, staurolite, and mica schists.
KEEWATIN:	Basic sill-like intrusives. Lavas, mainly intermediate to basic in composition; pyroclastics, hornblende gneiss, amphibolite, eclogite. Conglomerate. Lavas, mainly acid to intermediate in composition; pyroclastics, bedded tuffs, sediments, iron formation. Lavas, dominantly basic in composition; pyroclastics, iron formation.

Keewatin Series

Basic Volcanics

The dark-green and grey to black volcanics bordering the Algoman batholith north of the East arm, Keezhik lake, consist of massive flows and tuffs. Much of

the tuffaceous material has been worked over by water forming black-bedded tuffs, which are easily mistaken for true slates. The lavas are exceptionally uniform, dull-looking rocks, devoid of pillow structures, amygdules, or breccias. Only the banded nature of some of the tuffs breaks the monotony of the series. The banded rocks are present in about equal proportions with the massive lavas. The banding is often quite fine. Where siliceous members are present the individual beds are about one-eighth of an inch in thickness, but elsewhere the bands are from an inch to a foot or more in thickness. Associated with the fine-grained massive lavas are coarser phases representing thick flows.

The intrusion of the granitic batholith on the north has undoubtedly caused considerable recrystallization of the original materials, so that the volcanics are now masses of hornblende and basic feldspar, but such metamorphism is not especially marked along the actual contact zone. This belt of volcanics dips steeply south or vertically over its entire length, and strikes quite consistently at S. 70° E. At its greatest width the series is about one mile across.

A very persistent band of iron formation occurs in this volcanic belt, but was found outcropping in only one place over a traced length of seven miles. It was accurately located at numerous positions along the strike by means of its strong magnetic attraction. Stratigraphically it lies just within the border of the massive volcanics on the south side of the main banded tuff horizon. Where observed, it was about thirty feet wide, but elsewhere seemed much narrower. At the extreme west end of the traced length its boundaries were closely defined, although not actually observed, and it was found to be about 10 feet in width.

The volcanics of the belt north of Troutfly lake and west of Nesting lake are probably of the same age as the basic volcanics just described. They vary from intermediate to basic in composition and include pillow lavas, massive volcanics, tuffs, and breccias as well as a band of iron formation. The outcrop areas are large and prominent. A stretch of drift hills 3 miles wide separates the volcanics west of Nesting lake from those north of Troutfly lake, but they are in all respects similar and join up structurally, although different stratigraphic horizons are present. The tuffaceous horizons aid in revealing the structure and trend of the rocks. As a rule the outcrops are elongated parallel to the strike of the volcanics.

The iron formation horizon of the volcanic band north of Troutfly lake was traced for several miles and observed in a few places. It is about 10 feet wide and is a strikingly banded black and white rock but sometimes shows yellowish or brownish bands where it has a micaceous appearance. The bands are uniformly from one-eighth to one-quarter of an inch in width and consist of alternate quartz and magnetite horizons.

Acid to Intermediate Volcanics; Sediments

North of the East arm of Keezhik lake, the basic volcanics already described grade upward (southward) into a series of sediments, bedded tuffs, and lavas, which have a fresher appearance than the northern volcanics. The sediments occur as narrow beds and include sandstone, greywacke, and shale. Sheared lavas and bedded tuffs are the common rock types. All are exposed at the east end of the East arm. Associated with the lavas is a narrow band of finely bedded iron formation, which is considerably altered and in which hematite is an important constituent. Minor quartz stringers occur in this iron formation, but there is very little mineralization. This formation is exposed on the south side of the creek flowing into the East arm, and the sediments occur along the north bank.

At approximately this same time, or only slightly later, a series of light-coloured acid to intermediate volcanics were extruded in the Keezhik lake section.

The rocks of this region present a striking contrast in colour and character to all the other volcanic rocks. They are readily classed together from field observations, although the composition of various members may vary greatly. They are all rather fresh-looking rocks, buff to greenish in colour, and usually massive. Dacite is the most prevalent type; but rhyolite, andesite, and even basalt occur in this series. The latter types have been considerably carbonatized and weather to a light-green or buff. Coarse-grained phases are common amongst the andesitic members, and some definite intrusives with hornblende phenocrysts are represented. Pillow structures are numerous in the hard, fine-grained dacites and in places reveal the direction of the top of the flows. This group of rocks is best exposed in the vicinity of the North bay. They also extend eastward to the East arm, where breccia members are present; but owing to the granitic intrusions in this section, they are of little value in determining the sequence or structure.

A band of iron formation occurs in this series and while it was not found exposed, it was traced by magnetic deflections of the compass along the whole length of the west shore of the North bay and northeast to the largest lake on the creek flowing into the North bay. Most of this section is heavily drift-covered.

Fresh, light-coloured volcanics are also exposed along the east side of Nesting lake, where they are overlain by a conglomerate band. The volcanic horizon immediately underlying the conglomerate is a carbonatized pillowed hornblende andesite, the hornblende occurring as long needles, which are very conspicuous on the pale weathered surface. It strikes N. 40° E., dips 80° S. E., and faces southeast.

The pillow lava, conglomerate, and overlying sheared greenstone horizon, are all truncated on the southwest by a diorite dike, on the other side of which tuffaceous rocks striking northwest-southeast are the common volcanic types. This whole section has been greatly folded. The tuffaceous rocks are in part bedded tuffs and have been highly recrystallized by the granitic intrusions on the southeast. Associated with the tuffs is an impure quartzite, which forms an island in Nesting lake and outcrops along the north shore.

These tuffaceous rocks and sediments are grouped with the acid volcanic series of Keezhik lake, as they more closely resemble it than any other type, and because of their position above the intermediate to basic volcanics west of Nesting lake. Heavy drift areas prevented the solving of the true relationships of all these rocks. A large area of these recrystallized tuffs bounded on the north and south by typical Algoman granite occurs east of Troutfly creek.

Conglomerate

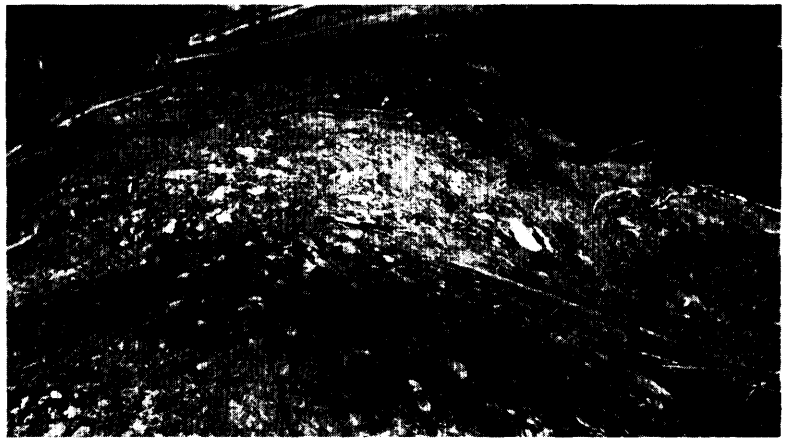
The Keewatin conglomerate occurs between two volcanic horizons. It is best exposed east of Nesting lake, but small outcrops were found on the north shore of the South bay of Keezhik lake. In the South bay the overlying rocks are not exposed, but the conglomerate can be seen to be resting on a dense pillow lava. At Nesting lake the conglomerate rests on the andesite pillow lava already described and is overlain by rather soft, green, banded volcanics grading upward through breccia into more massive types. The conglomerate band is 800 feet wide in this section. The upper contact dips at 50° S. E., but the lower contact appears to be steeper.

The lower half of the conglomerate contains boulders of a variety of volcanic rocks, many of which are similar to types found around Keezhik lake. Boulders of quartz, jasper, chert, and highly siliceous banded iron formation are also common and are the sole constituents of the uppermost part. No granitic

or porphyry boulders were seen. Banded ferruginous boulders up to 3½ by 1½ feet were observed. The groundmass consists of fine volcanic materials.

Younger Intermediate to Basic Volcanics

Probably closely related to the green volcanics overlying the conglomerate east of Nesting lake are the volcanic rocks exposed at the east and west ends of the South bay of Keezhik lake. These volcanics are quite similar to those described to the west of Nesting lake, but on the whole appear fresher. The volcanics at the east end of the South bay can be traced directly to Miminiska lake. The series consists of fine-grained massive lavas, dioritic phases, pillow lavas, intrusives, and pyroclastics. Schistose phases of these rocks are not abundant. They usually weather a dull-green colour, but where scraped and polished by glacial action have a black surface and appear more basic than they actually are.



Conglomerate east of Nesting lake composed of boulders of quartz and cherty materials in a volcanic groundmass.

A notable example of this is in the vicinity of Ivan lake. The lavas in this locality have been made more resistant than the surrounding rocks by the intrusion of small dikes and barren quartz stringers and hence form prominent outcrops.

Normally the lavas of this series contain equal proportions of hornblende and basic oligoclase. Occasionally quartz is present. Magnetite is the dominant accessory. Basaltic members of the series contain up to 65 or 70 per cent. hornblende.

Pillow lavas are important members of the series in the section between Howell's lake and Keezhik creek. Near Keezhik creek pillow structures were found up to 20 feet by 4 feet. North of the western part of Miminiska lake, pillow lavas were observed continuously over a width of a mile and a half. Volcanic breccia is also present, usually near the north side of the belt. In the Howell's lake section and westward, coarse-grained flows and dioritic intrusives are the prevalent rock types. These are hard, massive, and fresh in appearance.

The volcanics occurring along the south shore of Miminiska lake are probably related to those just described and include lavas, intrusives, and pyroclastics. Inland from the south shore of the western part of Miminiska lake, these rocks are especially dark-coloured and are very tough and resistant. They form prominent outcrops between the shore line and the high drift hills on the south.

The lavas are unsheared and fine- to medium-grained, with many pillow structures. One large dioritic intrusive represents a sill and is shown on the accompanying map.

On Miminiska peninsula the lavas give way northward to a series of tuffs and ultrabasic rocks. The latter include fine-grained amphibolite and coarser-grained eclogite. These are for the most part intrusive and have caused much alteration of the neighbouring rocks, producing various gneisses. Probably some sediments were present interbedded with the tuffs and lavas. Explosive breccia occurs on the east side of Miminiska peninsula and at the outlet of the Albany river. Massive recrystallized tuffs and related intrusive diorite are also present and consist of quartz and feldspar, with a minor quantity of hornblende needles.



Differential weathering of tuffs north of the western part of Miminiska lake. The hammer handle points north and is almost on the contact of the tuffs with poorly formed pillow lavas.

They are a dull-grey colour and have a sugary texture. The most pronounced alteration and gneissic development is along the zone closest to the trace of the thrust fault separating the volcanic belt from the fresh sediments of the Miminiska lake basin proper. The rocks in this gneissic zone all dip to the south at angles steepening southward from 30 to 70 degrees. Garnets are common in some of the intrusive rocks such as the eclogite, as well as in the gneisses along the thrust zone.

The volcanic series appears to have been thrust over the sediments of the Miminiska basin and at the same time to have been overturned.

Basic Sill-like Intrusives

Basic rocks often showing intrusive relations with the older rocks are numerous in the Miminiska lake section. They usually follow the general trend of the volcanic flows, but have intrusive contacts in places. Some are probably true sills. A variety of ages are no doubt represented, but most of these rocks are thought to have been intruded during the period of volcanic activity that gave rise to the

lavas with which they are now associated. Others are distinctly later. An elongate dioritic mass occurs along the contact of the sediments and volcanics west of Keezhik creek and has caused some alteration of the sediments. This may imply a recurrence of volcanic activity after the period of sedimentation. The large gabbro intrusion that follows the trend of the sediments in the northern part of the Miminiska lake basin may be more closely related to the Keewatin volcanics than to the pre-Algoman basic intrusives of the East arm of Keezhik lake, with which it is now grouped.

Timiskaming(?) Sediments

The sedimentary belt of the Miminiska lake section includes quartzite, greywacke, arkose, grits, argillite, iron formation, and conglomerate. The most prevalent types are the impure or argillaceous quartzites and siliceous greywackes, which are often tough, resistant rocks and consequently form prominent outcrops. Interbedded with these are argillites, greywackes, and feldspathic sandstones, the last being only partially recrystallized. Bedding is often very well displayed by these distinctive rock types. All these rocks, and especially the resistant quartzites, are well exposed on the Miminiska peninsula, Miminiska island, and the island south of it.

Another very common sediment is the feldspathic grit or sandstone, which is typically best developed at a horizon north of the quartzites and greywacke, but south of the iron formation. It consists of sub-rounded to sub-angular grains of quartz and feldspar up to one-fifth of an inch in diameter. This rock is well exposed on the islands near the north shore of the western part of Miminiska lake.

Microscopic studies bear out the field appearance of these sediments; they are remarkably fresh. The resistant rocks are impure quartzites and siliceous greywackes. The greywackes consist of grains of quartz and feldspar up to one-eighth of an inch in diameter in a poorly sorted, fine groundmass of quartz, feldspar, and micas, with minor amounts of magnetite, tourmaline, and other minerals. The larger grains are sub-rounded to rounded. Magnetite in some cases is quite abundant. These sediments give evidence of transportation for moderate distances and rapid deposition. The impure quartzites, which in the field are fine, dense rocks, are made up of an equigranular mass of quartz and probably feldspar, with considerable quantities of mica. The more highly argillaceous members of the series are like the quartzites, but contain abundant mica and often some carbonate.

On the small island near the point on the west shore of the western part of Miminiska lake, and on the northwestern side of Miminiska peninsula there is a peculiar conglomeratic rock. On the west this consists largely of yellowish-weathering quartz porphyry boulders with a maximum size of 14 by 8 inches in a softer indefinable groundmass. On the peninsula, however, boulders of sediments are to be found with the porphyry boulders. The boulders are all siliceous types. Microscopically the groundmass appears to be arkosic. The groundmass fragments are usually angular, whereas the boulders and pebbles are well rounded. The softer pebbles are usually greatly elongated due to shearing. The average size of the pebbles is about 2½ inches by 1 inch.

Lying north of the feldspathic grits is the banded iron formation. This is best developed around the eastern part of Miminiska lake, where it is highly folded and crumpled, and in the Wottam lake section. It consists of interbanded magnetite-rich horizons and beds of argillite, quartzite, and more rarely greywacke. The magnetite-rich horizons occur up to 10 inches in width on the north side of the formation, but become narrower southward until they are only an

inch or two in width. Over a 5-foot section near the central part of the formation there were 12 horizons of magnetite, each 3 or 4 inches wide. On the north there are usually 6 to 8 inches of argillaceous sediments to every 3 or 4 inches of magnetite. Here also the magnetite is often interbanded with quartzite. The magnetite bands of the iron formation are reported by E. M. Burwash[1] to contain less than 40 per cent. iron.

The magnetite bands in the iron formation consist almost entirely of magnetite and quartz, which occur as equidimensional grains. The argillaceous bands in the iron formation consist of a fine dense mass of quartz and abundant green



Iron formation, eastern part of Miminiska lake. Magnetite bands alternate with argillite, greywacke, or quartzite.

mica, often with some carbonate. The mica occurs as minute rods and blades. These bands are seen to be well bedded. The gritty bands in the iron formation contain less mica, are rather poorly sorted as to grain size, and poorly bedded.

North of the iron formation the rocks are dominantly argillaceous, but there are a few gritty bands and quartzite horizons. North of the western part of Miminiska lake, west of Howell's lake, and along the northern stretch of the Albany river, these fine-grained sediments give way northward to coarse sandstone and conglomerate. The sandstone horizon is very narrow. In the Howell's lake section the matrix is more argillaceous.

The conglomerate contains boulders of granitoid rocks, volcanics, porphyries, sediments, iron formation, quartz, chert, and jasper. The boulders form about 80 per cent. of the rock north of the western part of Miminiska lake, 65 per cent. near Howell's lake, and only 50 per cent. in the Albany river section. The granitoid boulders vary from granite and pegmatite to diorite. The more siliceous types are more or less equidimensional, whereas the more basic types have been elongated by shearing. Volcanic and slaty pebbles or boulders are usually much elongated. The volcanic boulders, many of which are spotted types,

[1]E. M. Burwash, op. cit., pp. 47, 48.

are all dark-weathering but are not basic. Quartzite, arkose, and greywacke are also present as boulders, especially in the western sections of the conglomerate.

Granite boulders up to 14 by 6 inches were found in the conglomerate north of the western part of Miminiska lake. These have angular outlines, whereas the other boulders are more rounded and elongated. The granite boulders are medium-textured with quartz grains with a maximum diameter of one-sixth of an inch, and they contain very little mafic material. Granitic rocks in places form about 45 per cent. of the boulders present. Pure quartz pebbles and boulders are of sporadic occurrence.

The source of the granite boulders is not known. The same is true for part of the sedimentary boulders, which closely resemble some of the fresh sediments now occupying the Miminiska basin. Many of the sedimentary types could have



Banded sedimentary schists, near the crest of a minor anticline, east of Wottam lake.

been derived from the sediments interbedded with the older lavas, as seen in the Keezhik lake section. The conglomerate band is between 300 and 400 feet in width.

Eastward from the western part of Miminiska lake, the boulders become smaller and the conglomerate finally gives way to a coarse arkose. This is exposed in a few places along the lower reaches of Keezhik creek. It lies north of a soft black argillite, as does the conglomerate in the western sections. West of the north-south stretch of Keezhik creek at the sedimentary-volcanic contact, the sediments are greywacke, fine feldspathic sandstone, and impure quartzite, the arkose horizon either occurring south of these rocks or else grading laterally into them.

The sedimentary belt can be readily traced through to the Wottam lake section, but here the sediments have been largely metamorphosed to garnet, staurolite, and mica schists. The largest garnets and staurolites occur in the argillaceous sediments close to or within the iron formation. The development of garnet and staurolite has been a very selective process, depending upon the composition of the original sediment. For this reason certain beds contain staurolites up to one inch or more in diameter, whereas the neighbouring bed contains abundant small garnets. Sometimes both garnets and staurolite occur in the same bed.

Folding in the Wottam lake section has resulted in a repetition of the iron formation. Two bands, approximately 3,000 feet apart, are present. Between these bands with their accompanying garnetiferous and staurolite horizons the

rocks are less altered and consist of mica and graphitic mica schists. In places they may still be termed argillites, greywackes, etc. At the extreme east end of the mapped sedimentary belt the iron bands must come very close together, as the garnet and staurolite horizons span the whole section and magnetic attraction is intense. Part of the attraction is due to small quartz-magnetite veinlets.

Microscopic examination shows tourmaline to be present in the sediments over most of the area. Where quartz-tourmaline veins have come in, tourmaline schists have resulted. The black argillites north of Wottam creek are seen under the microscope to be spotted graphitic schists. The spots are due in part to poorly formed cordierite porphyroblasts with flecks of graphite in and around them. Some spots are due to segregation of the graphite.

The garnet and staurolite schists contain abundant brown and green biotite, the former parallel to the schistosity and the latter cutting across it. The magnetite is also coarser than in the Miminiska lake section. The highly argillaceous sediments occurring between the iron formation horizons, towards Frond lake are seen under the microscope to be highly crenulated mica schists containing abundant tourmaline. Dioritic to ultrabasic dikes were found cutting the sediments locally, and the latter have often caused further mineral changes in the sediments.

The sediments of the Wottam lake section and eastward are thus seen to be distinctly different in character from their counterparts to the west.

Pre-Algoman Basic Intrusives

A series of basic rocks intrudes the volcanics and sediments of the East arm of Keezhik lake, forming a chain of islands and shoals and prominent outcrops. Hornblendite is the dominant type, forming conspicuous outcrops. It is a very hard, massive, black rock, consisting of about 90 per cent. hornblende and 10 per cent. feldspar. Dioritic types of intrusives are closely connected with the hornblendite but are slightly younger in age. At the east end of the East arm the intrusive has a flaky weathered surface and is a diorite or gabbro in composition. In this section it is at least 400 feet wide, but the southern contact is hidden under the drift hills. Judging from the exposed portions the dike dies out a short distance east of the end of Keezhik lake.

Prominent outcrops of these basic rocks occur on the north shore of the East arm where they appear to form a small stock. Soft biotite-rich rocks along the north edge of the stock may represent the altered country rocks.

It would appear that these basic intrusives have invaded the folded Keewatin rocks and penetrated laterally more or less along the bedding to form elongate bodies.

The large gabbro sill in Curry bay and the western part of Miminiska lake may be of the same age as these basic intrusions.

Algoman Intrusives

The Algoman is represented by granite, syenite, and quartz diorite, the diorite probably representing the major batholithic intrusion.

South of Wottam lake, what appears to be a narrow tongue of granite strikes in a northeast-southwest direction and tapers off to a point, as shown on the accompanying map of the area. It is a coarse-grained, white-weathering granite, which under the microscope is seen to consist of quartz, microcline, albite, biotite, muscovite, and the accessory minerals epidote, apatite, and zircon. Dikes of similar material cut the sedimentary schists northeast of Wottam lake.

The granite tongue is cut by many pegmatite dikes and quartz veins. The pegmatite dikes, which have a maximum width of 4 feet, consist of feldspar crystals up to 10 by 4 inches in a groundmass of quartz and feldspar with much tourmaline and muscovite. The dikes and veins are most prevalent along the north edge of the granite outcrop. They occur in three sets, striking at N. 35° E., N. 50° E., and S. 50° E., the first set being the youngest and best developed.

A small outcrop of granite was found north of the western part of Miminiska lake, fairly close to exposures of the volcanics. It weathers pinkish and consists of quartz, albite, and biotite. These two occurrences represent the only granite masses seen in the Miminiska lake section.

Granitic rocks form large outcrops from the northernmost small lake on Keezhik creek northwards into the South bay of Keezhik lake. These rocks are very variable in composition and texture. Typical granite is not abundant.



Horizontal jointing in granite north of Talbot lake.

The rocks are usually either porphyritic or pegmatitic types, and the mafic mineral is either biotite or hornblende. Syenite is present, with hornblende as the mafic mineral. The exposures on Keezhik creek immediately north of the small lake probably represent the contact zone, as inclusions of volcanics are abundant, and in places over 50 feet in diameter. They show sharp contacts and in many places are cut by small granitic stringers.

North of Keezhik lake the granitoid rocks are massive pink of light-weathering rocks of medium to coarse texture. A section studied microscopically showed the feldspar to be oligoclase, and the rock may therefore be termed a quartz diorite. Biotite is the only mica present, except north of Talbot lake where muscovite accompanies the biotite. Around Troutfly lake the granitoid rocks are porphyritic granites, large phenocrysts of orthoclase up to 2½ inches by three-quarters of an inch in size occurring in a coarse-grained groundmass of orthoclase, biotite, and quartz. This rock type is closely related to the porphyritic and pegmatitic facies around Keezhik creek and South bay. North of Troutfly lake the age relationships between the porphyritic granite and the common granite or quartz diorite of the north may be observed. The batholithic intrusion appears to cut off the westward extension of large dike-like masses of the porphyritic granite in the volcanic series. Field relationships do not indicate that the porphyritic granite is an offshoot from the main mass but rather that it

is somewhat earlier although most probably closely connected with the same parent magma.

The porphyritic granite forms prominent outcrops along the east side of Troutfly lake and displays two well-developed joint systems: N. 68° E., with a dip of 55° S.E.; and N. 20° E., with a dip of 85° N. W. A third poorly developed system strikes at N. 50° E. and dips at 20° N. W.

The peninsula separating the main part of Keezhik lake from the East arm contains outcrops of a granitic rock of a different character. This is a sheared, quartz-feldspar porphyry representing a small stock. The rock is chiefly made up of much altered albite phenocrysts. The groundmass is a schistose aggregate of abundant white mica with quartz and feldspar.

The evidence suggests that this porphyry body is older than the fresh Algoman intrusives, which do not show either shearing or alteration effects. There are several dikes in the Keezhik-Miminiska Lakes area which are similar to this mass and may be related in age. These porphyries are mapped along with the Algoman rocks, since age relationships have not been definitely determined.

Minor acid intrusives are rather scarce in the area, but small feldspar porphyries are of sporadic occurrence. Quartz porphyry and quartz-feldspar porphyry bodies with widths up to a hundred feet are well exposed on the Albany river at the west end of the area. These occur near the sedimentary volcanic contact where there has been much shearing. The quartz porphyries and granitic dikelets are very similar to the fresh Algoman rocks, whereas the feldspar porphyries are sheared and altered. This may be due to an inherent tendency to shearing owing to the amount of feldspar present or to an earlier age, as already suggested. A large granitic dike occurs on the peninsula at the north end of Howell's lake, fairly close to the sedimentary-volcanic contact, and other smaller dikes occur to the east along this same zone. A highly sheared quartz-feldspar porphyry occurs as an 80-foot sill in the gneissic rocks along the high escarpment at the trace of the thrust fault in the eastern part of Miminiska lake. Granite dikes, pegmatite, and porphyry occur in the sediments at the east end of the Wottam lake section. These are all young Algoman-type intrusives.

Keweenawan Dikes

Two large dikes from 150 to 300 feet in width cutting at nearly right angles across the sedimentary and volcanic belts form the main representatives of the Keweenawan period. The large dike in the eastern part of Miminiska lake is an olivine diabase. The olivine, which is frequently partially altered, in places occurs as fresh phenocrysts up to a quarter of an inch in diameter. Augite and chlorite fill the interstices between the large, lath-shaped crystals of acid labradorite and the olivine phenocrysts. Biotite is present as an alteration product of the augite. Magnetite is an accessory and also an alteration product of the olivine, along with serpentine.

The other large dike, which runs southward from Keezhik lake through Wottam lake, is very variable over its length and often appears diabasic. One thin section studied was a quartz gabbro. In many sections the dike would best be termed a diorite. This dike was found cutting Algoman granitic intrusives in both the sedimentary and volcanic series. It definitely does not cut through the granitic tongue mapped south of Wottam lake.

Small diabase dikes are scattered throughout the area. One of these was found cutting the hornblendite of the East arm of Keezhik lake, but none were

seen cutting a granite mass. The main minerals are augite, labradorite, magnetite, and a little white mica. They are usually fine, dense rocks with minute feldspar laths readily discernible in the hand specimen.

STRUCTURAL GEOLOGY

Folding

Keezhik Lake Section

The granite mass occurring between Miminiska and Keezhik lakes divides the area into two distinct structural units. The volcanics in the Keezhik lake section occur in the north limb of a syncline; the basic volcanics occupying the northern and basal part, while the younger acidic volcanics and sediments occupy most of the basin. The uppermost or youngest rocks of the syncline lie in the Nesting lake–South bay section near the bordering granite mass on the south. Here the conglomerate overlies the acid volcanic series but is in turn overlain by greenstone. The nose of the syncline occurs in the vicinity of Nesting lake, where the rocks swing sharply around, and pitches to the east at about 50 degrees. Except for this local section of the syncline, the structural flexures are quite open over the whole Keezhik lake section, and the strike of the rocks is uniform over a long distance. From the east end of Keezhik lake they strike northwest as far as the North bay, where the regional strike changes rather abruptly to southwest. This trend continues to the nose of the fold where the strike swings to the south and southeast.

The acid volcanics of the Keezhik lake basin seem to represent a period of volcanic activity that was localized in that area, so that to the east and west only basic and intermediate volcanics should be encountered.

The greenstones exposed north of Troutfly lake probably represent the north limb of a syncline. These rocks have an east-west trend, but near Talbot lake they show many minor contortions imposed upon them by the invading porphyritic granite dikes and the granitic batholith.

Miminiska Lake Section

The sediments of the Miminiska lake section may be Timiskaming in age. This is indicated by the large number of granitic boulders in the conglomerate exposed along part of the sedimentary-volcanic contact. Such a sequence suggests a synclinal structure for the area, with the nose of the fold along the north-south stretch of the Albany river. Structural evidence, however, is not conclusive as to the relative ages and attitude of the two rock series. Evidence of the structure or of the direction of flow tops in the volcanic belt north of Miminiska lake is usually wanting, owing to the massive nature of the series. Near the sedimentary contact west of the north-south stretch of Keezhik creek, the pillow lavas show tops facing the north. North of the western part of Miminiska lake a narrow zone of pillow lavas was found between two fine-grained massive horizons. This zone dips 70° N.E., with tops facing north.

It is possible that the sediments of the Miminiska lake basin and the acidic volcanic series of the Keezhik lake section with its associated sediments are of the same age, as both series appear to underlie the greenstone and are separated from it in places by a conglomerate band.

The southern volcanic belt along Miminiska lake does not bear the same relations to the sediments as does the northern belt, but rather is thrust over the

sediments from the south. Determinations on pillow lavas also show that the series is overturned to the north. The dips throughout the whole belt are invariably to the south and range from 30 to 65 degrees. The flatter dips occur in the gneisses along the northern side of the belt and, therefore, closest to the trace of the thrust fault across Miminiska peninsula.

From the eastern part of Miminiska lake eastwards an anticlinal structure is well developed but on a smaller scale, as folding is closer and has resulted in a repetition of the iron formation. Determinations on drag folds and fracture cleavage, as well as the general lithology, show that the structure is a narrow, tightly folded anticline, overturned to the south. Around Wottam lake this anticline plunges east at 20 degrees, but east of this lake the anticline plunges at 20° or 25° W.

Faulting

No evidence of faulting was found within the volcanic belts, possibly owing to their massive nature and lack of horizon markers. The scarcity of outcrops also makes recognition of faulting difficult. The faults recognized in the area are confined to the Miminiska lake section. A large fault is believed to extend across the northeastern part of Miminiska lake, striking in a northeast-southwest direction and accounting for the displacement of the iron formation from the northwest corner of the lake to the north end of Miminiska island. The iron formation at both these localities is highly contorted. A similar type of fault is believed to extend along the Albany river west of Howell's lake, where the conglomerate horizon seems to be considerably displaced on either side of the river. A minor fault occurs at the southwestern tip of the conglomerate, at the west end of the area, beyond which it could not be picked up.

The most striking evidence of faulting in the area is the northward-facing escarpment on Miminiska peninsula, where the volcanic series has been thrust northward over the sediments in the Miminiska basin. South of the fault trace the rocks are metamorphic gneisses, mostly derived from volcanic rocks, dipping south at angles of 30 to 45 degrees, whereas north of it the rocks are rather fresh, unaltered sediments with a vertical dip. Amongst the gneisses are various basic intrusives. The escarpment is only developed on the peninsula, but evidence of the fault can be picked up again north of the Albany river where it leaves Miminiska lake. Here a series of basic intrusives with some gneisses outcrop in a low woodland section and lie stratigraphically north of the typical volcanics of the southern belt. The escarpment on the peninsula in the eastern part of Miminiska lake rises almost vertically about 75 feet above the lake.

ECONOMIC GEOLOGY

While little evidence of mineralization has been found in the area up to the present, the possibilities of finding deposits of economic value cannot be overlooked. The claims drilled along the lower part of Keezhik creek show that low values are contained in some veins. Drilling was also done some years ago on a quartz vein near the bend in the Albany river at the west end of the area, and low values were reported. A number of porphyry bodies heavily mineralized with pyrite occur on a small island in Howell's lake. There was also much massive stibnite occurring here as float, but only minor amounts were found in place. Neither the porphyry bodies nor the quartz stringers within them carry a gold content. Quartz veins are uncommon throughout the sediments and volcanics around Miminiska lake, except near the contact on the north, where

both porphyries and veins may be found. This section, however, seems to have been well prospected.

A well-developed "break" occurs along the southern volcanic-sedimentary contact. This is especially well seen north of the Albany river where it leaves Miminiska lake. Here there is a stockwork of sheared wall-rock and quartz veins over 100 feet in width. An assay of one sample from this zone proved barren.

The Wottam lake section is quite unlike any of the others, as it contains abundant quartz veins up to 4 feet in width. Tourmaline is a common mineral in many of these veins, and some contain traces of sulphides. A low gold assay was obtained from a quartz-arsenopyrite showing in the sediments south of Wottam lake. This section has been little prospected.

Many veins occur in the basic volcanics north of the East arm of Keezhik lake, but no well-developed ones were seen, nor was there any apparent mineralization. The veins follow the regional trend. The overlying series of the more acid lavas appear to offer better prospects. Quartz and quartz-carbonate veins are numerous and were often found to be heavily mineralized. Both pyrite and arsenopyrite are present. Siderite is the common vein-forming carbonate, so that the veins weather brownish, in striking contrast with the green volcanics. An assay of 0.07 ounces gold per ton was obtained from a network of quartz stringers in a mineralized porphyry dike on the creek entering the northeast end of the North bay of Keezhik lake. An assay of the porphyry itself did not give any values. Veins are more numerous on the east side of the North bay, but the west side should be an equally favourable site for prospecting. This volcanic series seems to have responded to deformation by the development of fractures, which have acted as loci of vein deposition.

At the east end of the East arm, there are interbedded lavas, tuffs, and sediments in which mineralized quartz stringers were found carrying pyrite and chalcopyrite.

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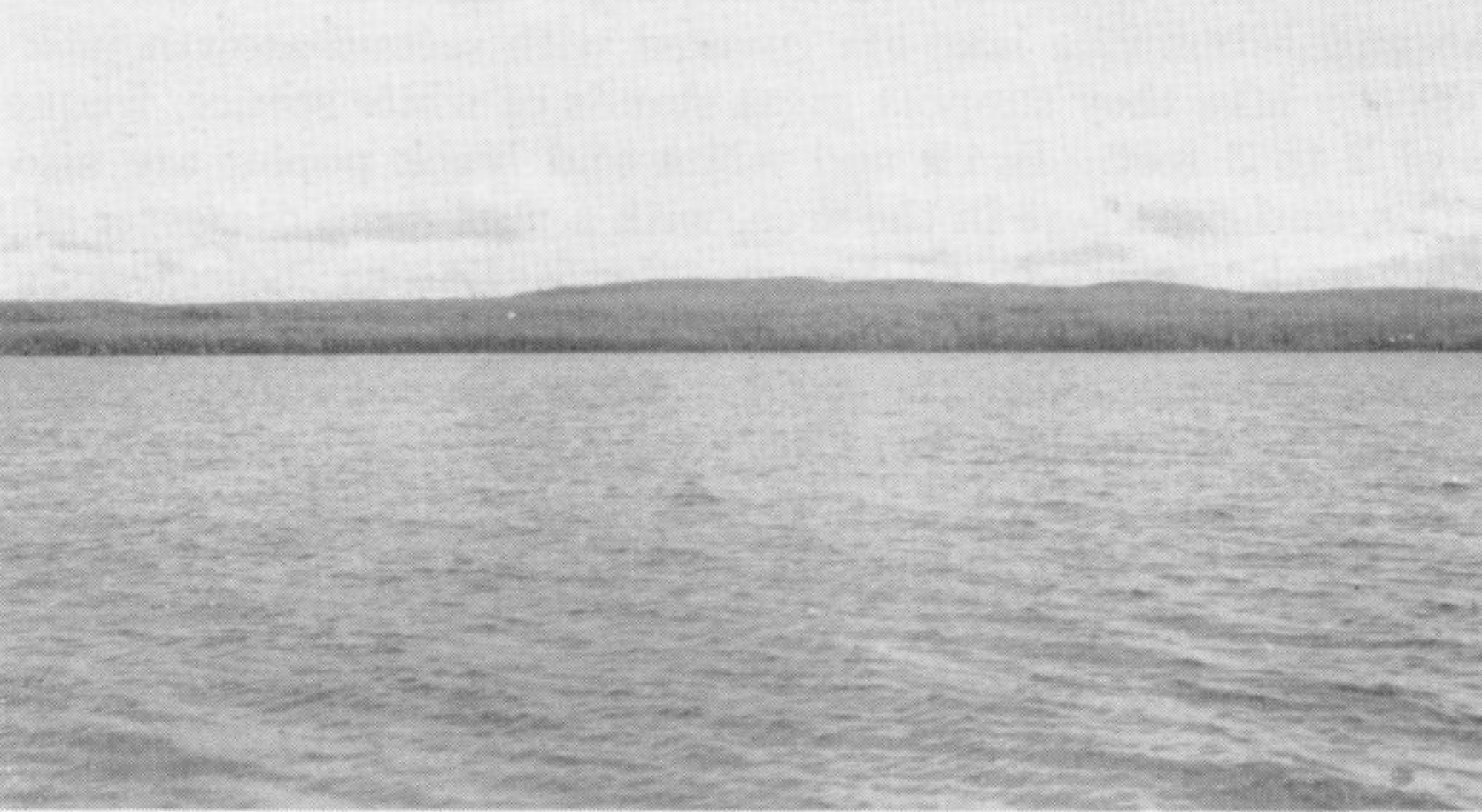
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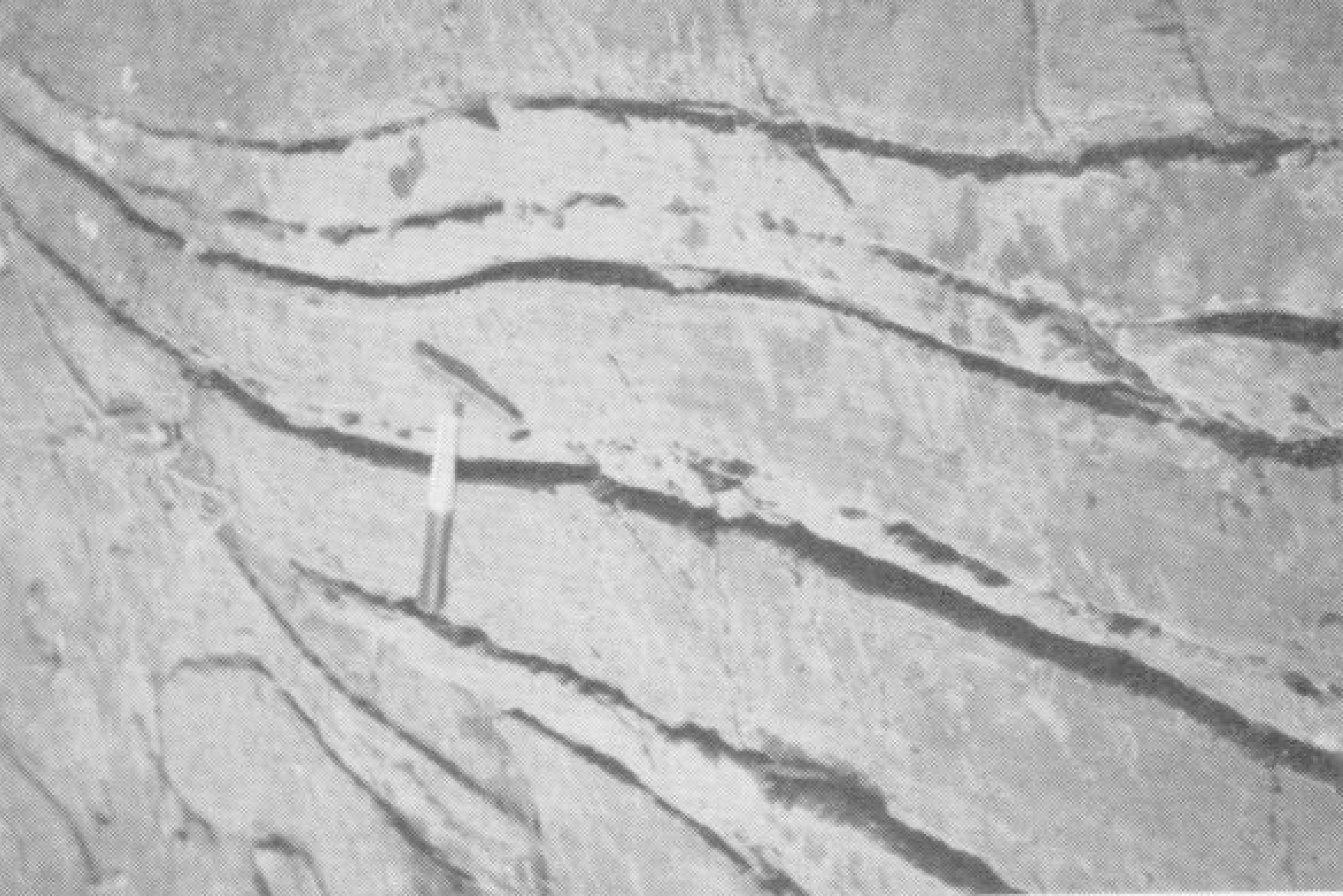
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PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. ROBERT LAURIER, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART VII, 1939

Geology of the Eastern Extension of Crow River Area

By

E. L. EVANS

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GEOLOGICAL MAP

(In pocket at back of report)

Map No. 48f—Eastern Extension of Crow River Area, District of Kenora (Patricia Portion), Ontario. Scale, 2 miles to the inch.

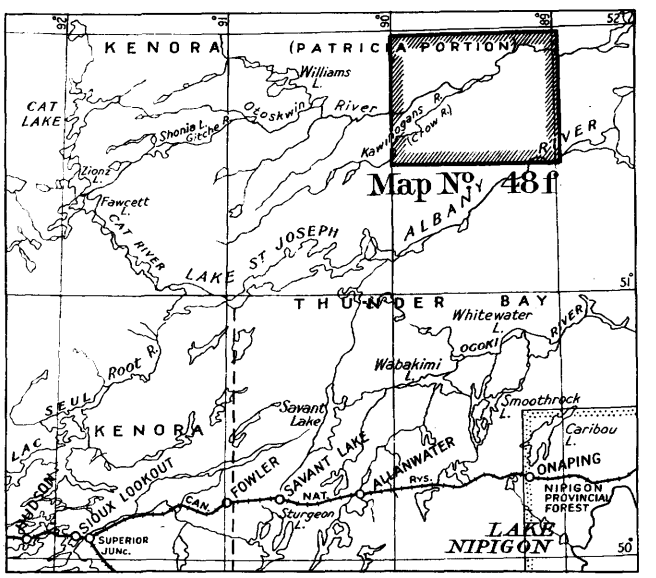
Geology of the Eastern Extension of Crow River Area

By E. L. Evans

INTRODUCTION

The Eastern Extension of Crow River area, in the Patricia portion of the district of Kenora, was mapped by the writer's party during the summer of 1938. The survey covered a roughly rectangular area of approximately 600 square miles, with a maximum length of 40 miles measured in a northeasterly direction.

Reconnaissance work was done by canoe along all the navigable streams and shores of lakes. Pace-and-compass traverses were made at intervals of half a mile or less in the sections containing volcanics and sediments and at wider intervals in areas underlain by intrusives.



Key map showing the location of the Eastern Extension of Crow River area. Scale, 50 miles to the inch.

The purpose of the survey was to determine the location of the boundary of the volcanics and the sediments trending northeastward from the Crow River area and the establishment of a connection or relationship between the rock belts to the north and to the south.

Gold was discovered in the Pickle Lake–Crow River area in 1928, and the area was systematically mapped by M. E. Hurst[1] in 1929 and Jas. E. Thomson[2] in 1936 and 1937. Promising mine developments in the Crow River area made it desirable to investigate the belt of volcanics and sediments in the eastern extension of the area. Volcanics and sediments similar to those of the Crow River area were surveyed in the Miminiska Lake area to the northeast by Prest in 1937. In 1938 Prest[3] continued this survey westward to join the writer's map area.

[1]M. E. Hurst, "Pickle Lake–Crow River Area," Ont. Dept. Mines, Vol. XXXIX, 1930, pt. 2.
[2]Jas. E. Thomson, "The Crow River Area," Ont. Dept. Mines, Vol. XLVII, 1938, pt. 3.
[3]V. K. Prest, "Geology of the Keezhik-Miminiska Lakes Area," Ont. Dept. Mines, Vol. XLVIII, 1939, pt. 6.

Acknowledgments

The writer is indebted to the residents of the Crow River area, and particularly to J. Sutherland and F. Williams of Crowshore Gold Mines, Limited, and E. Guertin of the Ontario Forestry Branch, for courtesies extended to the party. The able assistance given by J. B. Crombie, senior assistant, and J. J. Ivan and Reid Townsley is gratefully acknowledged. Sincere appreciation is expressed to W. L. Grossman and K. E. Lowenstein, of Columbia University, for many helpful suggestions and criticisms given during the preparation of this report.

Location and Means of Access

The Eastern Extension of Crow River area is situated about 140 miles northeast of Sioux Lookout and 380 miles west of the southern part of James bay.



Drift hills south of Badesdawa lake

It is becoming increasingly accessible with the development of the mines in the adjacent Crow River region. During the summer barges ply constantly between Hudson, on the Canadian National railway, and Doghole Bay on Lake St. Joseph, from which a motor road leads to Pickle Lake. Summer and winter, except for the periods of break-up and freeze-up, airplanes carry supplies between Hudson or Sioux Lookout and Pickle Lake. The route into the area is completed by the Crow (Kawinogans) river, which has only one falls between the Albany River mine and Badesdawa lake.

Topography

The most prominent topographical features of the area are the drift ridges which extend from the Crow river immediately south of Badesdawa lake eastward to the Trading river. These form a region of narrow, steep-sided hills, none of which are higher than 150 feet above the general level of the land, separated by ravines and circular depressions containing muskeg. The southern boundary of these ridges is the chain of lakes that forms an arc between Badesdawa lake and the Trading river. The southern slopes are rather abrupt in contrast to the gentler gradient of the northern slopes. South of Kakagiwizida lake they form a low sand plain, which finally disappears under the muskeg. The rest of the area contains spruce muskegs and open swamp broken by a few small sand plains, isolated drift hills, and low rock outcrops.

Northeastward-flowing tributaries of the Otoskwin river drain the greater part of the area. The Badesdawa river, which rises in the southeastern part of the area within 12 miles of the Crow river, flows for the greater part of its length through low, swampy country. The upper part of the stream, where falls and rapids are numerous, is navigable only during the early summer; later, the flow is so diminished that most of its boulder bed is exposed. Streams enter from the muskeg on both sides of the river, but these are so overgrown with alders as to be impassable.

The Trading river, a much larger stream, flows northeast from the Etowamami river to join the Otoskwin river between Kakagiwizida lake and Ozhiski lake. Its main tributaries enter from the west. A few of these, particularly Foaming creek, which flows through muskeg along the south margin of the drift ridge, are navigable for some distance upstream.



Falls on the upper part of the Otoskwin river showing the low outcrops that are characteristic of the area.

Rock outcrops are scarce in the area, owing to the wide stretches of glacial drift and muskeg. Small, low outcrops are exposed, however, on the shores of the larger lakes, in the falls and rapids of the streams, and occasionally in the intervening muskegs. In the southern part of the area a belt of low hills, composed of volcanics and sediments, rises above the surrounding lowland. Even here glacial debris obscures much of the rock. In the northern part of the area, bed rock is exposed only in the streams that cut across the drift hills.

Natural Resources

A sand plain located along the lower part of the Badesdawa river near Badesdawa lake supports a growth of banksian pine, dogwood, and smaller plants and may be of agricultural value. No other land of this type was noted. Below the sand plain, spruce and balsam with diameters up to 2 feet were noted in the muskeg; similar growth occurs in the upper part of the Trading river. Birch, poplar, and banksian pine commonly attain a diameter of 12 inches in the tree-covered parts of the drift ridges. Brulé areas, ranging from small patches to large tracts, occur in the drift regions south of Badesdawa lake, along the lower parts of the Trading and Otoskwin rivers, and in the extreme southern part of the area.

Moose, bear, and beaver were seen in the southern, less accessible part of the territory. Elsewhere signs of game, other than grouse and ducks, were not apparent.

Inhabitants

The region is uninhabited except for a few Indians, who occupy cabins on Badesdawa lake during the trapping season. The territory appears to have been deserted some time ago in favour of areas of more abundant game.

GENERAL GEOLOGY

The general geology of this region is essentially the same as that of the adjoining Crow River area. There are some notable differences, however, such as a larger proportion of intrusives with respect to extrusives and sedimentary rocks, a greater degree of metamorphism in the extrusives and sedimentaries, and the absence of diabase dikes. The consolidated rocks are all of pre-Cambrian age. The volcanics and sediments have been classed as Keewatin and the granitic intrusives as Algoman(?) by Hurst.[1]

The Keewatin rocks, consisting of greenstones, chlorite and hornblende schists, and finely banded gneisses, have been intruded by diorite and gabbro and later by granite and granodiorite.

Table of Formations

QUATERNARY	
RECENT:	Peat.
PLEISTOCENE:	Clay, sand, and gravel.
	Great unconformity
PRE-CAMBRIAN	
ALGOMAN(?):	Granite, granodiorite.
	Intrusive contact
POST-KEEWATIN:	Diorite, gabbro.
	Intrusive contact
KEEWATIN:	Volcanics, sediments.

Keewatin

The Keewatin rocks of the Pickle Lake belt extend eastward into the area. In the vicinity of July falls on the Crow river, they terminate rather abruptly against the later intrusives. A tongue at the southern margin, however, continues to a point about 2 miles south of Monmonawson lake.

Two general rock groups can be distinguished in the belt of greenstones. One consists of basic volcanics, for the most part altered to chlorite and hornblende schists; the other is made up of finely banded gneisses, which are believed to be the metamorphic equivalents of the volcanic fragmentals and sediments of the Crow River area. Included in this group are narrow intercalated bands of iron formation.

Basic Lavas

Basic lavas make up the bulk of the greenstone belt. Generally these lavas are sheared and altered to chlorite and hornblende schists containing varying amounts of carbonate, either in the matrix or filling minute fractures, which

[1]M. E. Hurst, op. cit. p. 6.

traverse the rocks in all directions. In a few places they appear as unaltered, dark, fine-grained basalts with a close sub-rhombohedral jointing and a well-marked conchoidal fracture. Pillow lavas associated with the basalt west of July falls exhibit similar features.

Gneissic Rocks

The gneissic rocks of this group were observed only in the narrow tongue-like extension of the belt, where they lie between two bands of basic lavas. Included in this group are finely banded gneisses, which can be divided into three general rock types.

The first is a dark-green, fine-grained rock, almost schistose in character, with narrow discontinuous light-coloured bands up to several inches in length. In thin section the light bands exhibit a fine mosaic of oligoclase, quartz, and augite. The dark bands are composed of long, narrow crystals of hornblende with subordinate amounts of interstitial augite, microcline, and magnetite.

Continuous banding up to half an inch in width characterizes the second rock type. Dark bands rich in hornblende stand out from the general greenish-grey colour of the rock. In thin section this type differs from the first in the apparent lack of orientation of mineral grains. It is composed of varying amounts of hornblende, microcline, quartz, epidote, and titanite. In the darker bands approximately equal quantities of hornblende and epidote predominate over small interspersed grains of quartz and microcline.

The third rock type is a light-grey, fine-grained rock consisting of oligoclase, quartz, hornblende, and biotite. Narrow, irregularly spaced bands impart a gneissic appearance to the rock. Closer examination reveals an orientation of the dark minerals producing banding on a minute scale.

Associated with the above rock types are narrow bands of iron formation, which were determined in the field more commonly by compass readings than by actual observation. They consist of magnetite-rich layers, rarely more than a few inches wide, interspersed in the gneisses.

Post-Keewatin

Diorite and gabbro intrude the greenstones in the vicinity of July falls. The greater part of the intrusive mass is covered by drift, but outcrops indicate an oval-shaped body 2 miles long and 1 mile wide, roughly paralleling the direction of the greenstone belt. At some distance from the contact the rock is a dark-grey, medium-grained, massive diorite, composed essentially of hornblende and plagioclase with a minor amount of biotite. Closer to the greenstone contact, however, the proportion of dark minerals increases, and in many places the rock has been so sheared and altered as to be almost indistinguishable from the adjoining volcanics.

Algoman(?)

The greater part of the area is underlain by granite of several types, the most abundant of which is a grey, medium-grained biotite granite. It is usually massive, but in a few places shows a faint gneissic structure. Darker zones occur throughout the area; in these, hornblende, altered to chlorite, takes the place of biotite. Granodiorite, somewhat similar in appearance to the biotite granite and believed to be related to it, occurs in a few isolated outcrops.

Along the Trading river, a fine-grained, pink granite containing only minor amounts of biotite appears to intrude the biotite granite wherever the two are

found in contact. Pegmatite dikes cutting the granites are found in most exposures but are particularly numerous near the greenstone contacts. These intrusives are classed as Algoman(?) by Hurst:[1]—

As no Timiskaming sediments were found in the area, the age of these intrusions could not be determined more precisely than post-Keewatin. To the west, in the Red Lake and Woman Lake sections of the Patricia portion of the district of Kenora, where rocks of Timiskaming age do occur, the intrusions of granite, which closely resemble those of the Pickle Lake–Crow River area, are considered to be of Algoman rather than of Laurentian age. In view of this similarity and because the batholithic invasions of granite were probably contemporaneous over much of northwestern Ontario, it is believed that the bodies of granite and quartz porphyry in the Pickle Lake–Crow River area are also Algoman in age.

Pleistocene

Glacial deposits were encountered throughout most of the area but particularly in the northern part. Drift hills reach a thickness of 100 feet or more. Good sections are found at the northeast end of Badesdawa lake, where stratified, fine, white quartz sand rests upon blue clay and is overlain by gravel.

Recent

The only Recent deposits of any extent are moss and peat, which occur in the widespread muskegs. Sections of peat, several feet thick, have been cleared of moss by wave action along the low shores of many lakes.

STRUCTURAL GEOLOGY

The structure of the Keewatin rocks can be inferred only from the known structure of the corresponding rocks of the Crow River area. Thomson[2] interprets this structure as follows:—

The tracing of horizons of iron formation, however, is proving to be of considerable use in showing the deformation of the region. By this method it has been found that the formation immediately north of the Pickle Crow mine has been folded into a syncline, the axis of which strikes about N. 45° E. The axial plane is overturned to the north with a dip of about 75 degrees. North and east of the mine this syncline noses out, and a series of dip measurements taken on the nose of the folds indicates that it plunges to the northeast at an angle somewhere between 45 and 70 degrees. Two horizons of iron formations have been traced around both limbs of the syncline.

The few pillow structures observed in the area are too indistinct to permit their use in determining the tops of the lava flows. Metamorphism of the sediments has obscured any variation in grain size that might have existed. Thus, from position only, the tongue-like extension of the belt appears to be part of the southern limb of the syncline, the remainder of which has been blotted out by later intrusives.

The banded gneisses strike generally east and parallel the boundaries of the belt. Dips are very steep, the lowest recorded being 62 degrees. Much of the banding probably represents the original stratification of the volcanic fragmentals and sediments. Shearing along the bedding may be inferred from the parallel orientation of minerals such as hornblende and augite. This contention is supported by evidence of schistosity at a slight angle to the banding noted on a few freshly broken surfaces.

The only indications of possible faulting observed in the field were a few low escarpments marking the termination of outcrops. No proof of major faulting exists.

---

[1]M. E. Hurst, op. cit., p. 11.

[2]Jas. E. Thomson, "Preliminary Report on the Pickle-Crow Gold Area," Ont. Dept. Mines, 1936, p. 2.

FUTURE OF THE AREA

The gold deposits of the Pickle Lake greenstone belt have been shown by Thomson[1] to be associated with iron formation, massive lavas, and silicified sheared zones in the lavas. The Badesdawa lake part of the belt contains small amounts of iron formation in narrow bands, but none large enough to act as a locus of fracturing. Massive lavas outcrop in the immediate vicinity of the Crow river, south and west of July falls. This area has been thoroughly prospected in recent years without success. No silicified sheared zones were noted in any of the rocks in the belt. In view of the limited extent of the greenstone belt and the absence of suitable host rocks for mineral deposition, it appears improbable that deposits of economic importance will be found in the Eastern Extension of Crow River area.

[1]Jas. E. Thomson, "The Crow River Area," Ont. Dept. Mines, Vol. XLVII, 1938, pt. 3, pp. 25-27.

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FORTY-EIGHTH ANNUAL REPORT

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VOL. XLVIII, PART VIII, 1939

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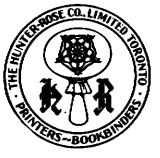

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COLOURED GEOLOGICAL MAP

(In pocket at back of report)

Map No. 48g—Uchi-Slate Lakes Area, District of Kenora (Patricia Portion), Ontario. Scale, ½ mile to the inch.

Geology and Gold Deposits of the Uchi-Slate Lakes Area

By J. D. Bateman

INTRODUCTION

The Uchi-Slate Lakes area lies in the Patricia portion of the district of Kenora in northwestern Ontario, between north latitudes 50° 56′ and 51° 08′ and west longitudes 92° 23′ and 92° 43′. Uchi lake is approximately 75 miles north-northwest of Hudson or Sioux Lookout on the main line of the Canadian National Railways. The area covers approximately 170 square miles, and comprises the townships of Birkett and Earngey, an equal area to the south, the eastern third of Mitchell and Bowerman townships, the southeast corner of Dent, and the southern sixth of Costello and Agnew. The field work in connection with this report was done during the summer of 1938.

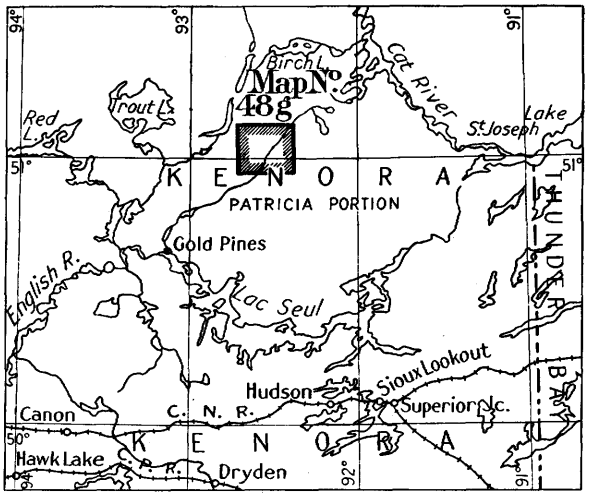


Fig. 1—Key map showing the location of the Uchi-Slate Lakes area. Scale, 50 miles to the inch.

Gold was first discovered in the Uchi-Slate Lakes area shortly after the Red Lake rush of 1925. When most of the favourable ground in the vicinity of Red lake was staked, prospectors moved out the following summer into the Woman and Narrow Lakes area, which became an active prospecting centre in 1926. Part of this activity was focused on what is now the northwestern part of the Uchi-Slate Lakes map area.

During the period from 1927 to 1929 shafts were sunk by the Consolidated Mining and Smelting Company on the Hill-Sloan-Tivy (Tapeworm) vein east of Lost bay of Confederation lake and on the MacAulay claims (now owned by Uchi Gold Mines) between Lost bay and Uchi lake. A small amount of lateral work was done from both prospect shafts, but findings were not encouraging and operations were discontinued. Bobjo Mines explored a gold discovery in Lost bay with a prospect shaft in 1928 but failed to intersect the surface vein at depth. Some gold was recovered, however, from ore taken from an open

cut on surface and treated in an amalgam plant. With the exception of some later high-grading of the Bobjo vein by lessors and the recovery of an estimated 40 ounces of gold from a quartz stringer on one of the former claims of Conwo Gold Mines, this represents the entire gold production of the area until 1939.

The flow of funds for development work was curtailed by the financial slump of 1929 and active work in the area lapsed until 1936, when J. E. Hammell and associates began a programme of surface development on the former MacAulay discovery and, in 1937, formed Uchi Gold Mines to continue development.

The successful development of a substantial tonnage of ore on the property of Uchi Gold Mines resulted in renewed prospecting activity in the area, which was mostly confined to the section surrounding Uchi lake and Lost bay. During the time the writer was in the area Woco Gold Developments was carrying out an intensive exploration programme on 28 gold-bearing zones on the properties of Conwo Gold Mines and Kenelda Gold Mines (now owned by Jalda Gold Mines and Hanalda Gold Mines). Surface development and diamond-drilling were renewed by Bobjo Mines and, in addition, a number of organizations and individuals were engaged in prospecting claims. In August, 1938, a gold discovery at Fly lake resulted in a small gold rush, during which more than 100 claims were staked.

Uchi Gold Mines has constructed a mill having an initial capacity of 500 tons of ore per day and a crushing plant with a daily capacity of 1,000 tons. The ore body has been developed by means of two shafts, capable of handling up to 2,000 tons of ore per day. A hydro-electric power line was completed early in the winter of 1938–39 from Ear Falls, north of Gold Pines, to the mine property; power is also available for other developments in the area. Up to the present time most of the transportation of supplies and equipment for developments has been accomplished by airplane, but in September, 1938, a road was completed from Gold Pines to Confederation lake, and continued to the mine property in the early summer of 1939. A townsite has been established at Uchi lake and a post office of the same name.

Acknowledgments

The writer is indebted to all operators in the area for their generous assisttance and co-operation and, in particular, to R. H. Sturgess, manager of Uchi Gold Mines, Limited, G. W. Moore, manager of Woco Gold Developments, Limited, and subsidiary companies (Kenelda Gold Mines, Limited, and Conwo Gold Mines, Limited), and to T. C. Fawcett, in charge of operations at Bobjo Mines, all of whom made company plans available. Much of the underground geology of the Uchi mine was taken from plans of R. F. Kent and the surface geology of the properties of Woco Gold Developments and subsidiary companies from detailed, accurate plans prepared by G. W. Moore.

The present report embodies a summary and conclusions of a dissertation, presented for the degree of Doctor of Philosophy in Yale University. The writer wishes to express his appreciation to Professors Alan M. Batemen, Adolph Knopf, and other members of the faculty of the Department of Geological Sciences at Yale University for their assistance. E. B. Knopf, Cyril W. Knight, and Professor E. L. Bruce contributed helpful discussions on the structural geology, and Dr. F. J. Turner determined for the writer the optical character of a number of minerals on the universal stage.

The party was dependent on the services of Starratt Airways for transportation of personnel and supplies, and the writer would like to thank the pilots and ground staff for their help in his work.

During the field season of four months, O. A. Seeber, in the capacity of senior assistant, and R. D. Hindson and W. L. McDonald rendered capable and willing service.

Means of Access

Tugs and power-boats operate on Lac Seul between Hudson and Gold Pines, the trip requiring about 12 hours. From Gold Pines there is a recently completed 50-mile road to Confederation and Uchi lakes, over which trucks and tractors may operate. From Gold Pines, the Wenasaga river may be ascended by canoe, and any part of the area may be reached by a short airplane flight.

The area is most conveniently reached in less than an hour from Hudson or Sioux Lookout by airplane. There is daily air mail, passenger, and express service to Uchi Lake from Hudson, Sioux Lookout, Kenora, Winnipeg, and Red Lake. There is a similar service from Sioux Lookout three times a week to Lost bay and the J. M. Consolidated mine. Four flying companies operate into the area, trips being almost daily; in addition, planes are stationed at Lost bay and Uchi lake, where radio-telephone communications are established.

Travel within the area is best accomplished by canoe, and all parts are easily accessible on foot from the different water routes.

Previous Geological Work

The first recorded geological observations in the area were made in 1893 by D. B. Dowling.[1]

A. W. G. Wilson and J. F. E. Johnston, in 1902, surveyed some of the water routes between Lac Seul and Cat lake, including Slate lake and the Wenasaga river. Wilson's report[2] contains the first petrographic descriptions of the rocks along these waterways.

In 1904, Charles Camsell[3] during an examination of the country around the headwaters of the Severn river made additional observations to those of Wilson on the Wenasaga river and Slate lake.

Wilson's geological work, together with the surveys of Camsell and Dowling, was compiled in map No. 1089, published by the Geological Survey in 1910.

When the Patricia portion of the district of Keewatin was added to the territory of the province of Ontario in 1912, all the earlier reports of the Geological Survey of Canada covering this region were republished by the Ontario Bureau of Mines in a single volume.[4] In 1919 a geological reconnaissance was made into the district of Patricia by E. M. Burwash, whose report[5] includes petrographic descriptions of rocks in the vicinity of Slate lake.

Following the Red Lake gold rush, the Ontario Department of Mines began a more or less systematic mapping of the areas of sedimentary and volcanic schists. Among the first of these areas examined was the Woman and Narrow Lakes area, which J. W. Greig[6] mapped in 1926.

As mining development progressed, there was need for more detailed geological studies, and parts of Greig's original map area were re-examined and mapped in subsequent years. These parts include the Woman, Narrow, and

[1]D. B. Dowling, Geol. Surv. Can., Vol. VII, pt. F, 1894.

[2]A. W. G. Wilson, "Report on a Traverse through the Southern Part of the North West Territories from Lac Seul to Cat Lake in 1902," Geol. Surv. Can., Pub. No. 1006, 1911.

[3]Chas. Camsell, Geol. Surv. Can., Vol. XVI, 1904, pp. 143-152A.

[4]"Reports on the District of Patricia," Ont. Bur. Mines, Vol. XXI, pt. 2, 1912.

[5]E. M. Burwash, Ont. Dept. Mines, Vol. XXIX, 1920, pt. 1, pp. 157-192.

[6]J. W. Greig, Ont. Dept. Mines, Vol. XXXVI, 1927, pt. 3, pp. 85-110. (Reprinted June, 1932.)

Confederation Lakes section, studied in 1927 by E. L. Bruce[1]; the Shabumeni-Birch Lakes area, mapped by Geo. D. Furse[2] in 1932; the Birch-Springpole Lakes area, studied by W. D. Harding[3] in 1935, and the Uchi-Slate Lakes area. The Papaonga area adjoining to the east was mapped by W. I. Wright in 1935.[4]

In 1937, an area, 4 by 2½ miles, lying between Uchi lake and Lost bay of Confederation lake was studied and mapped in detail by Jas. E. Thomson.[5] This section, known as the Uchi Lake area, is omitted from the present study, although subsequent mining developments in it were examined in detail by the writer.

The Uchi-Slate Lakes area adjoins the Birch-Springpole Lakes area on the north and the Woman and Narrow Lakes area on the northwest.

Summary of Geology and Topography

Geology

The rocks that underlie the southeastern half of the area are the oldest rocks in the region and are dominantly sedimentary in origin. They have been named the Slate Lake series and consist for the most part of impure quartzites, greywacke, and arkose, which are altered to mica schists and gneisses near the borders of intrusive granites and to sericite and carbonate schist along zones of intense shearing, such as those that pass through Slate lake. A belt of conglomerate, comprising part of this sedimentary series, trends eastward through the area, passing through Slate lake. Southeast of Slate lake an eastward-trending band of magnetic iron formation provides an additional stratigraphic horizon marker. Three east-west trending belts of greenstone, each locally showing pillow structures, pass through Slate lake and are intercalated with the sediments.

In contrast to the Slate Lake series, the northwestern part of the map area is underlain by rocks that are dominantly igneous and consist mostly of interbedded volcanics of different characters. This group has been named the Uchi series. Basic volcanics, termed greenstones, comprise the greater part of the group and lie interbedded with thin belts of volcanic breccias and tuffs of porphyritic andesite, rhyolite, and fine-grained silicic tuffs.

A number of long, narrow belts of altered gabbro, amphibolite, and peridotite lie between the members of the Uchi volcanics. These are, in part, the coarser-grained portions of thick basic flows and, in part, vertical sill-like intrusives between the flows, but both types have been mapped together owing to their petrographic similarity.

The older granite lies west of Fly lake and extends north through the main body of Confederation lake as a long, thick, vertical sill. The basic intrusives and the granite porphyry have been involved in the regional folding of the volcanics and sediments and have undergone some contact metamorphism resulting from the intrusion of the younger post-folding granites and related intrusives. The older granite is massive in the central part, but near the borders it grades into a "quartz porphyry," which is its sheared equivalent, and along the east border at Fly lake a broad zone of mylonite[6] has been developed from it.

The sediments and volcanics have been so folded that they now lie in nearly vertical positions, although in the southern part of the area the formations

[1]E. L. Bruce, Ont. Dept. Mines, Vol. XXXVII, 1928, pt. 4, pp. 1-51.
[2]G. D. Furse, Ont. Dept. Mines, Vol. XLII, 1933, pt. 6, pp. 21-51.
[3]W. D. Harding, Ont. Dept. Mines, Vol. XLV, 1936, pt. 4.
[4]Geol. Surv. Can., map 347A, 1936.
[5]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLVII, 1938, pt. 3, pp. 65-82.
[6]A compact, chertlike rock produced by extreme granulation and shearing.

have a steep southerly dip and in the northwestern part a steep westerly dip. The Slate Lake series, except where disturbed by granites to the northeast, have a constant east-west strike. The Uchi series, on the other hand, strike south in the northern part of the area and towards the south swing around to west-southwest. Thus the Slate Lake series are a structurally distinct unit from the Uchi series, and the boundary between the two is interpreted as an unconformity. The Slate Lake sediments, which have previously been called Timiskaming, lie unconformably beneath the younger Uchi volcanics. This throws some doubt on the validity of the term Keewatin as applied to the volcanics, and for that reason local names are used.

A large number of post-folding granitic intrusives occur in the area. In the vicinity of Perrigo lake there is a mass of hornblende granodiorite approximately 4 miles in diameter. East of One Island lake is the west border of a large granite batholith, which in the map area is a muscovite-albite granite with much associated pegmatite. These granitic rocks are called the younger granites.

Many small intrusive bodies are associated with the younger granite. These include granite, syenite, quartz-feldspar porphyry, diorite, diorite porphyry, and a wide range of dikes. The youngest of the dikes that are thought to be related to the intrusion of the younger granite are later than the period of gold deposition, and it is therefore believed that the gold deposits are genetically related to a late magmatic stage of the consolidation of this granite. The intrusion of the younger granite resulted in a broad metamorphic zoning throughout most of the map area, which is reflected in the ferromagnesian minerals. Most of the gold deposits discovered to date are related to this zoning, further indicating a genetic relationship to the younger granite.

Topography

The region is almost flat and from the air appears as a plane, whose monotony is broken only by lakes, which in some places are so numerous that they form a labyrinth of interconnecting channels. In detail, however, there is a marked irregularity; the outlines of the lakes are intricate and islands so numerous that these features, together with a variety of vegetation, produce a far from monotonous aspect. Low gravel, boulder, and rock ridges lie interspersed with muskegs, and in a few places hills rise as high as 150 feet above the general level. The glacial mantle is thin, and rock outcrops are relatively abundant, except in the southern part of the area, where the overburden is thicker.

The mean elevation of the area is approximately 1,300 feet above sea-level. East of One Island lake a number of round granite hills rise to an elevation of approximately 1,400 feet; similar elevations are also attained on eastward-trending ridges south of Jubilee lake and southeast of Slate lake.

Drainage

Most of the lakes are developed in rock basins, although many of them represent the flooded stretches of stream courses, where they have been dammed by rock barriers or morainal debris.

Except for Fly and Confederation lakes, all lakes and streams drain southwestward by the Wenasaga and Uchi rivers. The Wenasaga river is discharged into Lac Seul, the waters of which empty into Lake Winnipeg through the English and Winnipeg rivers. Fly lake drains northward into Confederation lake, and these waters are also discharged into Lac Seul by the Woman and Trout Lake rivers.

The largest river in the area, the Wenasaga, is characterized by long, flooded, sluggish stretches alternating with short lengths of rapids and swift water.

GENERAL GEOLOGY

All the consolidated rocks in the area are early pre-Cambrian in age. The relationships of the rock formations are shown in the accompanying table:—

Table of Formations

QUATERNARY	
RECENT:	Bedded clay, peat.
PLEISTOCENE:	Till, sand and gravel.
PRE-CAMBRIAN	
POST-VOLCANIC INTRUSIVES:	
YOUNGER INTRUSIVES:	Lamprophyre and related dikes. Aplite and silicic dikes. Quartz-feldspar porphyry, diorite, and diorite porphyry. Pegmatite. Granite, syenite, quartz monzonite, granodiorite.
	Intrusive contact—intense folding
OLDER INTRUSIVES:	Amphibolite. Basic intrusives: Metagabbro and peridotite. Granite porphyry, "quartz porphyry," mylonite.
	Intrusive contact
UCHI SERIES:	Rhyolite and silicic tuff. Altered andesitic tuff and breccia. Metabasalt: Pillow lava, amygdaloidal lava, spherulitic lava. Amphibolite. Quartzite, greywacke, slate. Porphyritic andesite tuff and breccia. Greenstone: Hornblende schist, amphibolite and carbonate schist, locally showing pillow and amygdaloidal structures.
	Unconformity—gentle folding
SLATE LAKE SERIES:	Biotite-quartz schist, granulite, paragneiss, staurolite gneiss, quartzite, and greywacke. Hornblende gneiss. Greenstone, pillow lava. Conglomerate. Arkose, slate, sericite schist, carbonate schist. Iron formation. Impure quartzite, mica schist.

Slate Lake Series

The Slate Lake series underlies the southeastern half of the map area and is separated from the volcanics to the northwest along an approximate northeast line diagonally bisecting the area. The sediments and intercalated volcanics have been so steeply folded that the planes of both bedding and schistosity are in approximately vertical positions, although in the vicinity of Slate lake there are steep southerly dips. Viewed broadly, the folding is simple, but detailed mapping has brought out many intricate relationships produced by folding. The various formations of the sedimentary series strike west in broad, curving trends. The members lying to the north of the conglomerate are truncated at their west contact with the Uchi series. The only exception to the east-west trend of the sediments is in the northeast corner of the area, where they have been disturbed by intrusive granites, and a narrow strip of mica schist between two granite bodies strikes north.

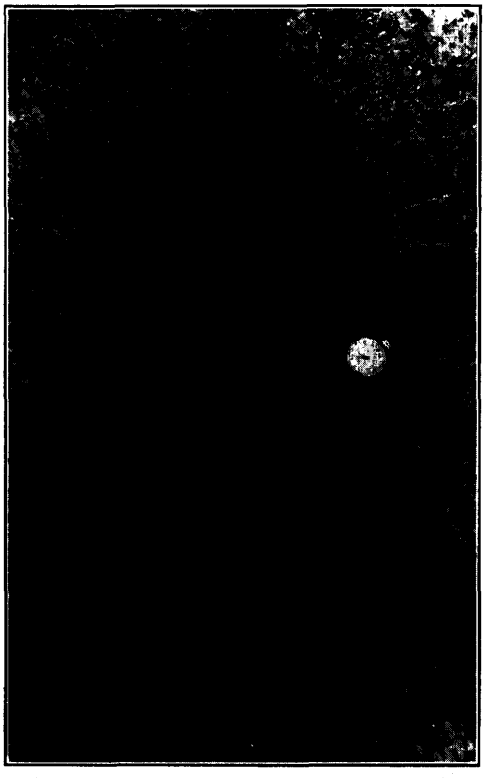
Impure Quartzite and Mica Schist

The south boundary of the area is underlain by impure quartzites, which are largely altered to mica schists. These rocks have been traced south of the

area to the Papaonga river, where they meet the main granite bordering the schist belt. They show indistinct bedding and are of undoubted sedimentary origin.

Iron Formation

A narrow belt of sedimentary iron formation was encountered a short distance north of mile post XI on the east boundary of the area and traced approximately 3 miles west, where it apparently disappears. The belt averages 500 feet in width, has a steep northerly dip, and is so highly magnetic that compass readings are not reliable within an area of 8 square miles surrounding it.



Fine-grained interbedded arkose and slate near the outlet of Lower Slate lake. Trace of displacement of beds due to minor faulting is outlined in black.

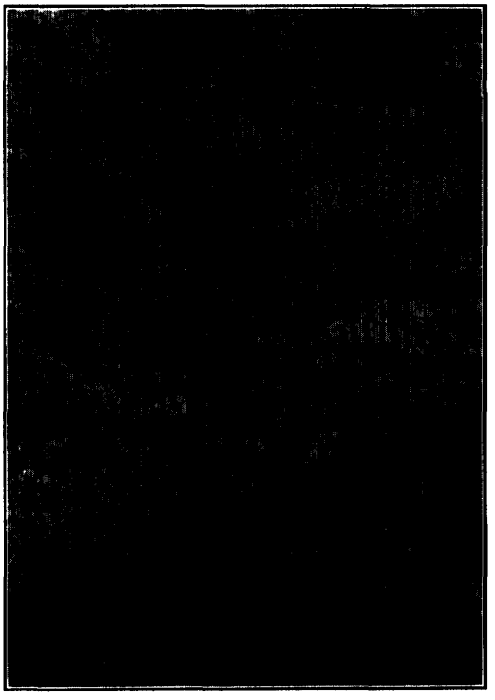
The iron formation is distinctly bedded and consists of thin layers of magnetite interbedded with arenaceous sediments, cherty quartz and jasper. Representative specimens were taken from two localities along the belt and submitted to the Provincial Assay Office for a partial chemical analysis, which is as follows:—

	No. 1	No. 2
	per cent.	per cent.
Iron	31.30	32.87
Silica	41.73	48.96
Phosphorus	.07	.19
Titanium	.14	.09

Sample No. 1—18 chains north of mile post XI, east boundary of the map area.
Sample No. 2—10 chains north of the west end of Tepeka lake.

The iron content is too low to be of economic value at the present time. The magnetite layers observed in polished sections contain much finely divided silica, which could not be separated by magnetic concentration.

The writer agrees with the conclusion expressed by Bruce[1] for the iron formation at Lake St. Joseph that the deposit is the result of chemical precipitation. This is suggested by the fine, even, rhythmical alternate banding of cherty quartz and silica. The Slate Lake iron formation is underlain and overlain by normal arenaceous sediments, and it is concluded that the principal source of the supply of iron was from the weathering and erosion of old land surfaces under special conditions.



Three-foot bed of pebble and cobble conglomerate in Sawan bay, Slate lake. Note relatively undeformed cobbles.

Arkose, Slate, and Derived Schists

Much of the Slate Lake sediments extending from Ben (Sucker) lake eastward through Slate lake consists of arkose and arkosic quartzites in various degrees of alteration to sericite schists. A small amount of bedded cherty sediments and very minor amounts of slate are included in this group. These rocks are, in general, distinctly and regularly bedded, but the bedding in many places is obscured by shearing. Adjacent to the strong shear zones that pass through Slate lake these rocks are altered to fissile quartz-sericite schists and local zones of rusty-weathering carbonate schists. In the vicinity of porphyritic intrusives east of Slate lake, the arkoses and slate have been altered to garnetiferous and chlorite-bearing rocks.

[1]E. L. Bruce, Ont. Dept. Mines, Vol. XXXI, 1922, pt. 8, p. 27.

Conglomerate

A formation of conglomerate extends westward through the area from the east boundary, passing south of Maskooch lake, through Sawan bay, and Slate lake and continuing westward, probably as far as the boundary with the Uchi series in the vicinity of Ben lake. The maximum thickness of the conglomerate formation is approximately three-quarters of a mile east of Sawan bay, but is less to the east and west, the conglomerate having a roughly lenticular shape. The conglomerate is bounded both to the north and to the south by dominantly arkosic sediments, and the matrix between the pebbles is mostly impure arkose.

Most of the conglomerate is similar to that occurring in the central part of Slate lake, where it consists of cobble and pebble horizons with rare boulders in a matrix of bedded arkose and arkosic quartzite. The cobbles are commonly drawn out in lines of no greater width than that of a single cobble, and many of the conglomerate horizons are no more than 4 to 6 inches wide, but have been observed up to 20 feet in width. The boulders and most of the cobbles consist of light-grey to buff weathering granitic rock types and show very little distortion due to deformation, having mostly round and smooth oval shapes. The pebbles, on the other hand, differ in the variety of material and the more obvious stretching due to deformation. The lithological types consist of greenstone, silicic lavas, quartz, hematite, iron formation, light and dark cherts, and thinly bedded cherts.

Two statistical analyses of the pebble content were made on conglomerate outcrops on two of the islands in Sawan bay, the following types being identified:—

	No. 1	No. 2
	per cent.	per cent.
Greenstone	38	38
Felsite and fine-grained porphyries	22	35
Granitic types	19	15
Iron formation	6	.....
Quartzite	5	.....
Coarse-grained porphyries	4	5
Diorite	3	1
Slate	1	.....
Vein quartz	1	.....
Hematite	1	.....
Sedimentary types	.....	2
Chert and quartz	.....	4
Total	100	100

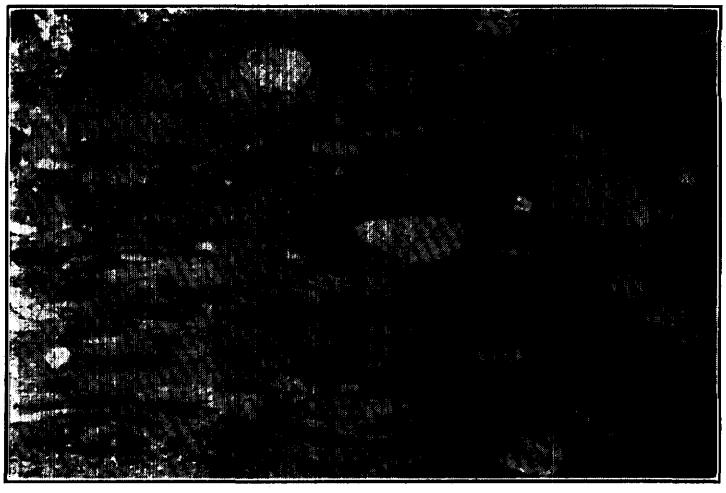
In analysis No. 1, 373 pebbles were counted, none of the material having a greater dimension than 7¼ inches; the pebbles constituted 85 per cent. of the rock. In analysis No. 2, 211 pebbles were counted, the pebbles constituting four-fifths of the rock and the arkosic matrix containing abundant grains of opalescent blue quartz.

All the volcanic pebble types, particularly the greenstones, could have been derived from volcanic flows lying either north or south of the sedimentary formation. Burwash was inclined to think that some of the silicic pebbles were derived from the rocks to the southeast.[1] The iron formation is not known to be repeated in the area by folding, and there is no known source for the iron formation pebbles in the conglomerate other than to the south. The iron formation pebbles are identical to the material observed in the belt to the south, suggesting

[1] E. M. Burwash, op. cit., p. 169.

that the tops of the beds in this section face the north. Plutonic pebble types, such as the granites and gneissoid granites, must belong to an unidentified granite older than the Slate Lake sediments.

Burwash[1] inferred from the conglomerate a widespread unconformity and tentatively correlated the Slate Lake conglomerate with that at Birch Lake to the north. The conglomerate at Birch lake, as will be shown, is younger than that at Slate lake. Rather than representing a widespread unconformity, the Slate Lake conglomerate, which is a great lens, appears to indicate a local unconformity, in which the chief controlling factor was uplift in an adjacent area, resulting in a change of the character of the sedimentation. Support for this concept is the gradual passage of fine conglomerate into coarser material across the formation from south to north and the presence of interbedded volcanic flows, which suggest some disturbance accompanied by igneous activity. A similar deposit could be formed as a fanglomerate along a down-faulted block.



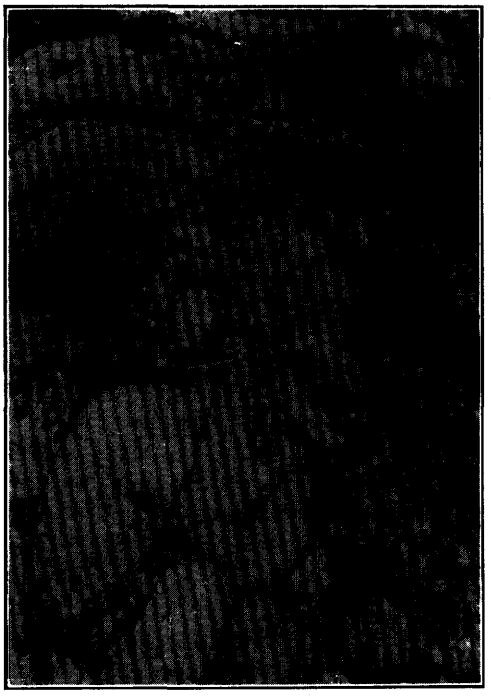
Stretched pebble conglomerate, Sawan bay, Slate lake.

Greig[2] described the deposit as a "series of conglomerates with interbedded arenaceous greywackes," and compared the formation to the Cobalt and other Huronian conglomerates, suggesting a glacial origin, the principal evidence being the presence of large boulders in otherwise uniform, fine-grained sediments.[3] Rather than large boulders dropped into otherwise uniform sediments, the boulders and cobbles commonly occur strung out in lines parallel to the bedding of the enclosing sediments and of no greater thickness than the width of a single boulder. Thicker fragmental beds are also common, and these generally have a lenticular shape. The beds and lenticular areas of pebbles, cobbles, and boulders appear to be incidents in the deposition of the arkosic sediments. The coarse material would be likely to be deposited at those times when the agency of transportation, such as streams, increased in size and volume, owing to heavy rains or rapidly melting snow. The origin of the Slate Lake conglomerate is most satisfactorily explained as a fan type of sedimentary deposit at the base of

[1]E. M. Burwash, op. cit., p. 175.
[2]J. W. Greig, op. cit., p. 102.
[3]Ibid, pp. 104, 105.

a highland. This would account for the lenticular character of the whole conglomerate formation, as well as the lenticular shapes of the pebble and cobble beds. The bedding of the intervening arkosic sediments is thus accounted for, and an explanation provided for the flattening of cobbles along bedding planes by increases in the capacity of the depositing streams at flood times. The large boulders described by Greig could easily be transported in this manner, and with the return to normal stream flow deposition of finer-grained sediments would continue until the next flood period.

There is a single outcrop of conglomerate at the east end of Sawan bay for which the above explanation is not valid. The conglomerate here is a jumble of



Conglomerate composed of subangular boulders of lava, east end of Sawan bay, Slate lake.

large boulders and cobbles constituting more than 70 per cent. of the entire rock mass and exposed as solid conglomerate at least 300 feet thick. The boulders are up to 3½ feet in longest dimension, subangular in shape, and composed mostly of porphyritic rhyolite and silicic greenstones.

Interbedded Volcanics

Three narrow belts of basic volcanics, each having a westerly trend in conformity with the enclosing sediments, occur in the vicinity of Slate lake. One of the belts lies to the south of the conglomerate, the other two being to the north. The rock in each case is greenstone and locally shows pillow structures so severely deformed that they are barely recognizable. One of the volcanic belts north of Slate lake may be a repetition of the other due to faulting, as there is evidence of movement in the marked shearing of the rocks at Slate lake.

Throughout the Slate Lake series there are many narrow silicic flows interbedded with the various sedimentary members. These have been mapped with the volcanics in the Slate Lake series, but in some instances their igneous origin is questioned.

Hornblende Gneiss

A zone of hornblende gneiss extends eastwards from Upper Slate lake to the boundary of the map area south of Jubilee lake. The rock has the bedded appearance of a sediment, but is a saussurite-amphibolite containing 70 to 80 per cent. hornblende and has a specific gravity of 3.09.

Paragneiss and Related Rocks

Almost the entire Slate Lake series north of the Upper Slate lake and Jubilee lake are fine-grained, bedded, and arenaceous. These rocks have undergone considerable metamorphism, and although they still superficially resemble greywackes, they are mostly even-grained biotite-quartz schists and paragneisses. Near the borders of intrusive granites staurolite gneisses and garnetiferous mica schists are developed.

Origin of the Slate Lake Series

The Slate Lake conglomerate has already been referred to a continental origin. As the other sediments, with the exception of the iron formation, are dominantly arenaceous and lack the argillaceous and calcareous facies common to most marine sedimentary series, they, too, are presumed to be of continental origin. The presence of abundant arkose in the vicinity of Slate lake suggests a nearby source of the detritus by erosion under rapid mechanical weathering conditions. Although the sedimentary series is thought to be essentially homoclinal with the tops of the beds facing the north; the thickness cannot be safely estimated as the structure is incompletely known. Some of the formations are known to be thickened by folding, and there is a suggestion of minor repetitions of some of the beds by small close folds, as well as by faults. Allowing for all these features, the thickness is still enormous, being approximately 20,000 to 30,000 feet, as the region south of the map area for some four miles is also to be considered in making estimates.

Uchi Series

The Uchi series underlies the northwestern half of the map area and consists of interbedded flows and tuffs of different composition and minor sediments, between which there are a number of long, narrow, conformable bodies of basic intrusives, some of which are indistinguishable from thick basic flows. All of the formations are in vertical positions or have steep, westerly dips, and are more or less schistose. In the northern part of the area, the formations of this assemblage strike to the south, but farther south they swing to the southwest, and in the southwest corner of the area strike almost west.

Leg Lake Section

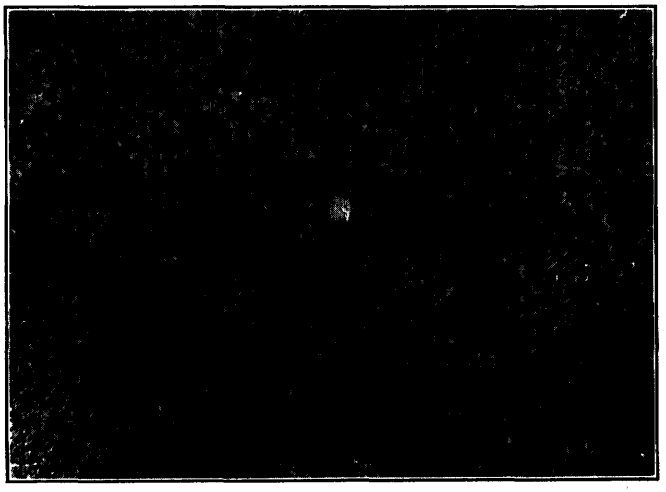
To the east, southeast, and south of Leg lake, the volcanics consist mostly of basic flows, which are altered to hornblende schists and fine-grained amphibolites, in which no vestige of original structures or textures remains. Small amounts of rhyolite occur near the boundary of the volcanics with the Slate Lake sediments.

Lower Uchi Lake Section

Between Leg and Uchi lakes, and extending to the north and southwest of the lower part of Uchi lake, is a broad belt of rocks that consist mostly of interbedded tuff and volcanic breccia with lesser amounts of basic pillow lavas. The

fragments in the breccias have the composition of andesite. The tuffs are composed principally of plagioclase feldspars, are well-bedded, and in many places resemble normal sediments. These rocks are termed porphyritic andesite tuffs and breccias, and their northerly extension at the upper end of Uchi lake was formerly mapped as Timiskaming(?) sediments. The pyroclastic origin of the rocks is clear, however, and they are here included with the volcanic group. The associated basic lavas consist of rocks that have been partly epidotized and amphibolitized and are generally schistose.

A narrow belt of quartzite, greywacke, and slate, representing sediments formed by erosion during a temporary cessation of vulcanism, was mapped by Jas. E. Thomson[1] in the Uchi Lake area. The belt extends southwards, passing through the eastern part of lower Uchi lake and continuing irregularly for some distance to the southwest.



Spherulitic lava on Bobjo point, Lost bay.

Section from Uchi Lake to Fly Lake

The greenstones in the Uchi Lake map area have been described by Thomson.[2] Those to the south of the area consist mostly of amphibolites interbedded with narrow beds of silicic tuff and rhyolite flows. West of the Uchi Lake map area, the rocks consist of altered basic flows interbedded with pyroclastics and thin rhyolite flows. These rocks are massive to schistose and in many places show pillow and amygdaloidal structures. They were originally basalts, although now composed mostly of zoisite, clinozoisite, chlorite, and carbonate; they have been traced south of Fly lake, where they are essentially chlorite schists. An unusual occurrence of spherulitic lava occurs on Bobjo point in Lost bay, where zones of chert-like nodules, as shown in the accompanying photograph, make up to 30 per cent. of the volume of the rock. The matrix consists of chlorite schist, in which the chlorite shows incipient replacement by biotite. These rocks were examined and described by E. L. Bruce,[3] who explained the nodules as "rhythmic crystallizations in the cooling lava."

[1]Jas. E. Thomson, op. cit., p. 69.
[2]Jas. E. Thomson, op. cit., p. 68.
[3]E. L. Bruce, Ont. Dept. Mines, Vol. XXXVII, 1928, pt. 4, p. 7.

An extensive group of rocks east of Fly lake was mapped as lavas of intermediate composition. This group, in addition to flows, some of which are pillow lavas, contains a variety of fine breccias. These rocks weather light pea-green in colour and have the general appearance of a silicic lava bordering on rhyolite, but on microscopic examination they are found to be composed mostly of zoisite and clinozoisite. A sample submitted to the Provincial Assay Office yielded the following analysis:—

	Per cent.
SiO_2	45.44
Al_2O_3	20.33
Fe_2C_3	3.07
FeO	5.40
MgO	4.76
CaO	12.12
Na_2O	2.33
K_2O	.45
TiO_2	.52
P_2O_5	.04
S	trace
CO_2	2.20
H_2O	3.23
Total	99.89

The rock may thus be classified as altered basalt.

Fly Lake Section

The Uchi series to the west of Fly lake consists mostly of rhyolite and altered andesitic tuffs with small amounts of breccia. The rhyolites, which occur mostly near the northwest corner of the map area, are light-green to white weathering and in the field are massive in appearance. The andesitic tuffs that lie near the older granite porphyry are pale-green to buff weathering. Small amounts of basic lavas associated with these rocks consist mostly of chlorite schists.

Throughout the entire volcanic series there are numerous rusty-weathering shear zones, in which the lavas and tuffs have been replaced by iron-bearing carbonates.

Post-Volcanic Intrusives

The post-volcanic intrusives have been divided into two groups on the basis of their relation to the regional folding. The first group, the older intrusives, came into place prior to or during the folding of the Slate Lake and Uchi series, and are commonly schistose near their contacts with the sediments and volcanics. This group includes the older granite west of Fly lake and the basic intrusives, which occur, for the most part, in the Uchi series. The second group, the younger intrusives, postdate the regional folding and consist of granitic bodies and related dike rocks. Rocks of the second group have been found in intrusive contact with those of the first group.

OLDER INTRUSIVES

Granite Porphyry

A body of deformed granitic rock and its sheared equivalents lies in the western part of the map area. The greater part of this intrusive mass underlies the main body of Confederation lake and it is the oldest granitic rock known in place in the region. It occurs as a mass at least 12 miles long and averages from three-quarters of a mile to a mile in width. It extends south through North bay of Confederation lake and, farther south, is bounded on the west by South bay and on the east by Fly lake; thus only a part of this intrusive lies within the map area.

The granite was first examined by Greig[1] in 1926, who remarked on the intergrowths of quartz and feldspar, noted the shearing, named the rock a granite porphyry, and concluded that the intrusion was a sill.

A year later Bruce examined the granite, stating:[2]—

> The older granite has been called a granite porphyry in the previous report, and much of it is porphyritic; but as there are also equigranular facies apparently belonging to the same mass, the term porphyry has been dropped in this report.

Bruce also noted the brecciation and described graphic intergrowths of quartz and orthoclase, and concluded:[3]—

> Greig has suggested that the granite is a sill. This may be true where it lies approximately parallel to the amygdaloidal lava tops exposed on the Tripp-Gutcher claims to the west. . . . Towards the north it intrudes the diorite and is, of course, a dike.

Both Greig and Bruce, however, have mapped the body essentially conformable to the enclosing flows so that, whereas it may be locally intrusive, it is principally a concordant mass. That part of the intrusive that occurs in the present map area shows both intrusive and concordant contacts. The rock is porphyritic but over a large area is pseudo-porphyritic owing to partial granulation of all the minerals, except most of the quartz; but along the west side of Fly lake the minerals are so finely comminuted that the rock has the appearance of a slightly sheared rhyolite and is a broad zone of mylonite.

The texture of the fresh rock is porphyritic and is characterized by a micrographic intergrowth of quartz with microperthite and albite somewhat similar to a micropegmatite or granophyre. Every gradation between the fresh granite porphyry and mylonite has been observed in the field, the intermediate zone having the appearance of a quartz porphyry.

Samples of the fresh rock and its sheared mylonitic equivalent were submitted to the Provincial Assay Office and yielded the following analyses:—

	No. 1	No. 2
	per cent.	per cent.
SiO_2	77.93	71.01
Al_2O_3	11.47	14.14
Fe_2O_3	1.34	1.43
FeO	.84	1.99
MgO	1.65	1.39
CaO	trace	.76
Na_2O	2.80	3.87
K_2O	2.44	3.03
TiO_2	.52	.17
P_2O_5	trace	.04
S	trace	.04
CO_2	.34	1.06
H_2O	.96	1.14
Total	100.29	100.07
Specific gravity	.....	2.674

Specimen No. 1—Granite porphyry.
Specimen No. 2—Mylonite.

Specimen No. 1 was unfortunately chosen from a place where there was a concentration of quartz phenocrysts. The mineral content estimated from thin sections is as follows:—

[1]J. W. Greig, op. cit., p. 100.
[2]E. L. Bruce, op. cit., p. 16.
[3]Ibid, p. 17.

	Per cent.
Quartz	45
Potash feldspar	13
Albite	24
Sericite	10
Biotite	5
Chlorite	2
Sphene	1
Total	100

The most remarkable feature of the granite porphyry indicated by the analysis is the lack of lime.

At Fly lake the granite porphyry is cut by basic intrusives similar to those in other parts of the area. This intrusive contact, together with the fact that it has undergone more deformation than the basic intrusives, suggests that the granite porphyry is older.

Basic Intrusives

A number of long, narrow belts and lenticular masses of medium-grained basic rocks lie for the most part within the Uchi volcanics and in general conform to the strike of the flows. These consist of amphibolites, or hornblende schists, and are here included under the term metagabbro.

The basic intrusives show few distinct intrusive relationships with the enclosing flows, and doubtless much of the material mapped as basic intrusives consists of the coarser-grained central parts of some of the thicker basic flows, as Thomson[1] has suggested. On the other hand, some of these bodies are half a mile and more thick, consistently uniform in cross-section, and no doubt intrusive. In some places mapping has shown that the masses break through a series of flows to higher stratigraphic horizons, thus indicating intrusive relationships. These rocks have their greatest development south and east of Uchi lake.

Included with the basic intrusives is a zone of ultrabasic rocks lying immediately southeast of Leg lake and trending parallel to the lake. The massive portions of the rock consist essentially of antigorite and carbonate with a small amount of talc. Along the shore of Leg lake the rocks are intensely sheared and altered to carbonate-serpentine schists.

The metagabbros and associated rocks appear for the most part to be long, narrow, concordant, sill-like intrusives. The thicker bodies are generally massive and the original textures unaltered, although the mineral alteration has been profound. In all cases the intrusives are sheared at the contacts with the enclosing rocks, but the deformation is not as profound as in the older granite porphyry. These rocks are believed to have been involved in the regional folding.

YOUNGER INTRUSIVES

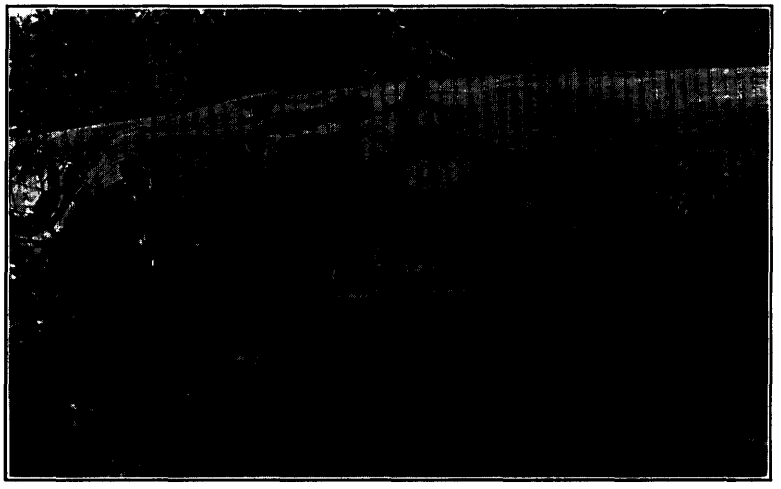
Whereas the older intrusives have generally been sheared by folding, the younger intrusives are fresh and massive, contain folded inclusions of the older rocks, and have superimposed a contact metamorphism upon a former deformational metamorphism. The younger intrusives consist mostly of large granite bodies, together with related dikes and stocks.

The west contact of a large granite batholith lies within the map area and is exposed along the eastern border from Jubilee lake northwards. Within the batholith, the rock is a normal granite, but where exposed much of it has been altered to an albite-muscovite granite containing garnet and topaz. The border of the batholith consists of a pegmatitic facies containing large crystals of albite

[1]Jas. E. Thomson, op. cit., p. 68.

of the same composition as that in the albitized granite. In the border zone of the intrusive and in the adjacent mica schists there are numerous pegmatite dikes that contain local masses of tourmaline.

Perrigo lake and the area to the south are underlain by an oval-shaped mass of granitic rock 3 to 4 miles in diameter, separated from the batholith to the east by a thin belt of sedimentary mica schist. The intrusion occurs along the boundary between the Slate Lake and the Uchi series and has produced a peripheral schistosity in the intruded rocks, the contacts being in part intrusive and in part concordant. The intrusive is full of small inclusions of the invaded rocks, which in the west half consist of amphibolite and in the east half of biotite granulites. Study of a cross-section through the intrusive has shown that the east half of the intrusive is essentially a biotite-quartz monzonite and the west



Flat dike on the Jalda claims exposed by erosion as a surface capping over the greenstone schist; to the right of the photograph the schist is also above the dike.

half a hornblende granodiorite, and that this change in composition can be attributed directly to contamination by the inclusions, which have been observed in all stages of digestion. The Perrigo lake granodiorite is thought to have been intruded contemporaneously with the granite to the east; it would have been a normal granite, except for contamination by the intruded rocks.

A small body of syenite composed almost entirely of alkali feldspar was mapped south of Wassa bay in Slate lake. A number of small stocks of diorite, diorite porphyry, and quartz-feldspar porphyry occur southeast of Slate lake in the southeastern part of the area. Similar intrusions of quartz-feldspar porphyry were examined in the northwestern part of the area at Confederation lake. In addition to the pegmatites there is a wide range of dike rocks, which are concentrated mostly in the eastern half of the area. The dikes range in composition from lamprophyre to aplite, and most of them are porphyries. The youngest dikes in the area are those that intersect the quartz veins and ore bodies at the Uchi, Bobjo, Jalda, and Hanalda properties. These dikes are mostly 2 to 3 feet wide and fill tension fractures at all angles to the schistosity of the rocks, unlike the earlier dikes, which are generally parallel to the schistosity. The dikes are composed of altered plagioclase feldspar, carbonate, and chlorite,

and are thought to have originally been related to lamprophyres. They are later than the period of gold deposition.

Underground in the Uchi mine there is a large number of these dikes, which strike in all directions and dip at all angles, many of them being horizontal. Although mineralogically altered, they are massive and intersect the schists; consequently they could not possibly be flows. Some of the dikes on the Jalda claims are flat lying and have been exposed by erosion, appearing as local cappings over the schists, as shown in the accompanying photograph. Most of them have a slight dip, however, and if followed down the dip, the schists will be found to overlap them. On the Hanalda and Jalda claims, however, there are a number of instances of interglacial or pre-glacial weathering of the rocks; and where any of the gold-bearing zones were involved in this weathering, there has been a small residual concentration of gold. This has been indicated by rich tailings of gold where some of the rusty material has been panned, whereas assays of the fresh rock beneath show only a small gold content. This enrichment is widespread, although not sufficiently extensive to be of any economic importance, but it has occurred in many places beneath the surface capping dikes. This condition has given rise to the erroneous impression that some of the dikes are lava flows and have acted as barriers localizing deposition of gold beneath them.

Metamorphism

Two principal metamorphic processes have been impressed on all of the rocks in the area, except the younger intrusives. The first of these went on during regional folding and is known as deformational metamorphism. The second process is the result of the effects of igneous intrusion on the older rocks. In this region igneous metamorphism has been superimposed on the older, previously deformed rocks.

Deformational Metamorphism

The principal deformational metamorphism took place during the regional folding of the Slate Lake and Uchi series and the included older intrusives. It has been expressed chiefly by the production of schistose rocks, but also by granulation of the rocks along zones of shearing or faulting. The widespread production of schists has been accompanied by the formation of platy minerals, such as chlorite and sericite, in parallel arrangement with the schistose structure. In addition many structures, such as pillows in basic lavas and pebbles in conglomerate, have been elongated, and the prismatic minerals, such as hornblendes, have their longest dimension parallel to and pitching with the fold axes. Some of the thicker flows and basic intrusives, although schistose near the contacts with other rocks, are essentially massive, and the primary igneous textures are unaltered. These rocks, however, have undergone a mineral reconstitution in the same direction as the schists, as may be seen in the alteration of hornblende to chlorite.

The granulation and production of mylonite along the eastern border of the older granite porphyry at Fly lake has already been described.[1] It is thought that this body acted as a buttress to stresses during folding and has localized the movement about its borders.

More commonly, zones of shearing or of intense deformation are expressed by partial mineral granulation and the growth of new minerals. This is illustrated by the metamorphism of the impure arkoses and arkosic quartzites that pass

[1]See page 15.

through Slate lake. These rocks are now quartz-sericite schists and may be observed grading into arkose.

Igneous Metamorphism

After they were deformed, the older rocks were invaded by granite, and a pronounced metamorphism was produced in the rocks surrounding the larger granitic masses. This type of metamorphism is particularly localized in the northeast corner of the area. The former impure quartzites of the Slate Lake sediments have been altered to massive granulites, schists, and gneisses. Where the metamorphism is more intense, as in the areas of abundant pegmatite dikes, there are local zones of porphyroblastic microcline, staurolite, and garnet in the metamorphosed sediments. The entire Slate Lake series north of the latitude between Upper Slate lake and Jubilee lake is characterized by metamorphism of this type, which has been superimposed on the pre-existing deformational metamorphism.

The Uchi series and the basic intrusives consist mostly of basic igneous rocks. In these the predominant metamorphic mineral is hornblende, and most of these rocks are hornblende schists and amphibolites.

There appears to be a broad metamorphic zoning outwards from the loci of most intense metamorphism adjacent to the Perrigo lake granodiorite and the batholith to the east.

Pleistocene and Recent

In Pleistocene time an ice-sheet moved over the area from northeast to southwest as indicated by the striae, all of which are within a few degrees of S. 45° W. The principal result of glacial erosion has been the removal of weathered rock material with the consequent exposure of fresh rock surfaces, the scouring of basins now occupied by lakes, and the rounding of hilltops and ridges. This erosion and the later filling-in of depressions with glacial debris has modified the bed rock relief. In the schist areas the strikes of ridges and valleys are invariably controlled by the strike of the foliation in the rocks, and neither structure nor topography appear to have exerted any marked control over the direction of ice movement. In the granitic areas, however, the topography is of a knob-and-basin type, and the ridges and lake basins have been elongated by ice movement in the direction of glacial advance.

A thin mantle of till was left spread over the glaciated rock surface and is sparse in the northern part of the area where rock is abundantly exposed, but somewhat thicker in the southern part where outcrops are less numerous. In the vicinity of Lower Slate lake and Ben lake there are some stratified deposits of sand and clay overlying the till, which may be continuous with the lacustrine clays in the English River valley to the southwest. In the northern part of the area there are a number of sand plains. Where the sand has been observed in cross-section in prospect trenches, it contains lenses of gravel and is commonly bedded and cross-bedded, the beds dipping southwest as much as 10 degrees, suggesting that the material was derived from the northeast. Muscovite sand beaches on the north shore of Jubilee lake were derived by erosion of the granite hills immediately to the north by south-flowing pre-glacial streams. The sand deposits overlie the till and are interpreted as outwash material. In the extreme northern part of the area east of Perrigo lake the sand plains are pitted with numerous oval muskeg depressions up to 100 yards in long dimension. These are interpreted as kettles.

Depth of Glacial Erosion

Bed rock surfaces are smooth and locally polished by glacial action, and since the disappearance of the ice, rock weathering has not extended to a depth greater than a quarter of an inch. Examples of weathering and formation of residual soil were observed in places protected from glacial erosion and are best exposed in a few of the development pits on the Hanalda and Jalda claims. In the gold-bearing zones this has resulted in a concentration of residual gold, which has already been discussed and is of no economic importance. As insufficient time has elapsed for this weathering and residual concentration to take place in the brief interval since the departure of the ice, it is concluded to be pre-glacial or interglacial in origin. The presence of this weathering implies a slight depth of glacial erosion.

The drainage within the area appears to be well adjusted both to lithology and structure. This adjustment is sufficiently marked to have required a very long period of sub-aerial erosion for its development and must, therefore, be pre-glacial in origin. The existence of pre-glacial drainage that has persisted into post-glacial time is further evidence that glacial erosion was largely superficial.

STRUCTURAL GEOLOGY

As the folding in the area and adjacent regions is isoclinal, the dips of bedding and schistosity are either steep, vertical, or slightly overturned. Consequently, the fold axes cannot be determined by plotting the dips. The interpretation of the structure, therefore, depends on a study of the inherent features, such as the shapes of pillows in lavas, cross-bedding and graded bedding in sediments, and unconformities.

Structure of the Slate Lake Sediments

The greater part of the Slate Lake sediments is poorly bedded, and in many places the bedding has been obscured or obliterated by the effects of either deformation or igneous intrusion. No instances of cross-bedding were observed in any of the sediments, and graded bedding, on the whole, is poorly developed. On the south shore of Ben lake, graded bedding would indicate that the tops of the beds face the south. South of the Slate Lake conglomerate two localities were studied in which the beds face northwards. On the north shore of Upper Slate lake and on the south shore of Jubilee lake, the tops of the beds also appear to face the north. Evidence from graded bedding is not considered reliable in the Slate Lake series. The only known source of iron formation pebbles in the conglomerate is to the south, and Burwash has similarly expressed the opinion that some of the pebbles were derived from the southeast. Although mapping has shown some indications of repeated folding, there is a suggestion that the stratigraphic sequence is mostly from south to north throughout the sedimentary series.

Structure of the Uchi Series

In the Uchi series a large number of reliable determinations on the tops of beds and flows indicate that the entire volcanic sequence faces west and northwest. The structure of the Uchi Lake map area was summarized as follows by Thomson:[1]—

> The fact that the tops of the beds and flows all face west indicates that the alternating succession of rock types makes up a continuous sequence of strata and is not repeated by close folding. The entire map area is located on the east limb of a syncline, the axis of which lies somewhere west of the area examined.

[1]Jas. E. Thomson, op. cit., p. 72.

In the section from Leg lake to Uchi lake, a large number of determinations from pillows and graded bedding in water-laid tuffs, indicates that the section is essentially homoclinal, facing west and northwest. No evidence was found for tops of flows in the narrow section between Leg lake and the boundary of the Slate Lake series.

In the section from the Uchi Lake area westward to Fly lake a number of determinations of the tops of flows from pillow lavas indicated that the volcanic sequence faces west.

The synclinal axis lies some place west of the present map area, possibly in the vicinity of Confederation and Woman lakes. Bruce quotes Greig as stating that the principal rhyolite flows lie above the basic flows and therefore represent synclines.[1] Bruce[2] stated that evidence seemed to corroborate this hypothesis. As there are extensive rhyolite flows at Woman lake, they would mark a synclinal axis according to this view.

The Uchi volcanic sequence, as far as is known, is not repeated by close folding and faces the west and northwest. The thickness of the series within the map area, after allowing for steep dips and thickening by basic intrusives, is approximately 20,000 feet.

Interpretation of Minor Structures

Throughout the area the pitch of the folds is to the south-southwest and west, as indicated by the elongation of deformed structures, the pitch of drag folds, and the orientation of the longest axes of tabular minerals. Harding[3] found a similar constant direction of pitch in the Birch-Springpole Lakes area to the north, but there are no vertical fold axes in the Uchi-Slate Lakes area, such as have been reported to the north,[4] and the pitch is commonly 35 to 65 degrees. On the basis of pitching folds at Lake St. Joseph, Bruce[5] observed:—

> If any bed of the iron formation is followed eastward along its outcrop, it will be found to offset in short folds southward. The pitch of the folds is to the east at angles of forty-five degrees upward. . . . It is evident then, that these beds are on the southern limb of a syncline pitching eastward and hence that strata lying to the southward are nearer the anticlinal axis, and so are lower than the main band of iron formation.

In the Uchi-Slate Lakes area, the pitch of the folds is to the southwest and the offset of the formations along the strike, southwestward, is to the southeast. Mapping has shown this offset clearly in the Uchi series, and the same offset is indicated in the Slate Lake series by small drag folds. Thus, the application of Bruce's interpretation at Lake St. Joseph to this area would indicate that the beds in both the volcanic and sedimentary series are on the southeast limb of a syncline and that the anticlinal axis lies somewhere to the south. If this is so, the Uchi series is the younger series.

Uchi-Slate Lake Unconformity

The Uchi series strikes in a broad curving arc from south to southwest, and it is noteworthy that its contact with the Slate Lake series to the southeast conforms with this general strike. The Slate Lake series, however, strikes west and abuts the Uchi volcanics at an angle. This angular contact must indicate either a fault or an unconformity. If the volcanics also approached the contact at an angle, a fault would be indicated, but, as noted above, they do not. Neither

[1]E. L. Bruce, op. cit., p. 12.
[2]Ibid. p. 13.
[3]W. D. Harding, op. cit., pp. 15, 16.
[4]H. W. Fairbairn, "Elongation in Deformed Rocks," Jour. Geol., Vol. 44, 1936, pp. 670-680.
[5]E. L. Bruce, Ont. Dept. Mines, Vol. XXXI, 1922, pt. 8, p. 12.

are other indications of faulting present, such as narrow, linear, drift-filled valleys or linear trends of drainage that would indicate the trace of a fault on surface. None of these features have been observed at the boundary between the volcanics and sediments. The contact is well exposed in massive outcrops in many places, and the rocks at the contact itself are no more schistose than elsewhere, but they yield no information concerning the relationships of the two series.

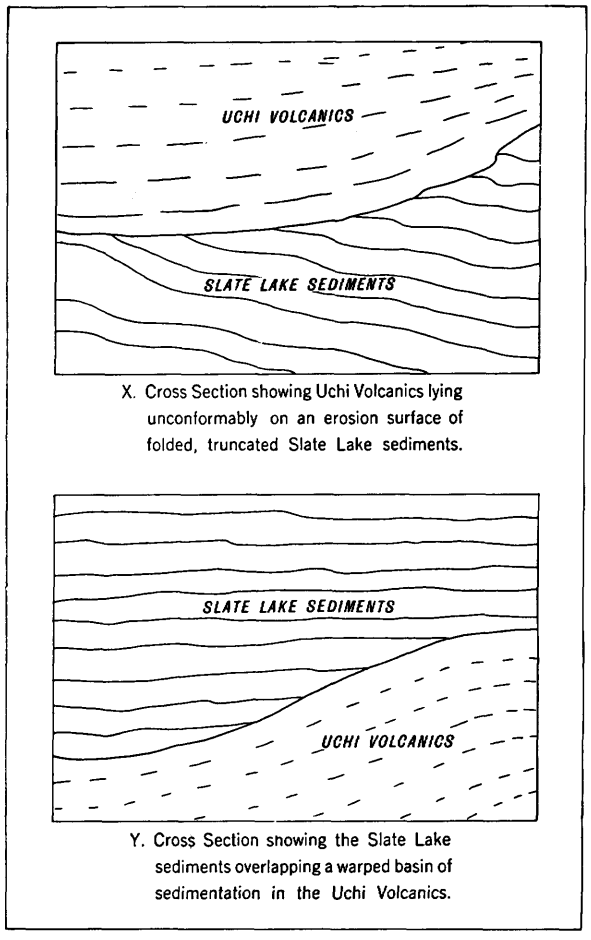


Fig. 2—Cross-sections showing two possible intrepretations of the Uchi-Slate Lakes unconformity. Cross-section X appears to be the correct interpretation from evidence shown in the text.

Examination of the geological map shows that the Slate Lake conglomerate, which is an excellent horizon marker, either meets the boundary of the Uchi series or lenses out into fine-grained sediments near Ben lake. Between the conglomerate and sedimentary-volcanic boundary in that vicinity there is only a thin belt of sediments, whereas at the east end of Slate lake a great thickness of sediments lies between the conglomerate and the sedimentary-volcanic boundary. The disappearance of such a considerable thickness of formations to the west could not be caused by faulting without some indications of movement being

present, and such is not the case. It has been suggested that the discordance between the sediments and volcanics could be produced by folding, but the consistency of trends within each series offers no support for this concept. It is unlikely that folding could have resulted in the disappearance of a large thickness of sediments without some accompanying displacement, for which there is no evidence.

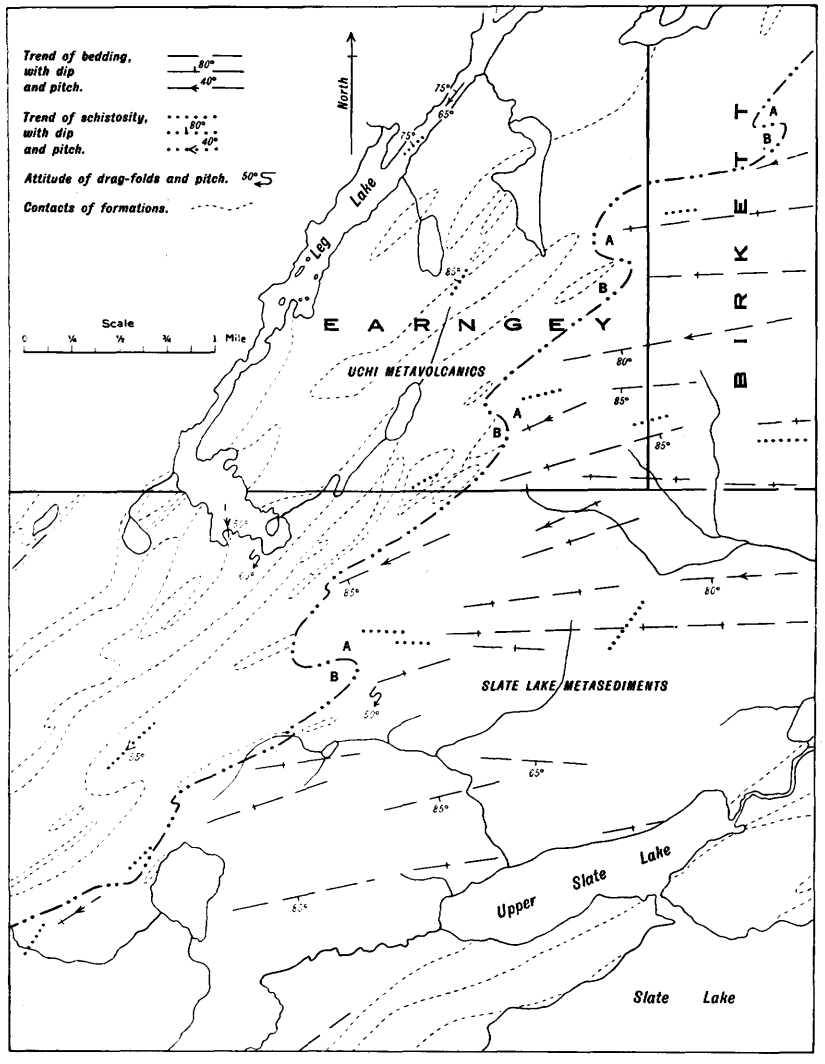


Fig. 3—Tectonic sketch map of the boundary between the Uchi volcanics and the Slate Lake sediments, southeastern part of Earngey township.

It is concluded that the discordance between the two series represents an unconformity, but the unconformable relationships themselves give no clue as to which is the younger series. Superficially the formations of the Slate Lake series appear to be truncated by the Uchi series, but a similar situation could be produced by off-lap or overlap of the sediments near the border of a folded trough or basin of sedimentation in the volcanics. In the former case the volcanic series

would be the younger; in the latter case they would be the older, and the tops of the flows would face southeast. The two possibilities are shown in the accompanying diagrams (Fig. 2). As the tops of the volcanic members consistently face northwest and west, the interpretation as shown in X would appear to be the correct one, and the Uchi volcanics, therefore, the younger series.

More reliable evidence as to the relative ages, however, is afforded by the offset of the unconformity between the volcanic and sedimentary series. The tectonic relationships between the two are shown in the accompanying sketch map (Fig. 3). Since the structure pitches to the southwest, those parts of the folds marked "A" must necessarily be anticlinal and plunge beneath the Uchi volcanics; similarly those parts marked "B" are synclinal and overlie the sediments. Therefore, the Uchi volcanics must be stratigraphically above and younger than the Slate Lake sediments.

As the Slate Lake sediments have formerly been called Timiskaming and the Uchi volcanics Keewatin, the present interpretation is seen to reverse the sequence of the series indicated by previous workers. Early pre-Cambrian sedimentary formations containing granite-pebble bearing conglomerates are commonly considered to be post-Keewatin. The existence here of a pre-volcanic sedimentary series containing a thick conglomerate member with granite pebbles and boulders casts doubt on the validity of the term Keewatin as applied to the volcanics. For this reason local names, Slate Lake and Uchi, have been applied to the two series.

ECONOMIC GEOLOGY

Gold is the only mineral in commercial quantities that has so far been found in the area. The history and earlier development of gold discoveries have been briefly reviewed in the introduction to this report. All gold occurrences discovered to date are located in the northwestern part of the map area, and most of them are in Earngey township. With a few exceptions, the gold occurrences are distributed in a north-south belt, which has been traced from the east side of Lost bay, southward through the Grasett, Jalda, and Hanalda claims, through the western claims of Uchi Gold Mines, and south into the Woco claims. This gold-bearing belt is some 3 miles long and averages about half a mile in width. Situated approximately one and a half miles to the east, on a point on the west side of Lost bay, is the property of Bobjo Mines, one of the earliest underground developments in the area.

The geology of the gold-bearing area, which was described in 1938 by Thomson, consists of long, narrow interbedded greenstones, metagabbros, rhyolite, and silicic tuff, all either vertical or with steep dips to the west and striking southward. These rocks, because of their variable degrees of resistance to stresses, have fractured along or near the contacts, thus providing channelways for ore-forming solutions. Similar structural conditions may be found wherever there is a variety of rock types, or where small intrusive bodies or large dikes may act as buttresses to stresses and localize fractures in the rocks about them. Such conditions are present in many parts of the area, except in such places in the Slate Lake sediments where the same rock types occur in monotonous succession. Gold deposition seems to have shown a predisposition for moderately brittle rocks that fracture well rather than for shear zones.

Character of the Gold Occurrences

Gold is found associated with quartz fissure veins and systems of quartz stringers filling fractures in the greenstone or metagabbro country rock. The

fractures owe their origin chiefly to stresses acting on rocks of different competency and are therefore localized along or near the contacts of different rock types. The gold is in the native state and may occur in the quartz or in the adjacent country rock, which is commonly mineralized with disseminated pyrite and pyrrhotite. In some places, as on the Bobjo and Jalda claims, narrow shear zones that have been mineralized with massive pyrite and pyrrhotite are intersected by gold-bearing quartz veins and stringers. The sulphides, which occur as a replacement of the rock in shear zones, are locally called iron formation, contain little or no gold, and definitely precede the time of vein formation and gold deposition.

There are two principal types of occurrence of quartz veins and stringer systems, as follows:—

1. Banded quartz fissure veins from 2 to 4 feet wide and commonly of considerable length. In some instances these veins have associated systems of quartz stringers branching from the vein into the wall rock. Examples of the simple banded fissure veins are the Hill-Sloan-Tivy or "Tapeworm" vein, which has been traced for almost 2 miles, and the No. 3 vein on the claims of Uchi Gold Mines, which has been traced for 3,000 feet.

2. Irregular systems of quartz veins and stringers constituting fracture zones. The stringers may have no definite pattern and may intersect each other, or the stringers may be in *en échelon* arrangement or even run transverse to the strike of the zone. Most of the gold-bearing zones on the Jalda and Hanalda claims belong to this class. The principal gold-bearing zone at the Bobjo mine consists of a swarm of stringers associated with a small, non-banded quartz vein. The Uchi mine is a combination of both classes, in which a banded quartz vein, known as the main leader, has an associated system of quartz-stringer offshoots, which locally forms a herring-bone pattern.

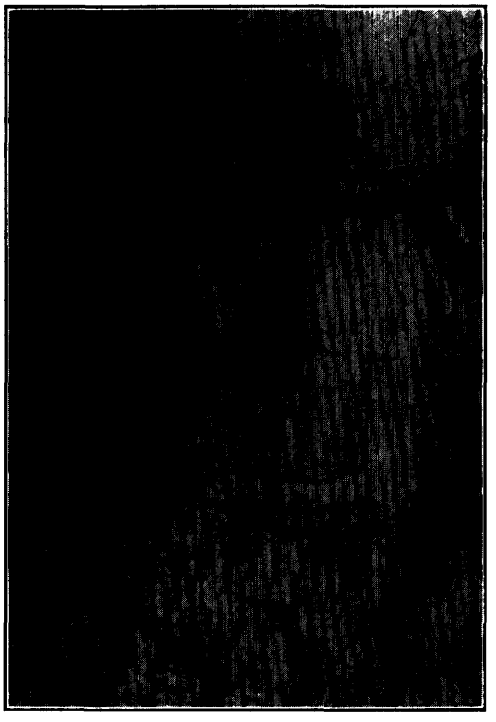
Character of the Banded Quartz Veins

The banded veins commonly show sharp contacts with the walls. Individual veins may range from 1 to 5 feet in width, but generally average 2 to 3 feet. The bands themselves are 1 to 3 inches wide and are separated by thin selvages of chlorite. A representative type is shown in the accompanying photograph. In the Uchi mine, north of the No. 1 shaft, the vein is locally characterized by a second type of banding due to the inclusion of parallel fragments of the wall rock, as illustrated in the accompanying photograph. Most of the banded veins, however, are of the first type. Generally the veins are sparsely mineralized, but they may contain veinlets and bunches of carbonate, and commonly the quartz is replaced by carbonate adjacent to the walls of the veins. The quartz of the banded veins, unlike the glassy quartz of the stringer zones, generally has a fine sugary or porcellaneous texture and is milky in colour. In many places they contain isolated areas of brecciated quartz localized at the borders of the bands. As this feature was not observed in the quartz of the stringer zones, there is a suggestion that the banded quartz veins may be older. The brecciated quartz is partly replaced by sericite, carbonate, and chlorite.

The banded veins occur parallel to the strike of the formations and have been localized at the contacts of the different rock types. The Hill-Sloan-Tivy vein, which is 2 miles long, occurs at the contact of brittle rhyolite and greenstone throughout its length. The No. 3 vein on the Uchi property, which is 3,000 feet long, lies between the contact of metagabbro with silicic tuff and greenstone. The Uchi main quartz leader lies a short distance east of and parallel to a greenstone-metagabbro contact. The persistence of the rock formations

along the strike is the principal reason for the great length of some of these veins. Although the Uchi main quartz leader is relatively short, conditions favouring a recurrence of the vein are favourable both to the north and south along the strike.

The banded quartz veins lie in shear fractures, but there is no evidence to show that they have been formed by replacement of shear zones. The only evidence of silicification observed in the area was in the case of some squeezed wall rock inclusions in the banded veins; otherwise the veins are fracture fillings. On the other hand, it is certain the veins are not simple fillings of formerly wide,



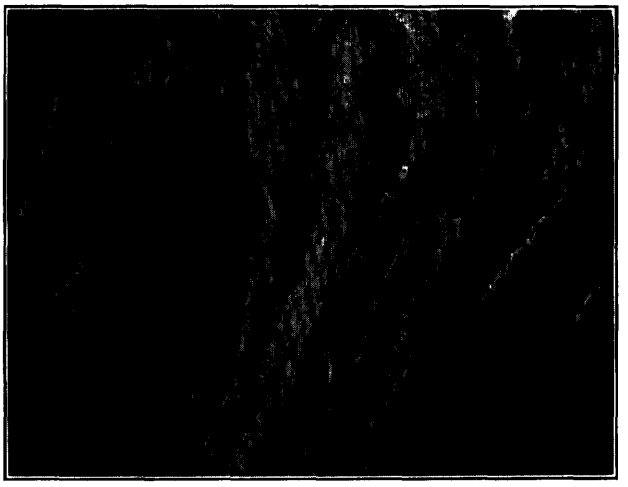
Uchi No. 3 vein on surface, showing banding representative of other banded veins in the area.

open, tension fractures. The length of some of the veins and the banded character are best explained as due to growth by accretion of quartz in small open spaces provided by recurrent movement of the walls.

Quartz Veins and Stringer Zones

Whereas the banded quartz veins occupy fractures formed by shearing stresses parallel to the rock formations and are thought to have grown by accretion, other non-banded quartz veins and stringer zones are largely simple tension-fracture fillings. These are best illustrated at many of the gold-bearing localities on the Jalda and Hanalda claims and in the stringer zones at the Uchi mine, where they have been mostly localized on the east side of the main quartz leader by a parallel bed of silicic tuff to the east. The quartz is fractured and locally mineralized with sulphides, but is not brecciated as in the case of the banded quartz veins. The quartz is commonly glassy, clear to milky in colour,

and, on the Jalda and Hanalda claims, contains tourmaline in many places. The tension fractures may have formed concurrently with the growth of the banded quartz veins, but the structure and mineralogy suggest that some of them are



Stringer zone showing mineralized country rock between stringers, 300-foot level, Uchi mine; this type of material constitutes the bulk of the ore.

later and were filled by a later stage of the vein-forming solutions. Whereas the banded veins are parallel to the strike of the formations, the stringer zones and other veins may strike in any direction, although in many cases groups of stringers



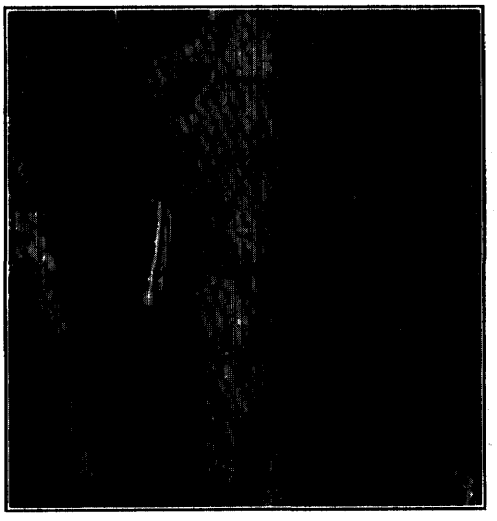
Typical stringer zone off main quartz leader, slash on the 300-foot level, Uchi mine.

strike parallel to the formations, owing to localization near thin, brittle rhyolite flows, tuff beds, or even porphyry dikes, as in the case of the Bobjo zone. The strikes of the stringers, however, are at various angles to the strike of the zones.

General Character of the Ore

The banded quartz veins are sparsely mineralized with metallic minerals and, in a few places, contain gold in fractures in the quartz. Some parts of the Hill-Sloan-Tivy vein have a gold content that approaches commercial amounts. Part of the Uchi No. 3 vein is reported to be of ore grade. Much of the main quartz leader in the Uchi mine is barren of gold, although some sections, as on the 300-foot level south of the No. 1 shaft, contain abundant gold. Quantitatively, the banded quartz veins have not been shown to date to contain much ore.

The quartz stringer zones and related veins, such as the No. 7 and No. 14 zones on the Jalda claims and the principal Bobjo zone, have indicated ore possibilities. By far the greatest amount of ore developed in the region is in



Quartz stringer on the 200-foot sublevel, Uchi mine. Note the transverse fractures in the quartz filled with later pyrrhotite.

quartz stringer zones associated with banded veins, as in the Uchi mine. The gold occurs mostly in the mineralized country rock between the stringers and, to a lesser extent, in the quartz. Underground work in the Uchi mine to date has indicated four or more ore shoots, mostly in stringer zone systems east of the main quartz leader and connected with it. The ore shoots are limited almost entirely by assay walls and are reported to average 10 to 12 feet in width, although they may be as wide as 20 feet in places, and they rake steeply to the south.

Mineralogy

Pyrite and, to a lesser extent, pyrrhotite are the two principal metallic minerals. They occur in the veins and as disseminated replacement grains in the wall rock. In the wall rock, the pyrite is present as cubic grains, whereas the pyrrhotite is finely divided and interstitial to the non-opaque minerals. In the quartz, the pyrite occurs as small masses in local concentrations and also as thin films along fractures. This last type of occurrence postdates the deposition of most of the metallic minerals in the ore bodies. The pyrrhotite also occurs as local concentrations in the quartz and, in many places, forms veinlets in fractures

in the quartz, as shown in the accompanying photograph. Chalcopyrite, although widely distributed, is quantitatively insignificant and almost invariably associated with pyrrhotite. Galena and sphalerite have been observed on the Jalda and Hanalda claims and in the Uchi mine, but are rare. Where observed, these last two minerals are associated with gold. The lead telluride, altaite, was seen enclosed in galena associated with gold in a polished specimen from the No. 16 zone on the Jalda claims.

Visible gold in the ore is not common in the Uchi mine, but has been observed in some places in the quartz, as on the 300-foot level, south of the No. 1 shaft. Gold, however, has been observed in quartz in the Bobjo vein and stringers, in parts of the Hill-Sloan-Tivy vein, and in numerous quartz veins and stringers



Photomicrograph of a typical pyrite and pyrrhotite replacement ore in wall rock, Uchi mine. (× 36.)

on the Jalda and Hanalda claims. In the Uchi mine, most of the gold that is in the quartz occurs in the stringers, and not in the main leader; the greatest amount of gold, however, is distributed as minute grains throughout the mineralized country rock in the stringer zones. According to company officials, the best ore consists of disseminated, coarse, cubic pyrite mineralization in the country rock adjacent to the quartz stringers.

Quartz-carbonate vein material commonly contains sparsely disseminated pyrite and pyrrhotite with very fine gold in fractures in the quartz, whereas the adjacent mineralized wall rock contains disseminated sulphides and may contain gold enclosed in pyrite, pyrrhotite, or even chalcopyrite, but most commonly the gold occurs as minute grains in the carbonate of the carbonatized country rock. In the disseminated sulphide replacement ore, the cubic pyrite is locally fractured and filled with gangue minerals and pyrrhotite. The pyrite may also enclose small grains of pyrrhotite and chalcopyrite. Pyrrhotite is generally interstitial to the vein minerals and occurs as a replacement of the wall rock in such a fine division that it is not recognizable by the naked eye. The pyrrhotite fills fractures in pyrite and, in some places, is veined with chalcopyrite, with

which it is commonly associated. Galena was observed associated with chalcopyrite and replacing pyrite. There has been extensive replacement of disseminated pyrite and pyrrhotite in the country rock by later carbonates, the replacement being metasomatic with the formation of ankerite or siderite. Although gold may occur associated with or enclosed in any of the metallic minerals, it occurs most commonly in the quartz gangue or adjacent country



Photomicrograph of a polished section showing a grain of gold in pyrrhotite, Uchi mine. (× 142.)

rock as isolated grains. Sufficient native gold has been observed to account for the gold content reported in the ore zones, but for the most part is visible only under the microscope.

The paragenetic relationships of the metallic minerals shown in Fig. 4 have been established from a microscopic study of the ore. The second generation of pyrite is an introduction into the quartz, whereas the first generation represents a metasomatic replacement of the wall rock.

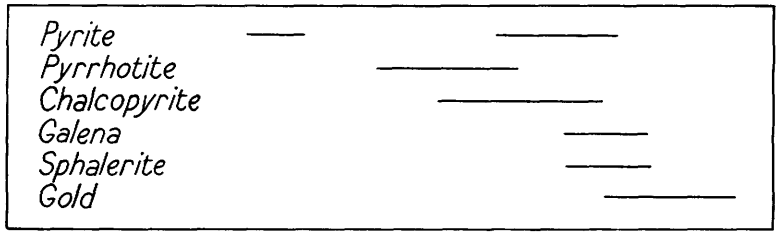


Fig. 4—Diagram showing the paragenetic relationships of the metallic minerals in Uchi ore.

The formation and deposition of the metallic minerals was accompanied by the formation of a number of non-metallic gangue minerals, which, when considered with the metallic minerals and wall rock alteration, form part of an orderly sequence of vein formation and mineralization. The quartz of the banded quartz veins is commonly replaced by carbonate near the borders of the vein and contains disseminated small areas and local concentrations of carbonate. Disseminated carbonate also occurs in the quartz of the stringer zones, which in addition contains small veinlets of carbonate.

Thin sections of quartz from the ore bodies that were studied microscopically generally contain 70 to 90 per cent. quartz, 10 to 20 per cent. carbonate, and small amounts of albite, sericite, chlorite, biotite, pyrite, pyrrhotite, epidote, and gold, in order of abundance. One grain of tourmaline was observed in the quartz of the Uchi ore, but this mineral is more common in the quartz of the gold-bearing zones on the Jalda and Hanalda claims. Most of the dark material in the vein quartz in the Uchi mine is chlorite or, locally, biotite. The quartz commonly occurs in large sutured grains showing undulatory extinction or strain shadows. Micro-brecciated quartz of the banded veins is largely replaced by chlorite and sericite. Carbonate commonly replaces quartz and, although some of it is calcite, most of it is an iron-bearing variety that oxidizes to a light-brown colour in development faces that have been exposed for a few months. In some areas, biotite replaces chlorite, sericite, and carbonate and, in other places, is deposited in fractures in the quartz contemporaneously with chlorite.

Wall Rock Alteration

The following remarks on wall-rock alteration are based on a study of the Uchi mine, but may be applied more or less to other gold occurrences in the area. The alteration in the vicinity of the ore bodies, particularly of the greenstone, is profound. The wall rock of the veins and country rock of the ore bodies is commonly buff-coloured and resembles in appearance the altered rhyolite and silicic tuff. It is disseminated with cubic pyrite and fine interstitial pyrrhotite. The altered greenstone consists essentially of carbonate with lesser amounts of chlorite, sericite, quartz, pyrite, pyrrhotite, and sphene. The secondary hornblendes and epidote minerals that comprised the bulk of the greenstone before alteration have been extensively replaced by carbonate, sericite, sulphides, biotite, and albite as a result of the action of hydrothermal solutions.

About half the carbonate in the wall rock and veins is calcite, and the remainder ankerite, which weathers light-brown after freshly broken surfaces have been exposed underground for a few months. Carbonatization has advanced in some parts of the mine to the extent that as much as 75 per cent. of the greenstone is composed of carbonate. This alteration is almost entirely metasomatic; that is, the ankerite was formed by carbon dioxide in vein-forming solutions combining with original lime, magnesia, and iron in the rock. Additional iron in the rock was taken up by hydrogen sulphide to form disseminated pyrite and pyrrhotite. Most of the calcite was formed later. The formation of sericite, biotite, and albite in the veins and country rock indicates the addition of potash and soda from vein-forming solutions. The presence of biotite and albite, the formation of which was approximately contemporaneous with the introduction of pyrrhotite into fractures in the quartz, indicates relatively high temperatures during at least one stage of the mineralization.

There is a notable lack of silicification throughout the entire mine, only a few instances being observed in the case of wall-rock inclusions in the quartz leader. In fact, the extensive carbonatization implies a desilication of the country rock, which has resulted in the removal of immense quantities of silica. The process of carbonatization appears to have started early and continued through to the very end, as the otherwise biotite-rich post-vein dikes are carbonatized in the vicinity of the ore bodies. Early formed carbonate in the veins is replaced by quartz, which is, in turn, replaced by calcite.

A chemical analysis of the freshest greenstone in the mine is compared in the following table with one from the altered country rock at the same horizon in the ore bodies:—

	No. 1	No. 2
	per cent.	per cent.
SiO_2	50.65	36.60
Al_2O_3	14.57	13.01
Fe_2O_3	2.31	2.15
FeO	11.59	7.41
MgO	4.34	4.48
CaO	6.70	8.78
Na_2O	2.45	2.76
K_2O	.59	3.28
H_2O	2.67	2.03
TiO_2	1.31	1.31
P_2O_5	.11	.04
MnO	.32	.29
CO_2	2.40	9.90
FeS_2	.28	8.04
Total	100.29	100.08
Specific gravity	2.82	2.854

Analyses by W. F. Green, Provincial Assayer.

Specimen No. 1—Greenstone country rock.
Specimen No. 2—Altered wall rock.

The most remarkable feature shown by this analysis is the considerable addition of potash to the altered wall rock by the formation of sericite and biotite. The loss of silica and increase in carbonate and sulphide is also shown.

Summary of Vein Formation and Sequence of Mineralization

1. The banded quartz veins, such as the Uchi main leader and No. 3 vein and the Hill-Sloan-Tivy vein, were first formed in fractures along or near contacts by accretion of quartz in small open spaces during recurrent movements operated by shearing stresses.

2. Either before or during the formation of the banded quartz veins some narrow pyrrhotite-pyrite replacements were formed in shear zones, as on the Bobjo claims and the "iron formation" on the Jalda claims.

3. The second period of vein formation followed, or was contemporaneous with, the formation of the banded quartz veins and resulted in the filling of fractures formed by tension stresses. In some cases the fractures formed adjacent to the banded veins, tapering into the country rock. In other cases they formed as a parallel series of tension cracks striking transversely to the strike of the zone, but in most cases the pattern is irregular and the stringer zones are not necessarily associated with leader veins.

4. The early mineralizing solutions contained carbon dioxide and hydrogen sulphide, which resulted in extensive carbonatization and desilication of the wall rock, particularly where fractures acting as channelways were most abundant, as in the stringer zones. In addition, some of the vein quartz was also replaced by carbonate, and disseminated cubic pyrite was formed in the wall rock.

5. The next stage in mineralization was marked by the introduction of potash into the vein-forming solutions and was accompanied by the formation of sericite and chlorite in the wall rock, chlorite in the veins, and the replacement of micro-brecciated quartz in the banded veins by sericite.

6. This was closely followed by a high-temperature stage, during which iron and soda as well as an excess of hydrogen sulphide were added to the vein-forming solutions. Biotite was formed in the wall rock as well as some albite,

and biotite, chlorite, and albite were formed in the veins. At the same time, the wall rock was replaced by fine, interstitial pyrrhotite, which in part replaced the earlier-formed pyrite and filled fractures in it. Pyrrhotite was also desposited in bunches in the veins and filled fractures in the quartz. Copper was added to the vein-forming solutions at this time, as chalcopyrite was contemporaneously deposited with the pyrrhotite, but continued to be deposited for some time after it. Towards the close of this stage a second generation of pyrite appears to have come in but, for the most part, is restricted to the quartz.

7. The vein-forming solutions continued to carry carbon dioxide but became relatively free from iron. Earlier-formed sulphides were replaced by carbonate, and calcite was developed by replacement of the wall rock and vein quartz.

8. The next stage is part of a falling temperature sequence in which sphalerite, galena, and gold were deposited, some of the gold being contemporaneous with the galena.

9. Following the deposition of the gold, a new set of tension fractures was formed and filled with post-vein lamprophyric dikes. The mineralization had apparently not yet ended as the dikes themselves show considerable carbonatization, in which ankerite, up to 30 per cent. of the rock, was probably formed as a metasomatic replacement of the ferromagnesian constituents by carbon dioxide.

Localization of the Ore

The vein formation and period of mineralization with attendant wall-rock alteration was probably one continuous process that operated over a long period of time, during which the vein-forming solutions continually changed in character. It was towards the close of this long and complex period of mineralization that the gold was introduced, probably at relatively low temperatures. Throughout the area gold commonly occurs in fractures in the quartz, but quantitatively the greatest amount of gold is localized in the wall rock adjacent to stringer zones. No individual constituents of either the veins or the wall rock appear to have exerted a particular effect on the precipitation of gold from solutions, and precipitation was probably localized by a combination of favourable channelways plus temperature, pressure, and chemical conditions that favoured gold deposition from the rising solutions. It may have been that vein-forming solutions preceding the gold "paved the way" for later precipitation of gold by preparing the wall rock chemically to favour deposition, but there is no definite support for this concept. Structural rather than chemical features appear to have been dominant in the localization of the ore.

Origin of the Gold Deposits

It is thought that the intrusion of the younger granite, related porphyry, and silicic dikes, the entire sequence of vein formation and mineralization, and the intrusion of the post-vein dikes are all part of the same continuous magmatic process. The period of vein formation and mineralization occurred towards the end of this process, and the deposition of the gold took place towards the close of magmatic activity.

The intrusion and subsequent cooling of the underlying granite probably played a part in producing stresses that first formed the shear fractures in which the banded quartz veins occur, the tension fractures of the stringer zones, and finally the fractures in which the post-vein dikes were intruded.

The source of the mineralizing solutions as well as the gold appears to have come from a late differentiate of the consolidating granite, the mineralization occurring as a falling temperature sequence in which carbonatization played the

dominant rôle. The gold may have been deposited from dilute solutions as a result of falling temperature, or as has been suggested, the long period of mineralization preceding the introduction of the gold may have chemically prepared the wall rock to favour precipitation.

DESCRIPTION OF PROPERTIES

Uchi Gold Mines, Limited

History

The property of Uchi Gold Mines consists of 27 claims situated to the west of the north central part of Uchi lake in Earngey township. The principal gold-bearing zone is located on claims K.R.L. 5,038 and 5,041, which are part of the original eight claims (K.R.L. 5,038–5,045) of the MacAulay property staked in 1926 during the Woman Lake gold rush. In the summer of 1927, the MacAulay claims were optioned to the Huronian Belt Company, which extended the original surface exploration.

The surface development up to that time has been described by Bruce.[1]

In 1928 the property was again optioned, this time to the Consolidated Mining and Smelting Company, which deepened the shaft begun by former operators to a depth of 110 feet, establishing a level at 100 feet, on which 100 feet of crosscutting and 300 feet of drifting was done. The results of this work, however, were inconclusive, and underground development was discontinued.

The property lay idle for eight years until, in the fall of 1936, J. E. Hammell in association with Val d'Or Mineral Holdings and Harker Gold Mines, obtained control of the property. A diamond-drill programme carried out over a length of 1,300 feet indicated commercial ore south of the old shaft and, as a result, Uchi Gold Mines was formed early in 1937 to continue development.

Development

The present company deepened the original 2-compartment shaft to 600 feet, establishing levels at 300, 450, and 600 feet. Short crosscuts were driven westward to the vein zone, and some 1,500 feet of drifting was done on each level, including the 100-foot level. As the widths of the drifts are reportedly less than those of the ore-bearing zones, full ore widths have been established in some ore shoots by short crosscuts and slashing of the walls. Throughout the greater part of the mine, however, the full width of the ore, determined by assay walls, has been indicated by a number of short, flat diamond-drill holes. Raises were driven upwards from each level and carried, as far as possible, in ore.

In the summer of 1938, a 4-compartment shaft was started at a point some 800 feet south-southwest of the No. 1 shaft and carried to a depth of 700 feet in 1938, and is expected to be completed to a depth of 1,000 feet in 1939, with two new levels established at 800 and 1,000 feet. On the upper levels, crosscuts were driven west from the south drifts of the No. 1 shaft to meet the No. 2 shaft. Hoisting equipment capable of handling 2,000 tons of ore per day and operating to a depth of 3,000 feet was installed in the No. 2 shaft.

Early in 1939, development raises from all levels were advanced in ore, and the 600-foot level was prepared as a haulage level, with ore passes driven upwards from each level, including one from the 100-foot level, which intersected the surface near the ore dump. Construction of a mill was begun late in the summer of 1938 and completed May 10, 1939, at which time production began.

[1]E. L. Bruce, Ont. Dept. Mines, Vol. XXXVII, 1928, pt. 4, pp. 49-51.

Transportation and Power

Most of the heavy material transported to the property has been moved from the railway point at Hudson to Gold Pines by boats operating on Lac Seul, and from there to the mine property over a winter road by tractor train. A government road was constructed from Gold Pines to Confederation lake in 1938 and completed to the mine property in 1939, a total distance of approximately 50 miles. Before the completion of this road, much of the light freight, including oil for Diesel power plants, was moved to Uchi lake by airplane. A hydro-electric power line from Ear Falls, north of Gold Pines, was completed to the mine property in 1938, and power was made available early in 1939.

General Geology

The geology in the vicinity of the mine has been adequately described by Thomson[1] and is summarized here. The vein system and ore zones lie in a series of thin greenstone flows adjacent to the contact of the greenstone with metagabbro ("diorite"). It has been previously emphasized that there is no sharp contact between the greenstone and metagabbro, and it is not known if the metagabbro is a vertical sill or the coarser-grained central part of a thick basic flow, but as the relation of this rock to the veins is structural, it is the same in either case. The metagabbro, however, is texturally and mineralogically distinct from the greenstone and is mapped as a separate rock.

The greenstone consists of narrow flows, 50 to 100 feet thick, which are interbedded with thin layers of silicic tuff and rhyolite 1 to 3 feet thick. Much of the ore zone lies between the principal quartz vein or main leader and one of these tuff beds. The silicic tuff and rhyolite have been altered adjacent to the veins and superficially resemble the carbonatized greenstone. The structure of all the formations as well as the vein is vertical.

Vein System

The ore body lies in the greenstone near the contact with the massive metagabbro, but the principal structural feature of the ore body is a vein of banded or ribboned quartz, 2 to 5 feet wide, which occurs on all levels. In vertical and horizontal directions at depth and to the south, the vein tends to lens out into an *en échelon* series of quartz stringers or in some cases a series of parallel stringers transverse to the strike of the ore zone. The banded vein is generally almost barren of mineralization and, except on the 300-foot level, south drift, is not commonly of ore grade.

The greater part of the ore lies in a series of stringer zones, most of which are situated to the east of the main quartz leader. The stringer zones were formed in tension fractures connected with the main quartz leader and have been localized to the east by a parallel bed of brittle silicic tuff. The stringers angle into the main vein and taper off in the country rock, in some instances, forming a herringbone structure. This feature has made it necessary to orient flat exploration drillholes from the drifts at an angle in order to intersect the stringer zones at right angles.

The stringers are commonly 2 to 5 inches wide and extend into the walls as far as 30 feet but, in general, not more than 10 feet, tapering at the ends. The greenstone in the stringer zones is carbonatized and contains disseminated cubic pyrite and abundant fine pyrrhotite. The bulk of the ore occurs in material of this character adjacent to the stringers, where the greenstone is intersected by a

[1]Jas. E. Thomson, Ont. Dept. Mines, Vol. XLVII, 1938, pt. 3, pp. 74-77.

minute, almost microscopic, reticulating system of quartz-carbonate threads. Fine chalcopyrite is commonly associated with the pyrrhotite. In the quartz there are local concentrations of pyrite and pyrrhotite, most of which are later than the early quartz; these sulphides are, in turn, partially replaced by later carbonate. Most of the gold occurs as isolated grains in the carbonatized wall rock and in quartz threads in the wall rock of the stringer zones, although it is also present in the quartz veins and enclosed in sulphides.

The vein system owes its origin chiefly to stresses acting on rocks of different competency. The banded quartz vein lies in a vertical fracture. Either concurrently with or following the formation of the banded vein, a series of tension fractures was formed on either side, but mostly localized to the east by a parallel bed of silicic tuff. The ore bodies occur in those places where the tension cracks were sufficiently close together to permit widespread impregnation of the country rock by mineralizing solutions, with later deposition of the gold. Following the major mineralization and after the deposition of the gold, a different type of fracture system was formed, in which the post-vein dikes were intruded.

Ore Shoots

As most of the ore occurs as a replacement of the wall rock, the widths of the ore shoots are determined by assay and are reported to range from 3 to 20 feet and average approximately 12 feet in width. Development work to date has indicated four or more shoots, all of which have a steep rake to the south.

The north shoot was exposed on surface north of the No. 1 shaft for a length of 340 feet and is reported by the management to average 0.31 ounces of gold per ton over an average width of 28 feet. On the 100-foot level, this shoot has been disclosed north of the shaft, where it is 230 feet long and is reported by the management to contain 0.23 ounces of gold per ton over an average width of 11.5 feet. Below the 100-foot level, this shoot appears to taper off, and on the 300-foot level no ore sections were located in the north drift.

A second shoot occurs at the No. 1 shaft crosscut on the 100-foot level and is reported by the management to contain 0.18 ounces in gold per ton over an average width of 20 feet for a length of 170 feet. According to company officials, this shoot has been opened up south of the No. 1 shaft on the 300-foot level.

A third ore lens, known as the high-grade shoot, has been exposed south of the No. 1 shaft on the 100-, 300-, and 450-foot levels, as well as on the 200-foot sublevel, but apparently tapers off before reaching the 600-foot level. This shoot is reported by the management to average some 240 feet in length and to have an average width of 12 to 15 feet.

A south ore body has been opened up on the 300-foot level in a section 90 feet long and in another section farther south 200 feet long. The shoot has been developed for an almost equal length on the 450-foot level, but is not known on the 600-foot level.

The 300-foot level is the best developed to date, most of the drift length being in ore. The only ore developed to October 1, 1938, on the 600-foot level is a short high-grade shoot, some 60 feet long which has been developed in the south drift and is reported to average somewhat less than an ounce of gold per ton. This shoot is thought to apex above the level.

The ore zone was intersected by diamond-drill holes some 75 feet below the 600-foot level in material reported to be of commercial grade. The most southerly of three diamond-drill holes at the 950-foot horizon is reported to have indicated ore, but two holes drilled farther north are thought to have gone beneath the main ore bodies at this horizon, owing to the southerly rake.

Description of Other Veins

The No. 3 vein on the property of Uchi Gold Mines is parallel to the main ore zone, but is situated 1,500 feet to the west, crossing claims K.R.L. 5,039 and 5,040. The vein has been traced for 3,000 feet, its considerable length being due to its location at the contact of metagabbro to the east and interbedded silicic tuff and greenstone to the west. The vein averages about 18 inches in width and consists of banded or ribboned quartz, which is somewhat glassy near the centre and cherty or porcellaneous near the borders. Thin selvages of chlorite lie between the quartz ribbons, which are 2 to 3 inches wide. Sparse pyrite mineralization occurs in the adjacent country rock. Part of the vein has been probed with diamond-drill holes, as shown on the accompanying plan (Fig. 8 facing page 36). A bulk sample over 600 feet of the vein is reported to have averaged better than ore grade.

The No. 2 vein, northwest of the mill on claim K.R.L. 5,041, lies approximately midway between the No. 3 vein and the main ore zone. This vein has been traced for 210 feet and consists of a narrow quartz stringer having a steep, westerly dip, a narrow rhyolite flow paralleling the vein on the west. At the south end of the vein there is an associated zone of quartz stringers in the rhyolite, which is about 20 feet wide. Mineralization is sparse, and surface development and diamond-drilling to date have not shown commercial lengths. Another short, irregular vein occurs in the metagabbro some 60 feet west of the No. 2 vein.

Another vein lies in the southwest corner of claim K.R.L. 5,038 and has also been probed by diamond-drilling. The vein consists of a short, irregular system of quartz stringers in bedded silicic tuff, which is sparsely mineralized with pyrite. The stringers pinch out in the adjacent metagabbro, and development to date has not proved commercial possibilities.

Jalda Gold Mines, Limited

History and Development

The property of Jalda Gold Mines, Limited, consists of 42 claims in Earngey township lying north of the Hanalda property. The claims were purchased by J. E. Hammell in February, 1939, 20 from Woco Gold Developments, Limited, and 22 from Conwo Gold Mines, Limited, a subsidiary of Woco. Jalda Gold Mines, Limited, was incorporated in May, 1939.

The property was developed by Woco Gold Developments in 1937 and 1938. A number of gold-bearing zones were uncovered by surface-trenching and stripping. The more important discoveries were drilled. Developments on the claims of Conwo Gold Mines in 1937 were described by Thomson.[1] Subsequent discoveries were examined by the writer in 1938.

Description of Gold-bearing Zones

Most of the zones described in the following paragraphs may be located on the accompanying geological plan (Fig. 10) facing page 38.

Zone No. 13 on claim K.R.L. 12,486 lies 350 feet east of zone No. 21 and consists of a quartz vein 2 to 12 inches wide, striking northeast and dipping steeply northwest in metagabbro. The wall rock is carbonatized and mineralized with disseminated pyrite and is reported to carry a higher gold content than the quartz. The quartz is fractured and contains veinlets of carbonate. The zone has been tested for a length of 240 feet by diamond-drilling, most of the 10 drill-holes returning commercial values over widths from 3 to 10 feet.

[1]Jas. E. Thomson, op. cit., pp. 78, 79.

Zone No. 14 on the same claim has been traced for a total length of approximately 700 feet. The zone strikes N. 70° E. and dips 80° N., being partially covered by a flat dike outcropping on the surface. The zone consists of a quartz vein and series of stringers with associated mineralization in the country rock. The quartz contains some ankerite and a small amount of tourmaline, but no gold was observed. Material heavily impregnated with pyrite was reported by company officials to have assayed 0.63 and 3.86 ounces in gold per ton. To the north, the zone passes into a persistent but barren quartz vein. According to company reports, this zone was probed with 16 shallow diamond-drill holes, which, combined with 4 surface channel samples, averaged 0.27 ounces gold per ton across 4 feet for a length of 320 feet, according to company reports.

Zone No. 16 on claim K.R.L. 12,487 consists of a quartz stringer half an inch to 2 inches wide and 40 feet long. The stringer strikes northeast and dips to the northwest at 45 degrees, and lies at the contact of metagabbro and greenstone, the latter containing abundant coarse disseminated pyrite, but no gold. The zone was opened up by a test pit exposing the stringer on the hanging wall, and coarse native gold, estimated at from 40 to 50 ounces, was recovered. In a polished specimen, the gold was observed associated with galena, which contained the lead telluride, altaite.

Zone No. 17, on claim K.R.L. 12,488, consists of a series of quartz stringers in mineralized, carbonatized greenstone. The zone, which strikes south and dips 70° W., has been traced for more than 1,000 feet and has been probed with numerous diamond-drill holes. The quartz locally carries fine visible gold with small amounts of tourmaline and carbonate. The adjacent country rock, which is reported to carry gold, is mineralized with disseminated pyrite, fine pyrrhotite, and a small amount of chalcopyrite. At the north end of the zone, the rocks are drag-folded and the quartz is irregularly distributed. Diamond-drilling over a section 600 feet long has indicated an erratic distribution of gold over widths from 1 to 9 feet.

Zone No. 18 on the same claim consists of a quartz vein about 2 feet wide, which has been traced for some 800 to 900 feet, striking north and dipping 50° W. The vein occurs in massive greenstone containing sparse sulphide mineralization. Gold occurs only at the north end of the vein, where assays are reported to average 0.3 ounces in gold per ton over a width of 3 feet for a length of 45 feet. At the north end of the zone a small east-west striking vein carries fine visible gold in the quartz associated with pyrite, chalcopyrite, and galena. The zone has been traced for a total length of 1,100 feet, over 170 feet of which gold has been found.

Zone No. 20 on claim K.R.L. 12,485 consists of a sulphide replacement zone in a shear zone in the greenstone. The sulphide zone is fractured and contains narrow quartz stringers, which are reported to carry gold. The zone strikes N. 35° E., dips 80° N.W., and has been traced for 1,200 feet. The sulphides consist principally of pyrite and pyrrhotite. Ten diamond-drill holes over a length of 650 feet have indicated gold in places where the zone is cut by later quartz stringers. Six feet of almost solid pyrrhotite mineralization in one hole failed to yield any gold upon assay.

Zone No. 21 on claim K.R.L. 12,486 consists of a narrow series of quartz stringers in carbonatized metagabbro. The zone strikes N. 40° E. and dips steeply northwest. The carbonatized country rock is mineralized with cubic pyrite, and small amounts of pink carbonate and tourmaline occur in the quartz. Gold is reported to have been panned from weathered material over a length of 300 to 400 feet.

Zone No. 22, in the northeast corner of the same claim, consists of a mineralized area 2 to 3 feet wide, striking N. 75° E. and containing visible gold. Grab samples yielding high assays have been reported.

Zone No. 25 on claim K.R.L. 12,486 consists of a series of quartz stringers. The zone strikes N. 65° E. and dips 70° N. The greenstone between the fractures is carbonatized and mineralized with pyrite. Although visible gold has been reported, the gold for the most part appears to be associated with pyrite. The northern part of the zone is capped by a flat dike, but to the south it has been stripped for a length of 200 feet and has an average width of 5 feet. Assays of diamond-drill cores returned low values over a length of 350 feet.

Hanalda Gold Mines, Limited

History and Development

The property of Hanalda Gold Mines, Limited, consists of two groups of claims in Earngey township. The main group consists of 21 claims lying north of the Uchi property. Sixteen of these claims were purchased by J. E. Hammell in February, 1939, from Kenelda Gold Mines, a subsidiary of Woco Gold Developments, and 5 claims were acquired from J. A. Tremblay. The smaller group of 4 claims lying to the northwest were also purchased from Kenelda Gold Mines. Hanalda Gold Mines, Limited, was incorporated in May, 1939.

Woco Gold Developments carried on surface development of the main group of claims in 1937 and 1938. This work revealed a number of gold-bearing zones which were explored by surface-trenching and diamond-drilling. The discoveries made in 1937 on the Kenelda claims have been described by Thomson.[1] Other gold-bearing zones found in 1938 were examined by the writer and are discussed below.

Description of Gold-bearing Zones

To the end of 1938, zone No. 7 on claim K.R.L. 5,020, had yielded the best results. According to company reports, 40 shallow diamond-drill holes and 12 channel samples returned 0.29 ounces in gold per ton over an average width of 5 feet for a length of 400 feet. The results of deeper holes in this zone are inconclusive.

Zone No. 15 on claim K.R.L. 4,567 (see Fig. 10, facing page 38) consists of a series of flat-dipping quartz stringers 1 to 3 inches wide over an area of 3 by 10 feet. The stringers strike northeast and dip 30° S.E. The associated pyritized greenstone carries no gold, but a few ounces of coarse gold were recovered from the stringers. The showing was opened up in a test pit, in which the stringers appear to pinch out down the dip.

Zone No. 23 on the same claim strikes N. 5° W. The zone consists of a network of quartz stringers in carbonatized metagabbro, which is mineralized with disseminated cubic pyrite along with some secondary biotite. Commercial assays over narrow widths have been reported. In the vicinity there are local shear zones of rusty-weathering carbonate, and in this section gold has been panned over a wide surface area from rusty-weathering mineralization.

Zone No. 24 lies near the north boundary of claim K.R.L. 5,020 and consists of a 1-foot quartz vein striking N. 40° W. The vein lies in fractured amygdaloidal greenstone, which is mineralized with pyrite. Near by an east-west set of quartz stringers was observed cutting a northeast set.

[1] Jas. E. Thomson, op. cit., p. 80.

Bobjo Mines, Limited

History and Development

The property of Bobjo Mines, Limited, consists of 15 claims located in the vicinity of the long point marking the west side of Lost bay of Confederation lake. The property, formerly known as the Laidley claims, was staked in 1927 and optioned in the early summer of that year to Coniagas Mines, Limited. The following year Bobjo Mines, Limited, was formed to develop the property, a mining plant was installed, and a shaft sunk to a depth of 270 feet. Two levels were established, and approximately 1,600 feet of lateral work was done; but as the high-grade showing on surface was not picked up at depth, work was discontinued in 1929. Some gold was recovered, however, from ore taken from an open cut on the high-grade surface showing, after treatment in a small amalgam plant.

With the exception of a few short-term leases, the property lay idle for ten years. With renewed activity in the region following the successful development of the Uchi mine, the company resumed surface work on the property, under the direction of T. C. Fawcett, in August, 1938. The work began with a thorough programme of surface-trenching and stripping, and some new veins were uncovered and investigated. By February, 1939, 7,000 feet of diamond-drilling had been completed. All work was discontinued in April, 1939.

General Geology

The geology of the claims has been described by Bruce.[1] In summary, the claims are underlain by massive greenstones, which are epidotized, amphibolitized, and chloritized and locally show a striking spherulitic development. The flows are cut by a quartz-feldspar porphyry dike, which trends northward across the claims and is situated on the east side of Bobjo point. The dike makes a sharp bend in the greenstones at the locality of the principal gold-bearing zone. At this point the dike is somewhat thicker, is fractured, and contains quartz veinlets in which gold has been observed. A post-vein lamprophyric dike intercepts the ore zone. This dike has undergone the same type of alteration as those on the Jalda, Hanalda, and Uchi properties and consists essentially of altered feldspars and rusty-weathering ankerite.

The main gold-bearing zone consists of a fracture system developed in the spherulitic greenstone at the bend in the porphyry dike. The greenstone shows strong shearing at the contact with the dike. The general pattern of the fracture system consists of an arc-like quartz vein concave towards the quartz-feldspar porphyry dike, the intervening area between the vein and dike containing a number of gold-bearing quartz stringers filling cross-tension fractures, as shown in the accompanying plan (Fig. 11, facing page 40). A sulphide replacement zone in the greenstone trends northward through this section, is earlier than the quartz, and contains no gold. The gold appears to be in the native state and is associated with the quartz. The main vein is almost barren of mineralization and contains little gold, most of the precious metal content occurring in the associated stringers.

Quartz, carbonate, sericite, and chlorite are present in the veins. Pyrite forms thin films along fractures in the quartz, similar to that observed at the Uchi mine. The quartz is generally glassy, discoloured varieties commonly carrying visible gold. Some parts of the veins have been formed by replacement of the wall rock, and in such cases the quartz has a fine, sugary texture. Bruce[2]

[1]E. L. Bruce, op. cit., pp. 46, 47.
[2]Ibid, p. 46.

observed that the quartz is fractured and the fragments cemented by a fine-grained mosaic of later quartz. Small amounts of pyrite and pyrrhotite are irregularly distributed in the veins.

The quartz vein and stringer system of fractures appears to have been structurally localized by the massive porphyry dike. The present work has been mostly confined to adjacent veins, and some encouraging assays have been reported.

Woco Gold Developments, Limited

In 1939 Woco Gold Developments, Limited, and its subsidiary companies, Conwo and Kenelda Gold Mines, sold several groups of claims in Earngey township to J. E. Hammell in return for a stock interest in Uchi Gold Mines. The claims north of Uchi Gold Mines were organized into Jalda and Hanalda Gold Mines. Woco Gold Developments still retained a large group of claims located south of the Uchi property and did assessment work on these in 1938.

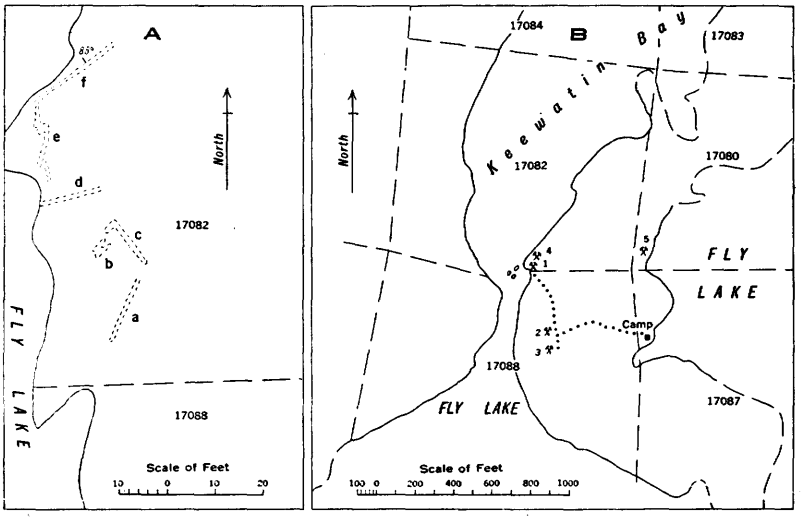


Fig. 12—Plans showing location of gold-bearing zones on claims of the Mining Corporation of Canada, Keewatin bay, Fly lake. Plan A shows quartz veins in No. 1 zone. Plan B shows the distribution of the veins.

J. E. Hammell Claims

The Hammell claims comprise three groups, totalling 36 claims. The western group of 22 claims shown on the map and the central group of 5 claims lying south of the Uchi property were purchased by J. E. Hammell in February, 1939, from Woco Gold Developments. The third group consists of 9 claims staked at Fly lake in the summer of 1938.

Woco Gold Developments prospected their claims in 1937 and 1938. Gold discoveries on the group of claims lying south of Uchi Gold Mines have been described by Thomson.[1]

Mining Corporation of Canada, Limited

A group of 12 claims was staked at Fly lake in July, 1938, by J. Penelton, representing the Mining Corporation of Canada, Limited, as the result of a gold

[1]Jas. E. Thomson, op. cit., pp. 77, 78.

discovery on the narrow peninsula separating Keewatin bay from the main body of the lake. Following the discovery, a number of prospectors entered the field and more than 100 claims were staked in the vicinity of Fly lake. At the time the writer left the field insufficient work had been done to determine the importance of the discovery.

Gold was found in five places, as shown in the accompanying sketch map (Fig. 12, plan B). The gold occurs in small quartz veins in "blue-eyed" quartz porphyry a short distance west of the contact of the porphyry with altered andesitic volcanics. The veins are narrow and sparingly mineralized with pyrite, tourmaline, sphalerite, and fine gold. The gold is in the native state and can be panned from pulverized vein material without roasting. The massive quartz porphyry adjacent to the quartz has been locally sheared and generally sericitized.

Assays of mineralized material selected by the writer returned the following gold content with reference to localities marked on plan A: Locality "a" in the No. 1 zone returned 2.63 ounces across 14 inches from a chip sample. A chip sample at locality "b" in the No. 1 zone yielded 0.53 ounces in gold per ton across 20 inches. A chip sample over 12 inches at zone No. 2 gave 0.55 ounces per ton in gold; a selected grab sample from zone No. 3, 0.01 ounces per ton in gold; and a grab sample from the No. 4 zone, 0.62 ounces per ton.

Earngold Mines, Limited

Earngold Mines, Limited, was formed to develop a group of 16 claims at the north end of Uchi lake, northeast of the property of Uchi Gold Mines. Late in the summer of 1938 a programme of surface prospecting was conducted on the claims under the direction of J. D. Turner, but nothing of interest was found.

Amorada Gold Mines, Limited

Amorada Gold Mines, Limited, an exploration syndicate, prospected a group of 27 claims in Agnew township (K.R.L. 16,722–16,748) optioned from the Waller Syndicate by K. J. Springer. The claims are located to the east and northeast of Burntwood lake and were originally staked by J. Penelton on behalf of the Mining Corporation. Exploration work by Amorada, which was discontinued late in September, 1938, consisted of prospecting and geological mapping along picket lines spaced at 500-foot intervals. The work was carried out under the direction of W. Hacker. No discovery of gold has been reported on the property.

Picairium Gold Mines, Limited

Picairium Gold Mines, Limited, was formed to develop 36 unpatented claims in Earngey and Mitchell townships. The group in Earngey is situated in the lower Uchi lake section. Some work was done on this group in 1937, but nothing of economic interest was found and the property has since remained idle.

Darrell Gold Mines, Limited

Darrell Gold Mines, Limited, was incorporated late in 1938 to develop 27 claims adjoining the property of Bobjo Mines on the west. Nothing is known concerning surface developments.

Other Properties

A number of other properties in the area have been described by Thomson.[1] These include the claims of Raingold Mines, Limited, and the Berrigan, Grasett, Tremblay, and Milberry claims. There are no later developments on these properties to report.

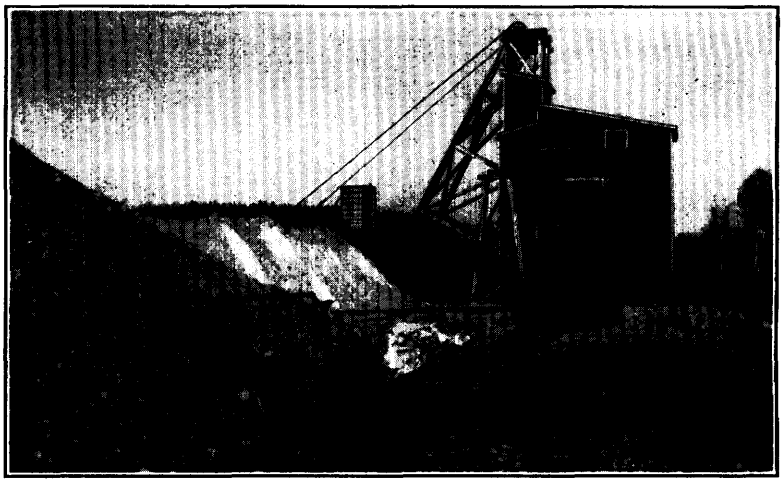
[1]Jas. E. Thomson, op. cit., pp. 81, 82.

Geology at the J-M Consolidated Mine

By J. D. Bateman

Introduction

In September, 1938, the writer paid a short visit to the property of J-M Consolidated Gold Mines, Limited, in order to examine the No. 2 shaft, which has been developed since 1937. J-M Consolidated Gold Mines owns 44 claims in Dent and Mitchell townships in the Woman Lake area, Patricia portion of Kenora district. The mine is situated between Rowe and Belljoe lakes in Dent township, 7½ miles west-northwest of the Uchi mine. The area is serviced by airplanes operating from Hudson and Gold Pines. The mine may now be reached by the new road constructed from Gold Pines to the Uchi Lake area. Power



View of No. 2 shaft, J-M Consolidated mine.

necessary for mining and milling operations is developed by steam pressure and Diesel-driven generators. Hydro-electric power is available from the line running from Ear Falls to the Uchi mine.

Acknowledgements

The writer is indebted to W. W. Westaway, manager, and W. Hubbard, superintendent, for the use of mine plans, helpful co-operation, and friendly hospitality during his brief visit to the mine property.

History

The present holdings of the company consist of three groups of claims, which were formerly separate properties. Two of these were staked in 1926, when interest centred on the area in the spring following the Red Lake gold rush of 1925–26. The northern claims were staked by Rowe, who is reported to have made the first gold discovery in the area on the Rowe vein, which is the subject of this report. The southern group was staked by Jackson and Manion. The two groups were optioned to Noah Timmins, Incorporated, the option expiring in the latter part of the summer of 1927. Jackson-Manion Mines, Limited, was then formed to develop the discovery, and by 1928 a mining plant had been installed.

The present company was incorporated in 1932 as a consolidation of the Jackson-Manion property and the claims of Mint-Ore Mines, Limited.

Development

A 3-compartment shaft was sunk to a depth of 375 feet on a vein east of Belljoe lake, and a winze continued to 625 feet. The mine was opened up with crosscuts and drifting on five levels and came into production with a 25-ton cyanide mill in 1934; in 1936 the daily milling capacity was increased to 100 tons. Ore developments did not keep pace with production, and early in 1938 the shaft allowed to fill with water. In the spring of 1937, however, shaft-sinking had been started on the Rowe vein, approximately 2,200 feet north of No. 1 shaft. By the end of 1938, No. 2 shaft had been sunk to a depth of 391 feet, three levels had been established, and intermittent production was continued. A narrow-gauge railway was built to carry ore from the Rowe vein to the mill. The mill was closed down for a few months in 1938 to permit ore development, production being resumed in August. Early in 1939 the company was operating on a milling basis of 100 tons per day, with production at approximately $25,000 per month. Ore reserves in January, 1939, were reported at 20,000 tons averaging approximately 0.3 ounces per ton in gold, or about seven months' supply at the present milling rate. At that time, however, there were a number of development headings in ore.

General Geology

The veins lie in a folded series of basic lavas (greenstones), which have been intruded by a number of narrow porphyry and granite dikes. A large mass of intrusive granite outcrops to the south, and the gold-bearing veins are located to the north of a "nose" of the granite, which extends northward into the greenstones at Belljoe lake.

The Rowe vein and the Belljoe Lake vein, formerly considered to be a single vein, three-quarters of a mile long, were examined by J. W. Greig[1] in 1927 and E. L. Bruce[2] in 1928.

The underground workings at the No. 1 shaft on the Belljoe Lake vein were completed since the publication of these reports, but were not available for examination by the writer as the shaft is filled with water. The present report, therefore, deals only with the geology in the more recent No. 2 shaft workings.

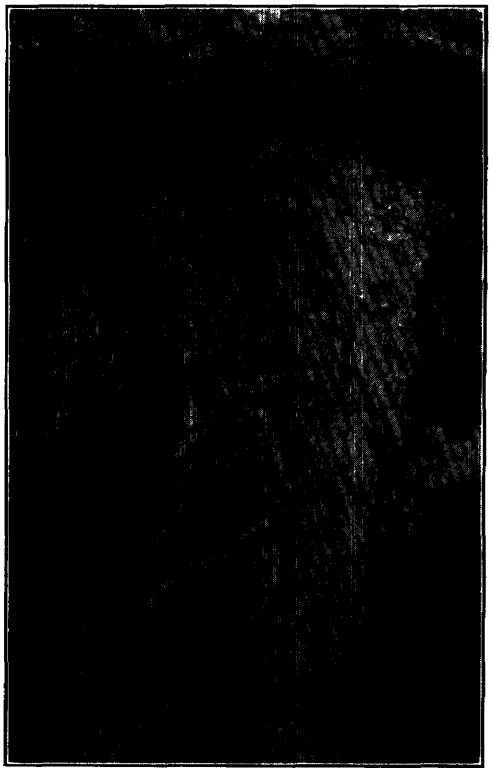
The No. 2 shaft area is underlain by massive greenstones, which are cut by narrow quartz-feldspar porphyry and granite dikes. The vein occurs in a northward-striking shear zone in a greenstone flow adjacent and parallel to a vertical quartz-feldspar porphyry dike. A massive, parallel granite dike lies a short distance west of the vein.

The greenstones consist of a series of altered basic flows, which had been steeply folded prior to the intrusion of the porphyry and granite. The massive greenstone in the vicinity of the vein is essentially a fine-grained, dark-green amphibolite composed mostly of fibrous amphiboles, secondary albite, and epidote.

The greenstone country rock, adjacent to the veins, has been altered to a strongly foliated dark-green schist consisting of parallel *laminae* of chlorite with carbonate and small amounts of sericite, albite, quartz, and sulphides. This rock is the schistose equivalent of the massive greenstone formed in a narrow shear zone, in which the vein was later formed, and the schist has been further changed by hydrothermal alteration.

[1]J. W. Greig, Ont. Dept. Mines, Vol. XXXVI, 1927, pt. 3, pp. 107, 108.
[2]E. L. Bruce, Ont. Dept. Mines, Vol. XXXVII, 1928, pt. 4, pp. 24-32.

The shearing occurred adjacent to a northward-striking porphyry dike, 1 to 6 feet wide, which splits into two forks towards the south. The fresh porphyry is buff-coloured and consists of phenocrysts of rounded quartz and plagioclase zoned from calcic oligoclase to albite in a fine-grained groundmass consisting of alkali feldspars and quartz with small amounts of biotite, sphene, hornblende, sericite, epidote, and zoisite. In a number of places in the mine the quartz-feldspar porphyry dike lies in the vein shear zone and has been altered to a schist, which has been further altered by hydrothermal solutions. This alteration has



Working face on the 125-foot level, south drift east, J-M Consolidated mine.

resulted principally in the development of sericite and quartz with lesser amounts of chlorite, albite, and carbonate, and the rock is a silicified quartz-sericite schist. The geological relationships are shown in the composite plan of the mine levels (Fig. 1, facing page 46).

Economic Geology

Character of the Rowe Vein

The quartz vein, which is a replacement of the narrow shear zone, ranges from a few inches to approximately 6 feet in width. In the ore shoots the vein averages approximately 3 feet in width, and mining is generally carried out over minimum stoping widths. In the south drifts the vein splits, apparently corresponding with the split in the quartz-feldspar porphyry dike. A study of the accompanying isometric diagram (Fig. 2, facing page 48) indicates that the split apexes between the 125-foot level and surface, and widens to the south and at depth.

A typical 5-foot section from east to west across the vein in the south heading of the south drift east on the 125-foot level is described below. The section is divided into subsections as indicated on the accompanying photograph of the working face, from which relatively high-grade assays are reported. Thin sections of each division were studied, in addition to polished specimens of the divisions containing metallic minerals:—

1. Seven inches of the east wall, consisting of dark, waxy-green chlorite schist containing fine ribbons of carbonate. This rock is the schistose altered equivalent of the massive greenstone.

2. Six inches across a lens of yellow, silicified sericite schist representing the altered equivalent of the quartz-feldspar porphyry dike. This section carries



Photomicrograph of a thin section of "black line" material showing brecciated quartz (white) partly replaced by carbonate in a matrix of chlorite (dark). (× 21.)

disseminated pyrite in the form of distorted octahedra, chlorite coating fracture surfaces, and a small amount of visible gold in threads of quartz.

3. Six inches of silicified chlorite schist containing disseminated pyrite and an irregular network of small quartz stringers. At the contact with the altered porphyry there is a concentration of pyrite and some visible gold.

4. Ten inches of extensively silicified porphyry containing a fine network of quartz stringers, disseminated pyrite, and some chalcopyrite.

5. A narrow, well-defined, black ribbon, which is from one-eighth of an inch to 3 inches wide and is in sharp contact with the silicified porphyry to the east, but has a gradational contact with brecciated vein quartz to the west. This feature is known as the "black line."

6. Six inches of coarsely brecciated quartz, in which the fractures are filled with chlorite and cemented by later quartz.

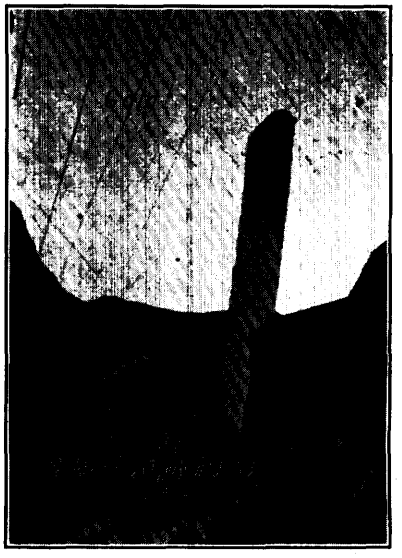
7. Seven inches across a triangular section of relatively massive milky quartz containing scattered areas of ankerite.

8. Eighteen inches of altered, fractured greenstone containing quartz stringers.

In the stope above the 125-foot level north of the shaft, the brecciated vein is separated from a massive milky quartz vein by a narrow belt of silicified porphyry. The porphyry is in sharp contact with the milky quartz vein, but is gradational into the quartz breccia vein. Two "black lines" are present, one within the quartz breccia vein and the other bordering it. The "black line" where exposed on the vein wall has a slickensided slip surface indicative of movement. It is thought that the brecciated quartz vein originally formed in the shear zone by replacement of the greenstone schist and preferentially by replacement of the porphyry wherever possible. The milky quartz is believed to represent a later generation formed largely as an open-space filling after brecciation of the original quartz vein.



Photomicrograph of a polished specimen showing veinlet of gold (white) and chalcopyrite (light-grey) in quartz (black). (× 50.)



Photomicrograph of a polished specimen showing a blade of calaverite cutting gold, altaite, and chalcopyrite. (×40.)

Origin of the "Black Line"

The "black line" is a well-defined, black, siliceous stringer, which owing to its appearance has been given this name by the miners. Observations have shown that wherever the "black line" is found in the vein, ore grade is indicated, and conversely the "black line" is confined to the ore shoots. This feature may occur within the brecciated quartz, locally splitting it, or on either side of it. Where the "black line" borders the quartz breccia vein, it has a gradational contact with it and a sharp contact with the adjacent altered wall rock or milky quartz vein. Where the "black line" has been exposed in longitudinal section in mining operations, it commonly has a slickensided surface. Microscopic examination of the "black line" material, as shown in the accompanying photomicrograph, shows it to be composed essentially of chlorite and minute irresolvable fragments with silica constituting a matrix in which there is a variety of angular quartz fragments. The "black line" is thought to be a silicified clayey gouge formed when the original replacement quartz vein in the shear zone was disturbed by renewed movement or faulting. The gouge was silicified and perhaps chloritized during the introduction of a later generation of quartz.

A post-vein fault that intersects the shaft station on the 250-foot level has

been identified in the south drifts on the 375-foot level. The fault plane apparently dips to the south-southeast at 35 degrees, but does not appear to have displaced the vein.

Mineralization

The original vein, although consisting mostly of quartz, contains some sericite and chlorite. The later quartz was accompanied by the deposition of ankerite and chlorite, and some of this quartz is also replaced and veined by ankerite. Thin sections of vein material commonly show large areas of strained quartz fractured around the borders of the grains, and cemented and replaced by later quartz.

Pyrite is the most abundant metallic mineral in the veins and commonly occurs in the shape of deformed octahedra rather than cubes. In addition there are minor local concentrations of sphalerite and, in lesser amounts, chalcopyrite. The chalcopyrite and sphalerite replace and vein the pyrite. Under the micro-



Photomicrograph of a polished specimen of ball mill concentrate showing electrum.

scope, minute areas of chalcopyrite may be seen in the sphalerite oriented in lines parallel to the dodecahedral cleavage of the latter mineral. Chalcopyrite is also associated with gold in veinlets in the quartz.

On the 125-foot level south, pyrite is the principal metallic mineral in the vein and most of the gold occurs as minute grains or fine seams in fractures in the quartz. Some of the gold seen in polished sections is a pale-yellow variety. Three telluride minerals have been identified in the ore. These are the lead telluride altaite, the silver telluride hessite and the gold-silver telluride calaverite. The tellurides occur in close association with native gold, which is generally associated with chalcopyrite. Quantitatively the tellurides are not important; altaite is the most abundant and occurs associated with hessite and native gold, the boundaries between the three minerals being smooth and even. Calaverite occurs as small, cream-coloured blades in the altaite.

Sufficient gold has been observed in polished sections to account for the gold content reported in the ore. According to company officials, silver constitutes almost half the precious metal recovery by weight, but the source minerals of the silver have heretofore been unknown. A portion of the ball mill discharge was panned to a concentrate, separated into two lots with a 35-mesh screen, and separated into five fractions on a superpanner.[1] Portions of the fractions were

[1]Work done by B. S. Crocker at Lake Shore Mines.

mounted in bakelite, mechanically polished, and studied microscopically. The heavier plus and minus 35-mesh fractions contained a gold-coloured mineral, which has various degrees of paleness, some of it being so pale as to be cream-coloured. Microchemical tests show it to be electrum—an alloy of gold and silver. The colour variability of the mineral suggests a wide range in ratios of gold to silver, and quantitative determinations from 4 of the 5 fractions indicate proportions of gold to silver as follows:[1]—

	Parts per thousand	
	Gold	Silver
+ 35 mesh heavy fraction	766.7	190
	720.5	158
	666.8	194.6
+ 35 mesh medium fraction	677	185.5
	469.5	172.7
	676.2	168.3
+ 35 mesh light fraction	280.1	84.4
− 35 mesh light fraction	76.7	15.5

The rough increase of gold to silver in the heavier +35 mesh fractions is the result of gravity separation. The variability of the assays is due to the fact that there are present gold-silver tellurides carrying different proportions of gold to silver, as well as electrum that may have some other element alloyed with it.

The heavier fractions also showed the presence of tellurium in chemical tests, which was determined by analyses as follows:—

	Tellurium, per cent.
− 35 mesh heavy fraction	0.22
− 35 mesh light fraction	None

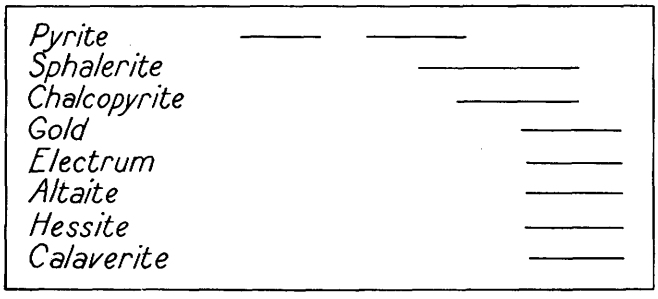


Fig. 3—Diagram showing the paragenetic sequence of the metallic minerals in the Rowe vein, J-M Consolidated mine.

Pyrite is the principal mineral of the light fractions. Silver-bearing tellurides do not appear to be present in the ore in amounts sufficient to account for more than a small proportion of the silver. The bulk of the silver is alloyed with the gold, the electrum being distinguished from the normally pure gold by its paler colour.

Except for the pyrite, the metallic minerals in the vein are later than the first, and mostly later than the second generation of quartz. The accom-

[1]W. F. Green, Provincial Assay Office, analyst.

panying diagram (Fig. 3) shows the paragenetic sequence indicated as a result of microscopic studies.

Ore Shoots and Localization of Ore

Most of the gold occurs in fractures in the quartz, particularly near the contact with silicified and chloritized wall rock either within or at the border of the vein. Although the wall rock is mineralized with disseminated pyrite, the gold is confined to the vein, and the precious metal content of the ore shoots is, in general, proportional to the amount of quartz. The walls of the vein are, therefore, the walls of the ore shoots, and ore is sharply defined from waste. The ore shoots are narrow and rake to the south at a moderately steep angle, as may be seen in the isometric diagram (Fig. 2, facing page 48). The principal ore shoot is situated in the vicinity of the shaft and, on the 125-foot level, is mostly north of the shaft. At depth this shoot tapers and is represented by a short drift length south of the shaft on the 375-foot level. The south drifts of the upper levels have located a second ore shoot, which, owing to the southerly rake of the ore, may be found in a southerly extension of the 375-foot level. The chief hope of future ore reserves and consequent continuation of mining operations exists in the development of ore to the south and at depth, as the upper end of the north ore shoot has been carried as close to Rowe lake as safe mining will permit. Geological conditions to the south on the rake of the ore appear favourable for the occurrence of new ore, and the chances for such developments are increased by the split in the vein. Up to the present, selective mining has not been necessary within the ore shoots, and shrinkage stoping methods have been employed.

Those sections of the vein that run ore grade lie within the area marked by the "black line" or former fault gouge, and it would appear that these areas have offered the best channelways for the mineralizing solutions that deposited their metalliferous content towards the close of the period of deposition of the second generation of quartz. The gold occurs in both generations of quartz, and the probable reason that the precious metal content is proportional to the amount of quartz is that the vein, owing to its brittleness, was thoroughly fractured and provided the best channelways for the solutions from which the gold was deposited. As microscopical examination shows approximately contemporaneous deposition of gold with chalcopyrite and sphalerite, the presence of these minerals should generally indicate ore.

Summary of Vein Formation and Mineralization

1. Granitic intrusion into steeply folded basaltic greenstone, accompanied by the introduction of quartz-feldspar porphyry and granite dikes.
2. Development of a shear zone, 5 feet wide, in the greenstone adjacent to a narrow quartz-feldspar porphyry dike and including part of the dike.
3. Formation of a quartz vein by replacement of the chlorite schist (greenstone) and sericite schist (porphyry) in the shear zone. At the same time pyrite was formed as a replacement in the silicified zone.
4. Renewed movement in the shear zone resulting in a fault within the vein and local formation of fault gouge, particularly where quartz was in contact with the wall rock.
5. Introduction of a second generation of quartz, probably as a later stage of the same continuous solutions from which the initial vein was formed.
6. Pyrite, ankerite, and chlorite were introduced into the vein accompanying and following the deposition of the later quartz.

7. Then followed the introduction of sphalerite and chalcopyrite, accompanied by gold, silver, and tellurides. Most of the silver is alloyed with the gold as electrum.

8. Post-mineralization faulting with no apparent displacement of the vein; subsequent oxidation of ankerite and sulphides near the fault-plane.

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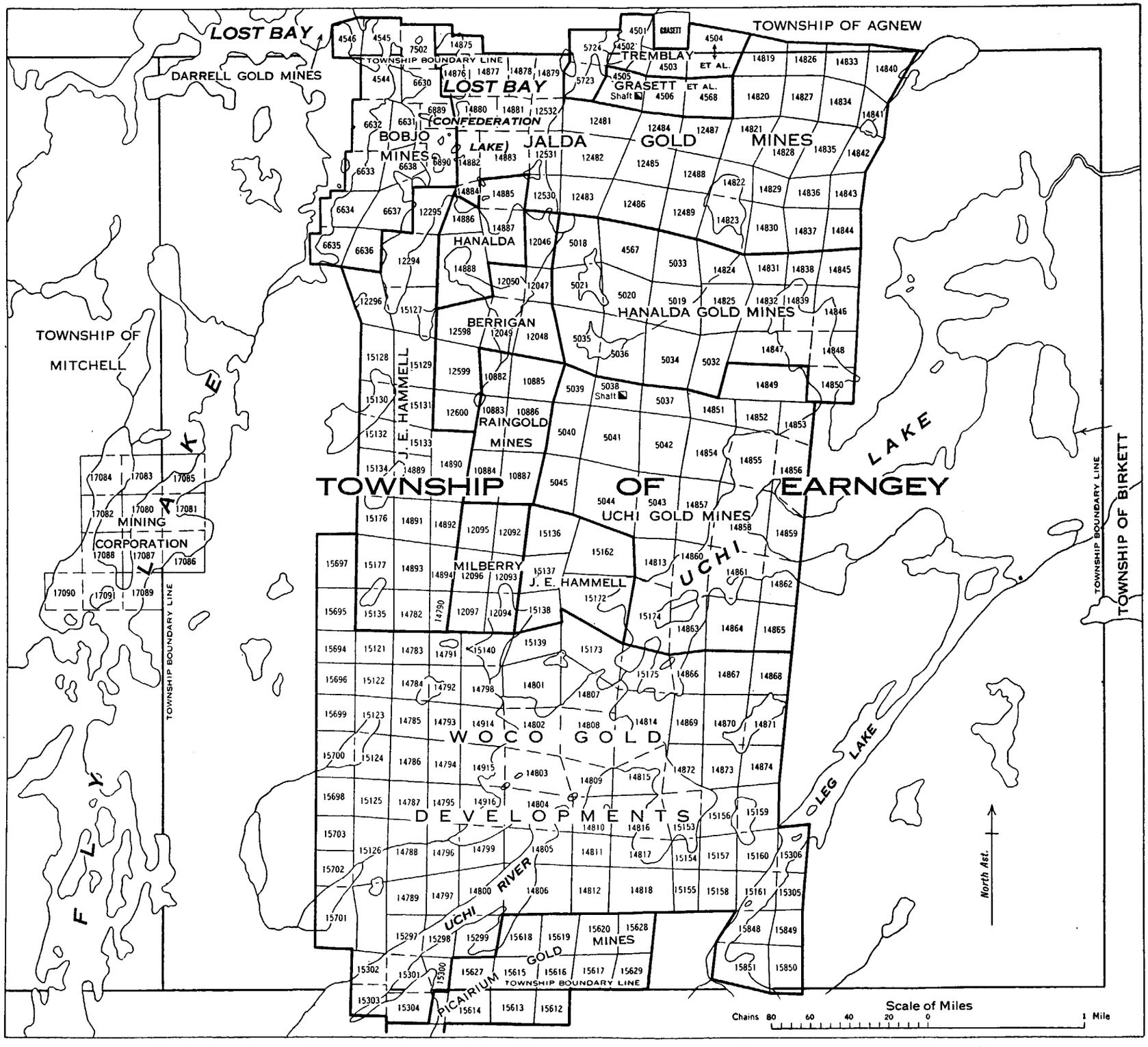


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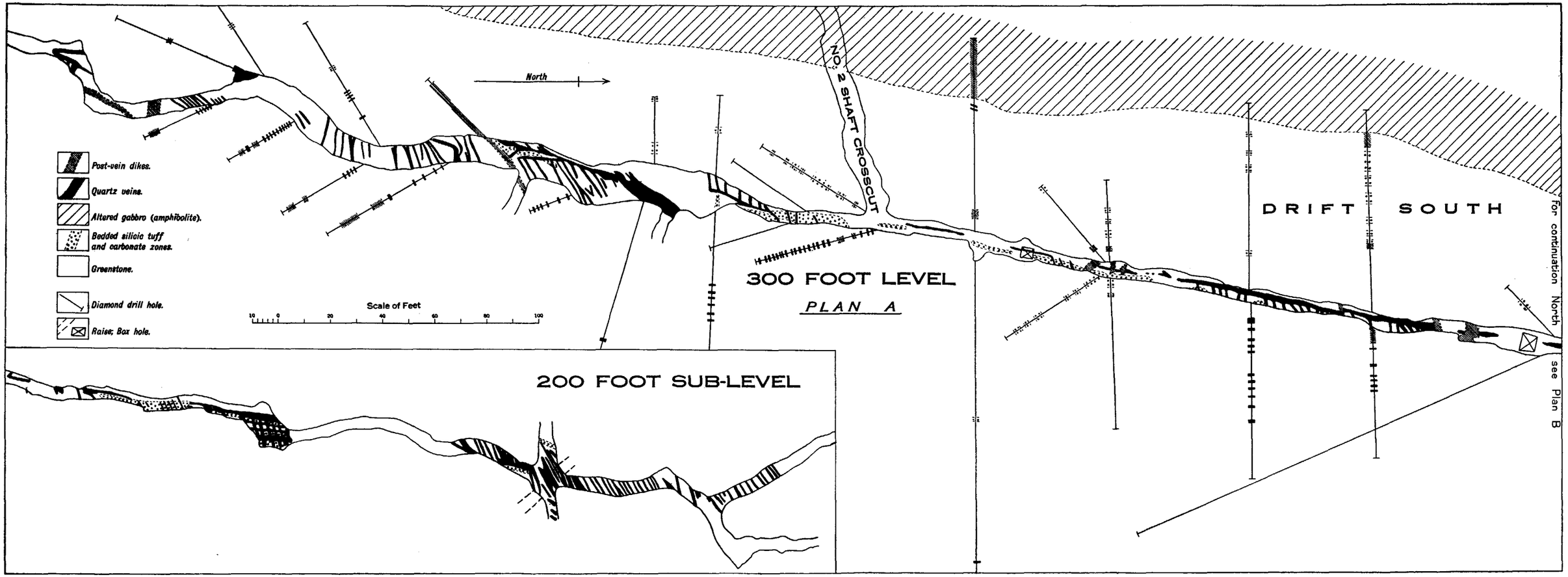


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(Modified after company plans. The northerly continuation of the 300-foot level is shown on plan B, Fig. 7.)

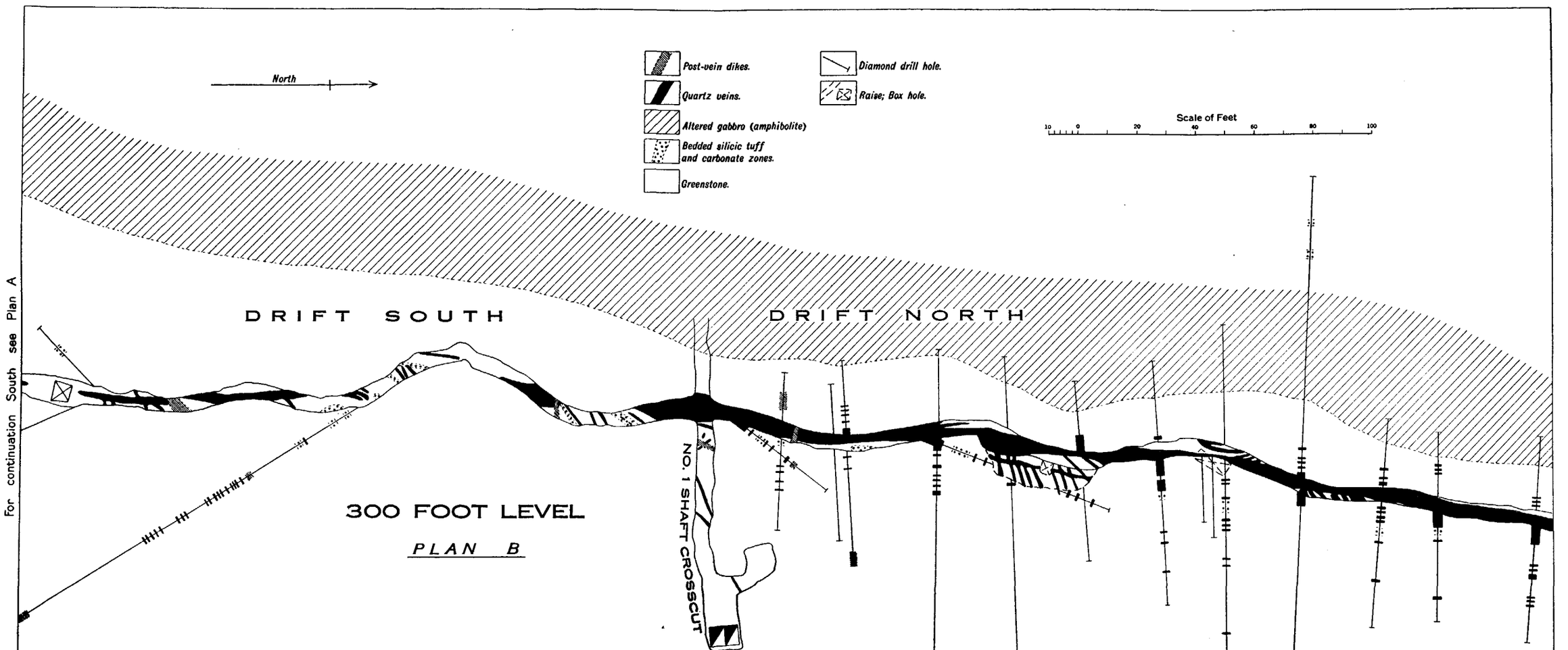


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(Modified after company plans. The southerly continuation of the 300-foot level is shown on plan A, Fig. 6.)

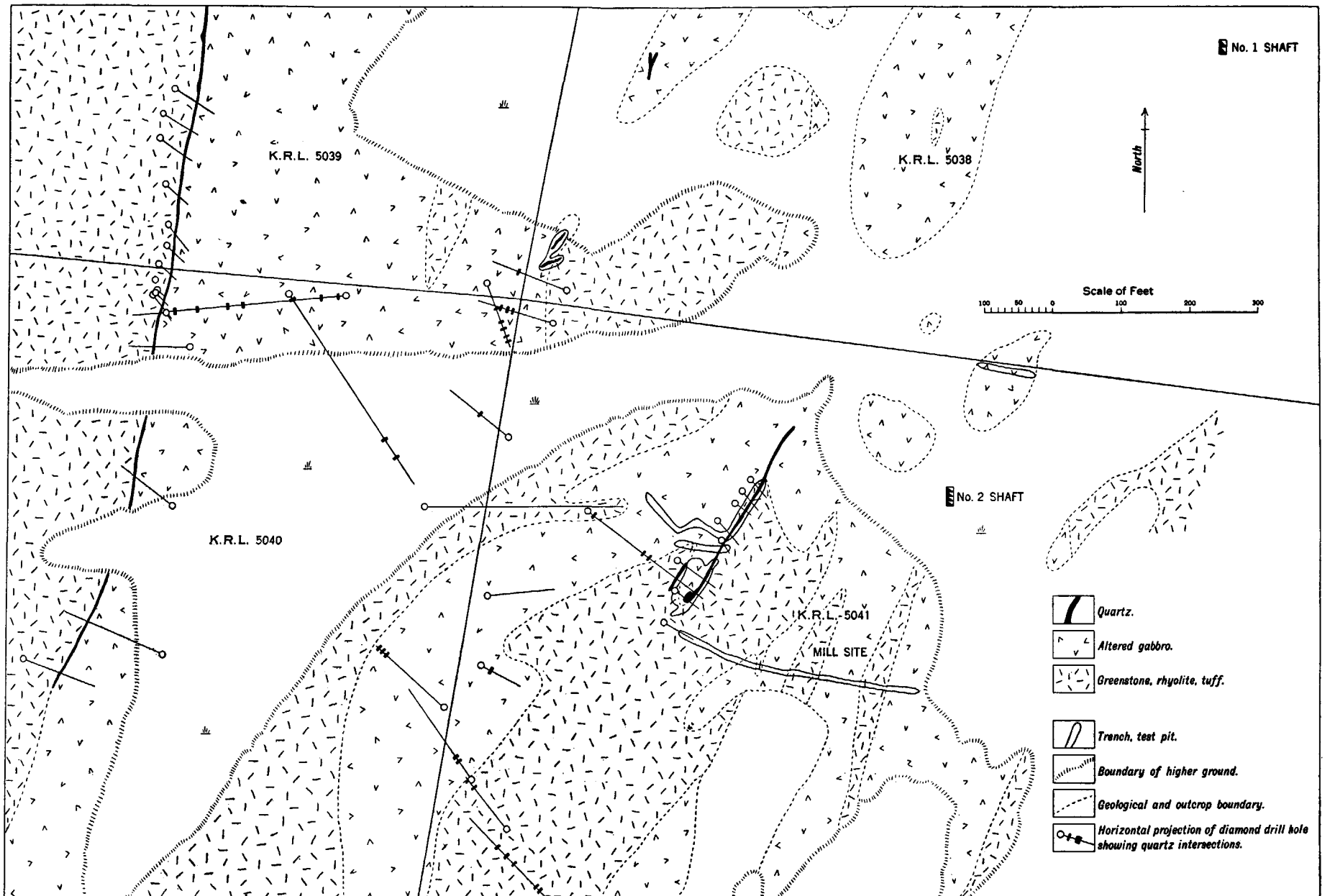


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(Modified after company plans.)

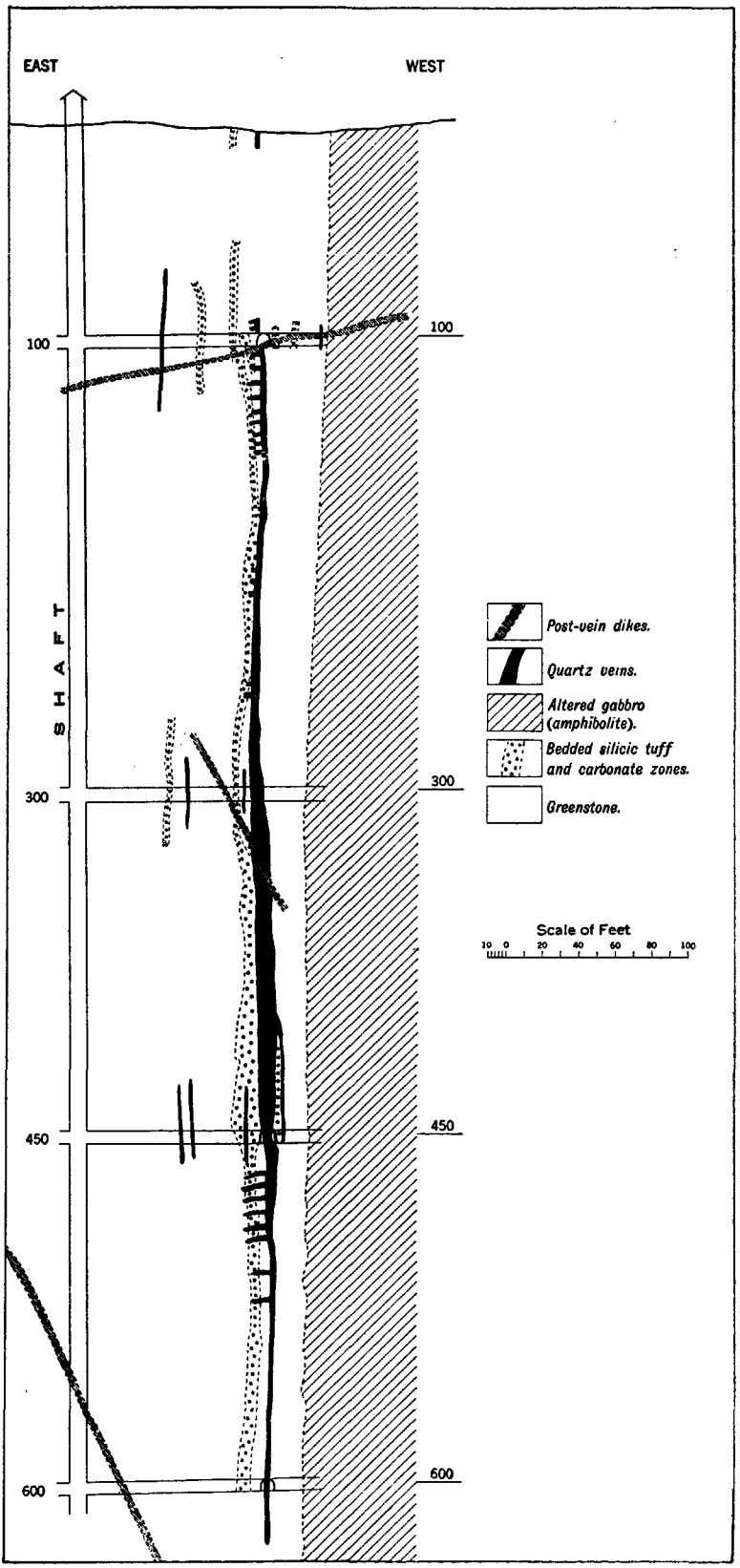


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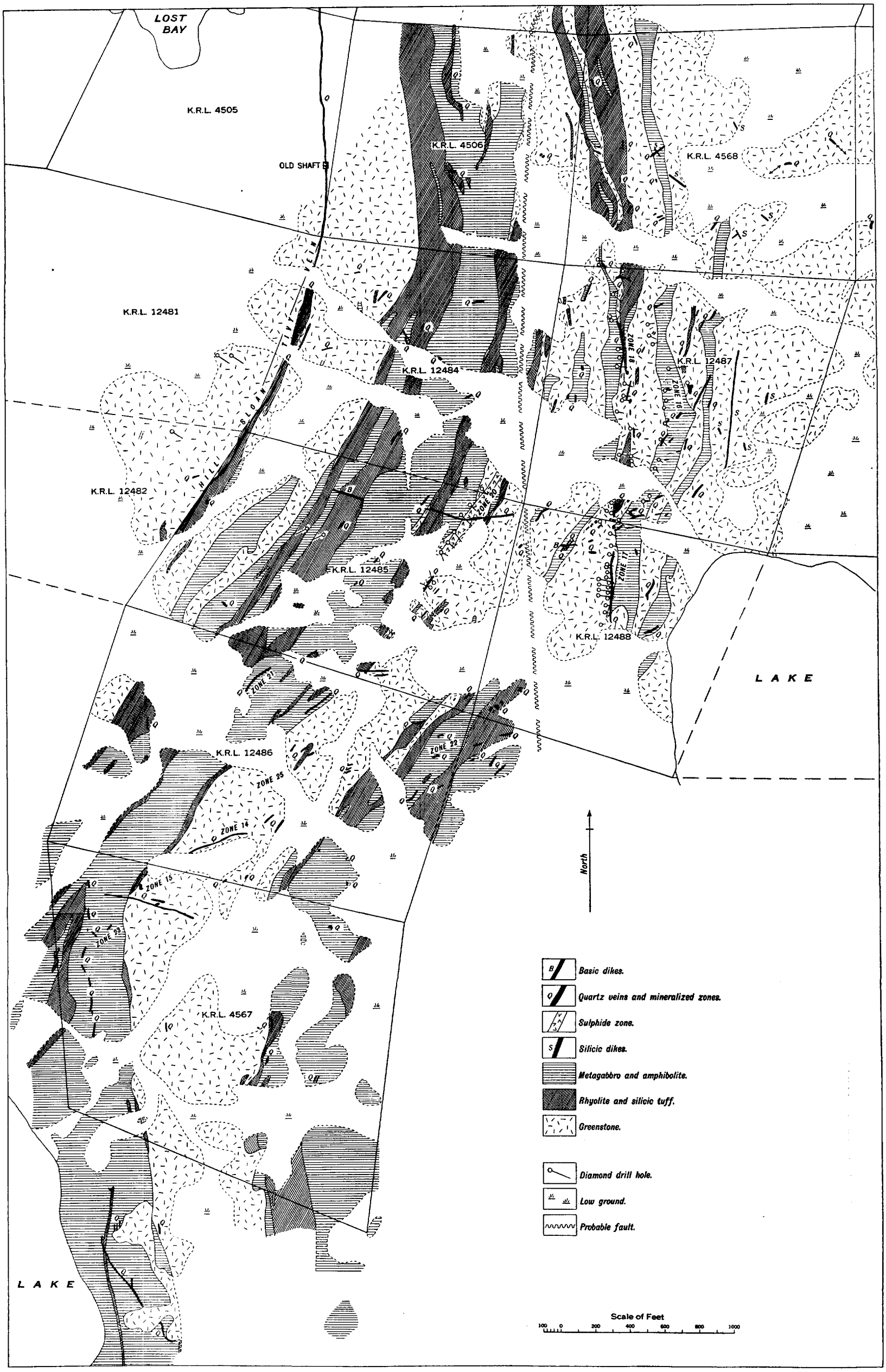


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(Modified from detailed geological plans made by G. W. Moore for Woco Gold Developments.)

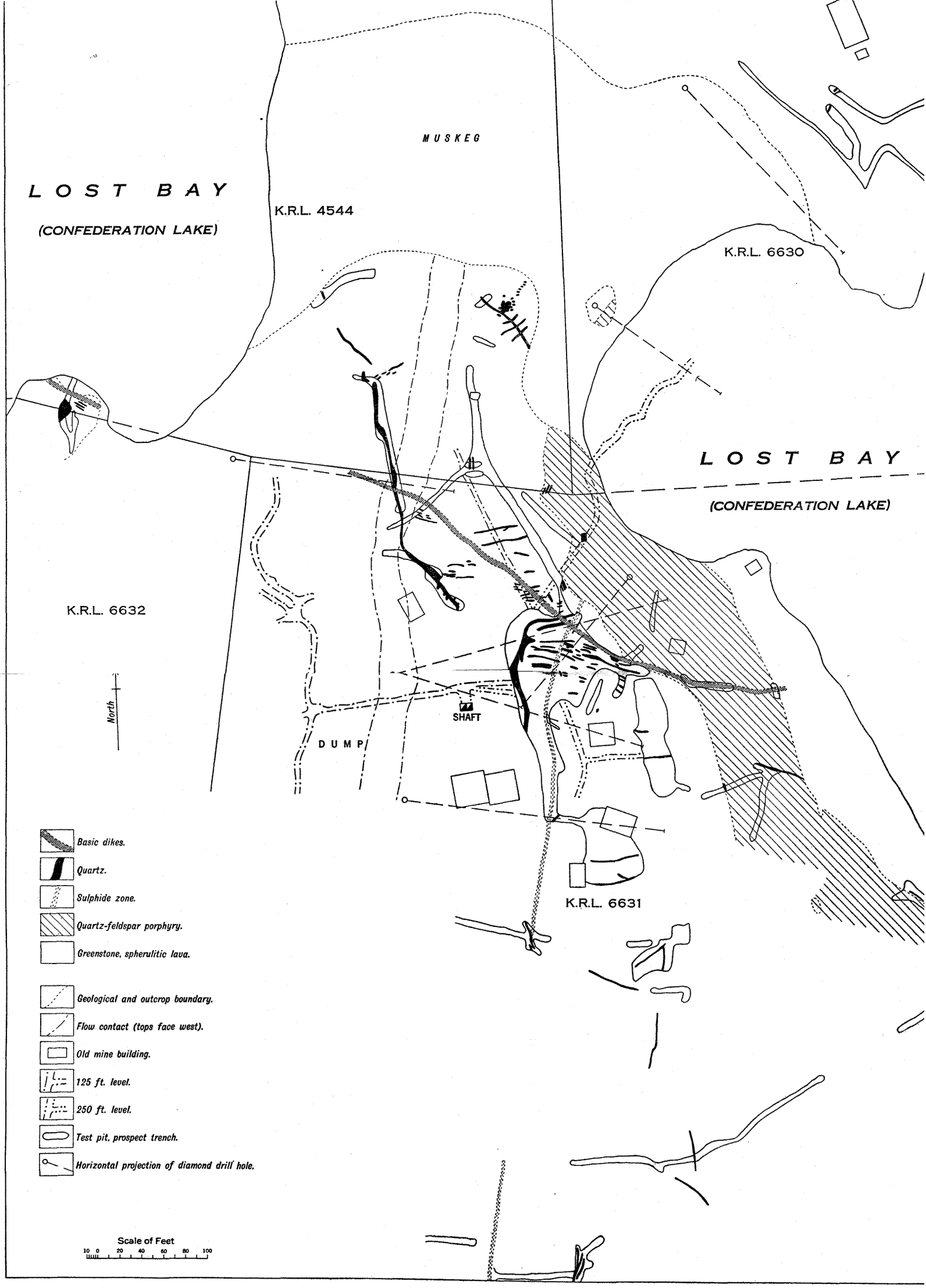


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(Modified after plans of Bobjo Mines, Limited. All blank space within trenches and area of outcrop boundaries is greenstone.)

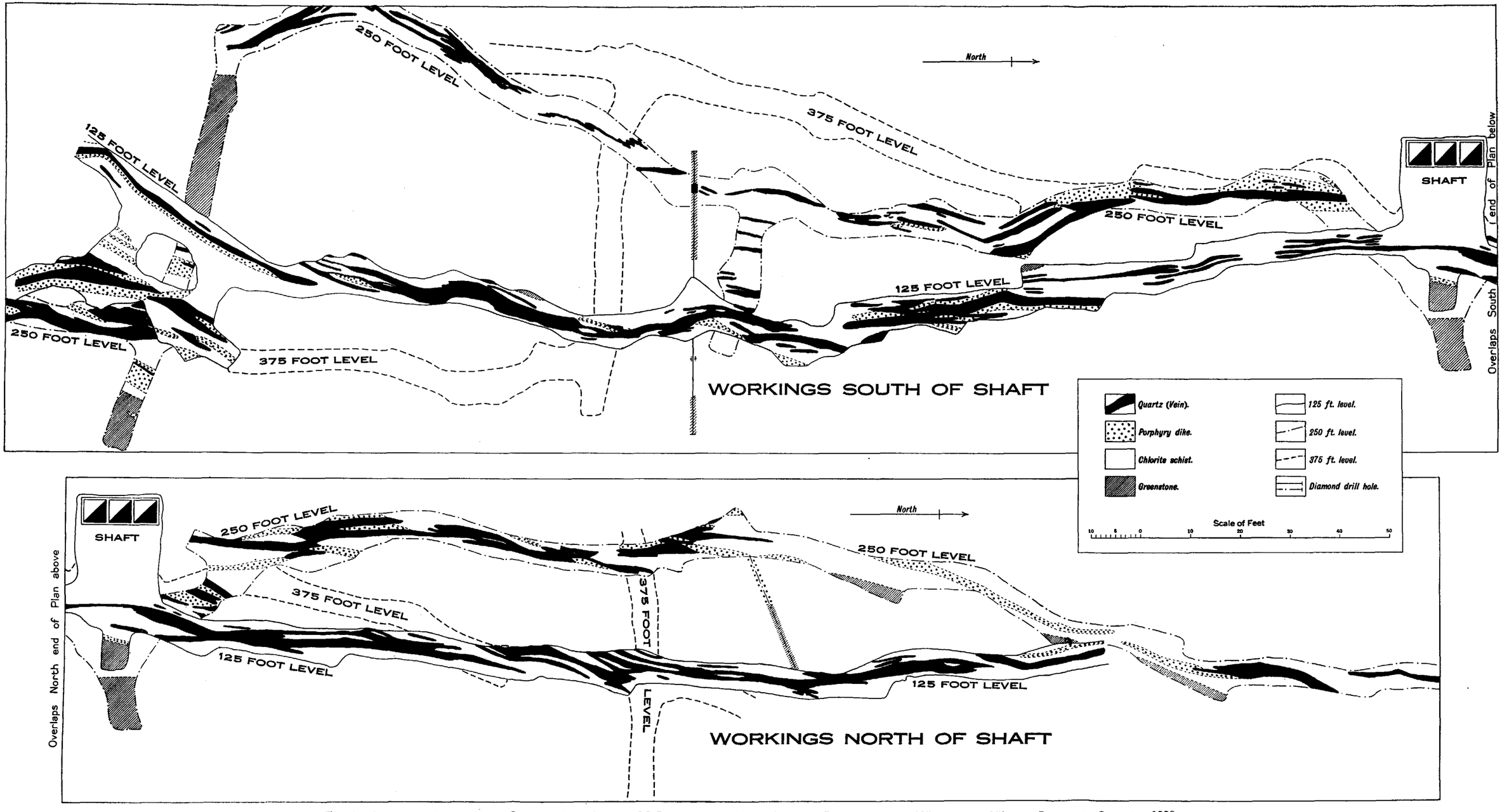


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(Modified after company plans.)

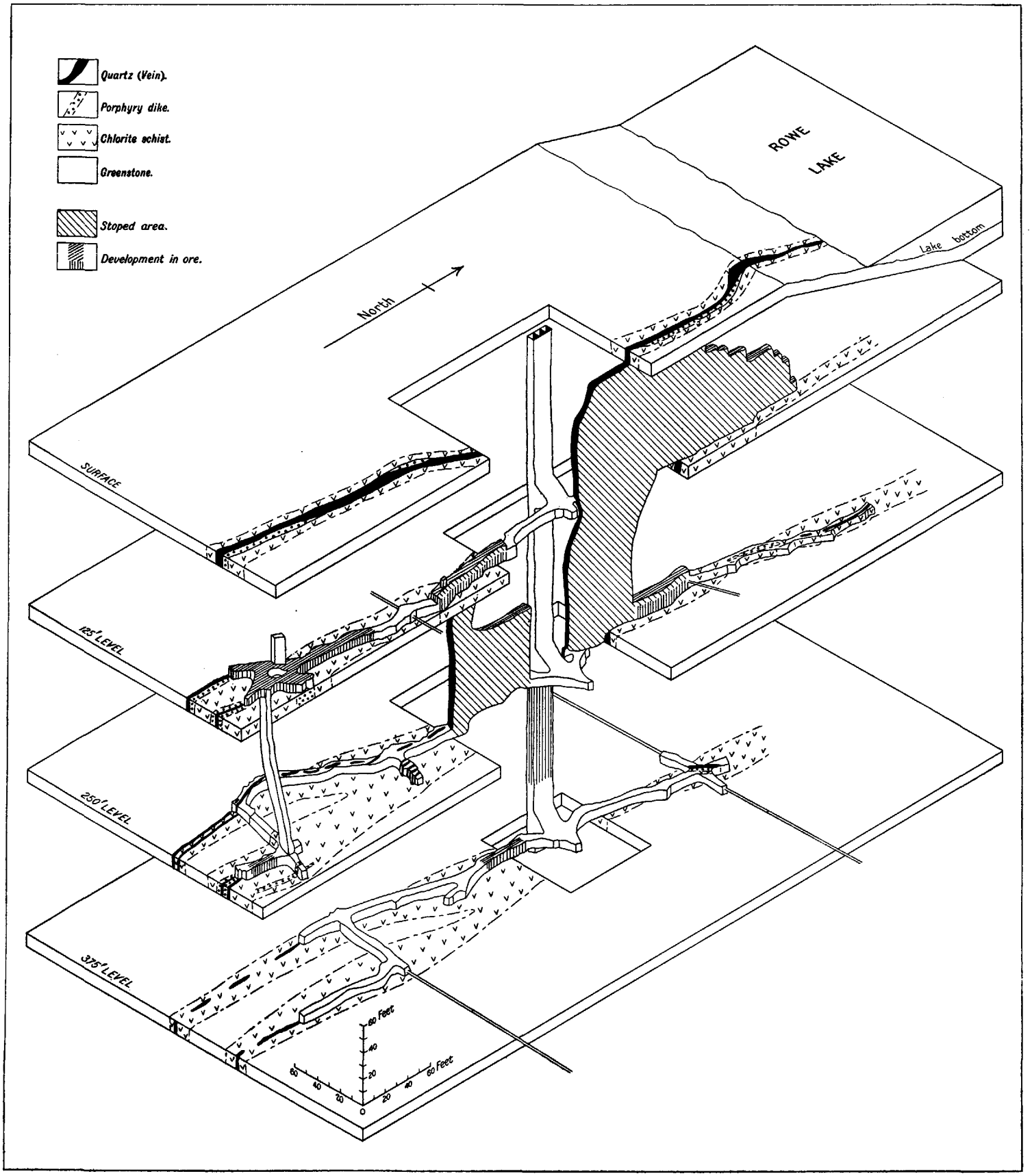
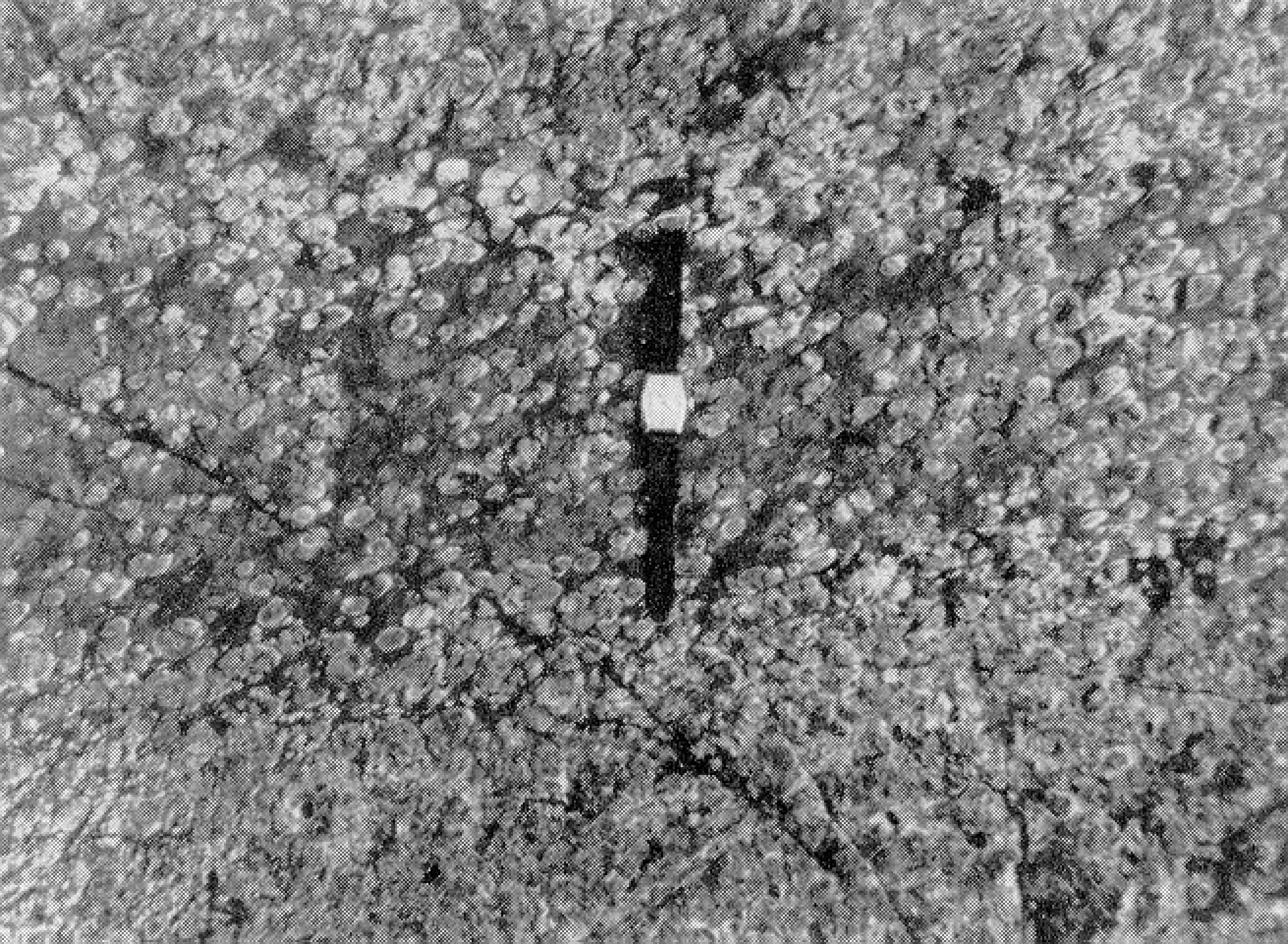


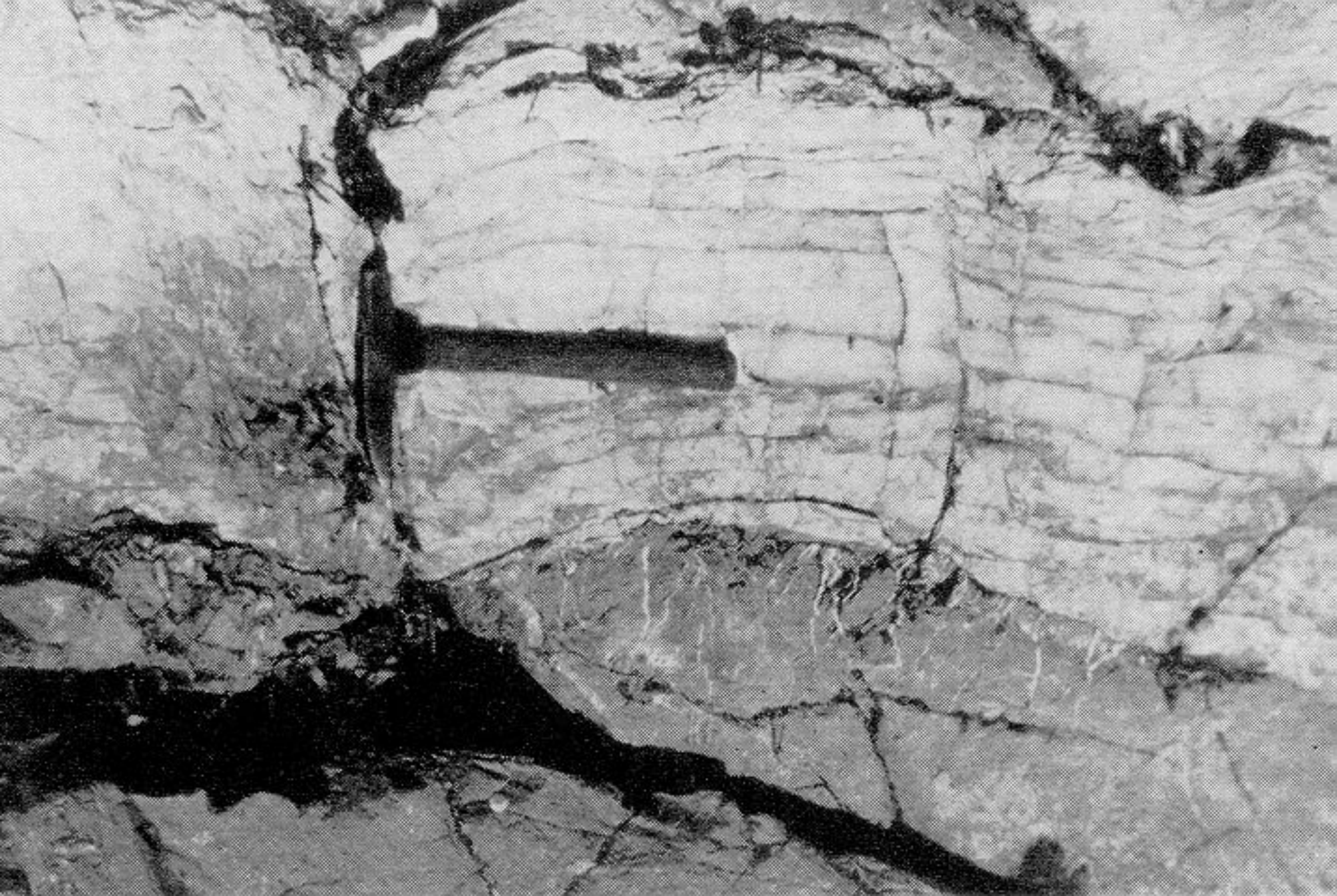
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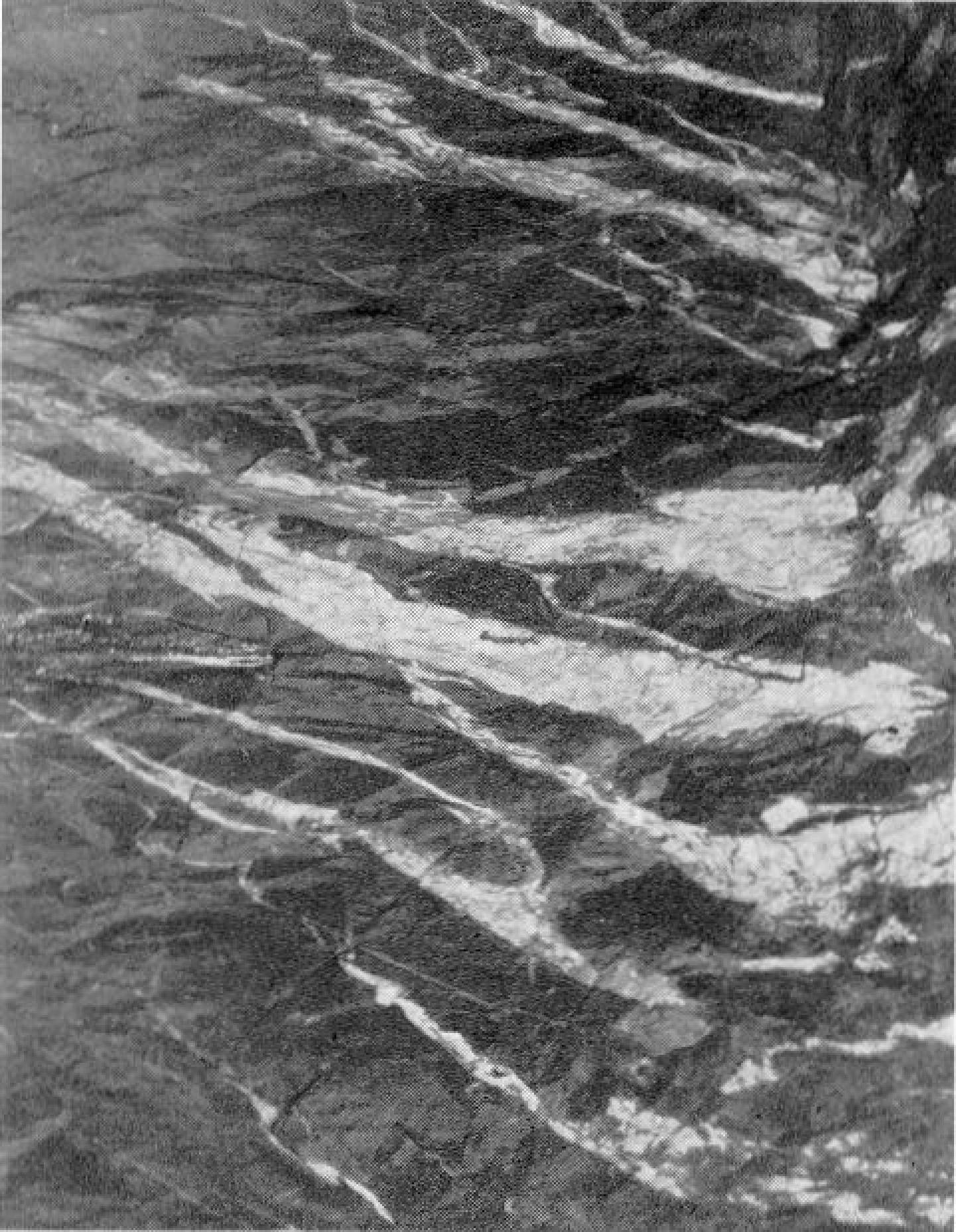
(Modified after company plans.)





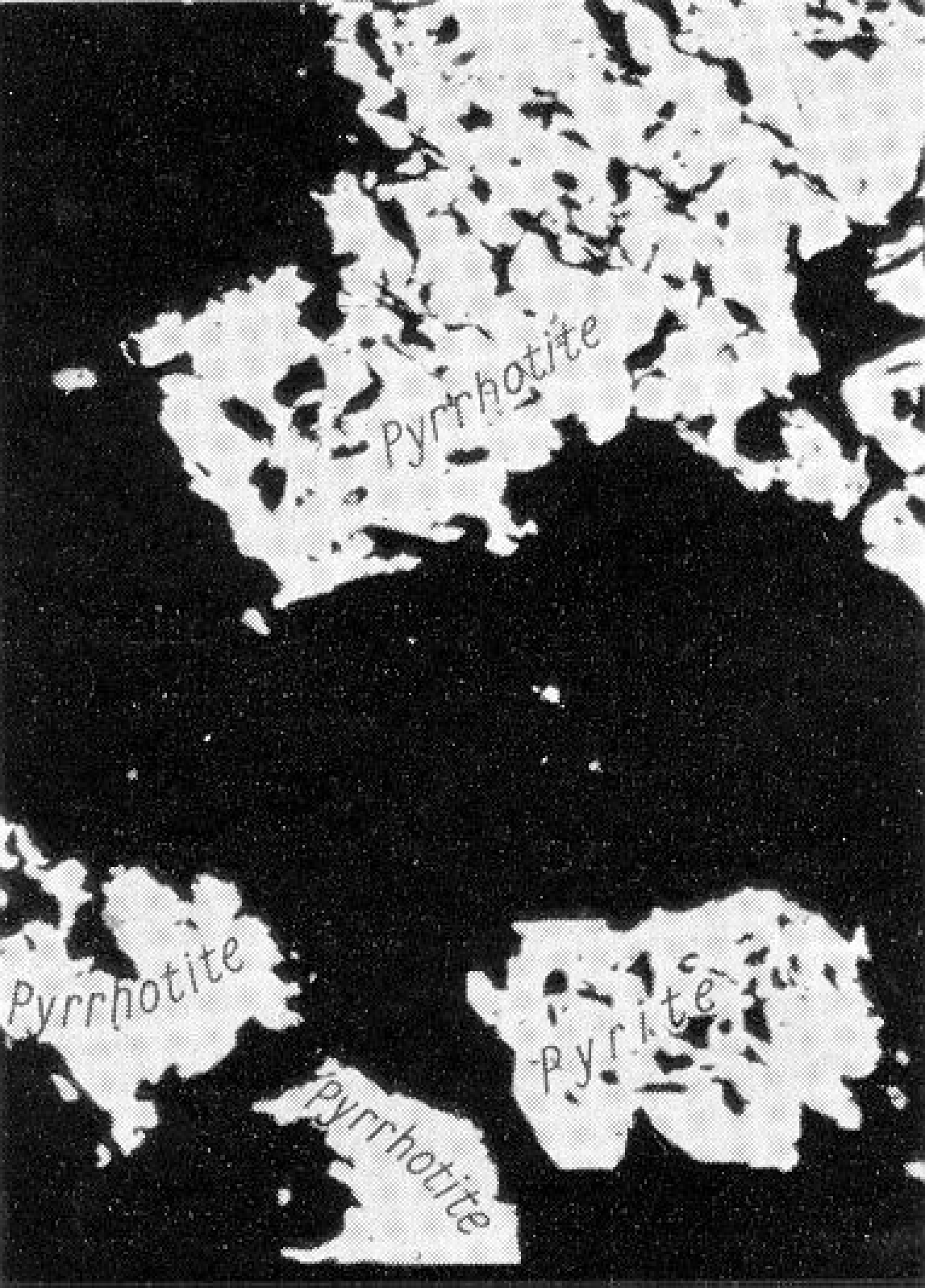


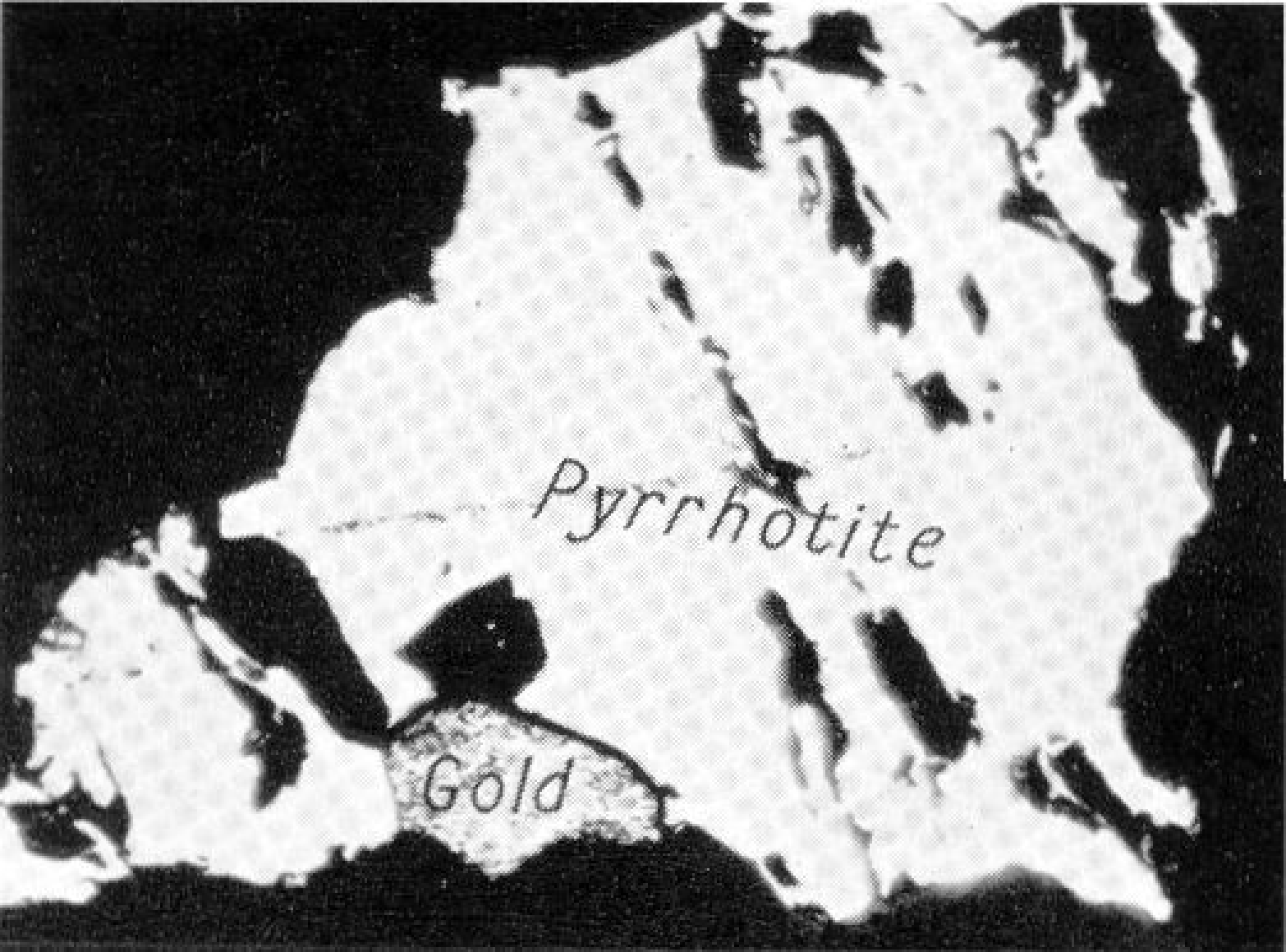






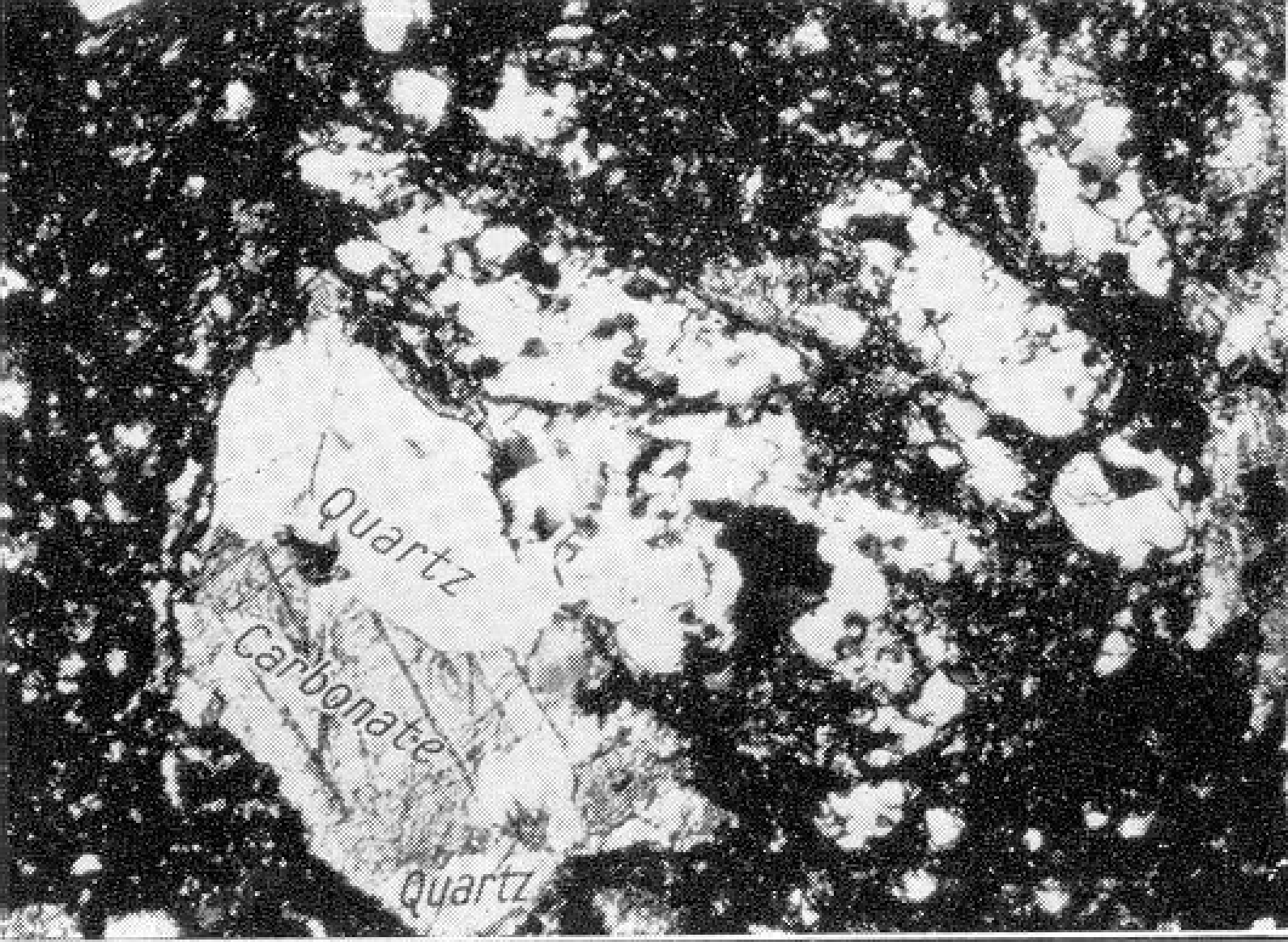


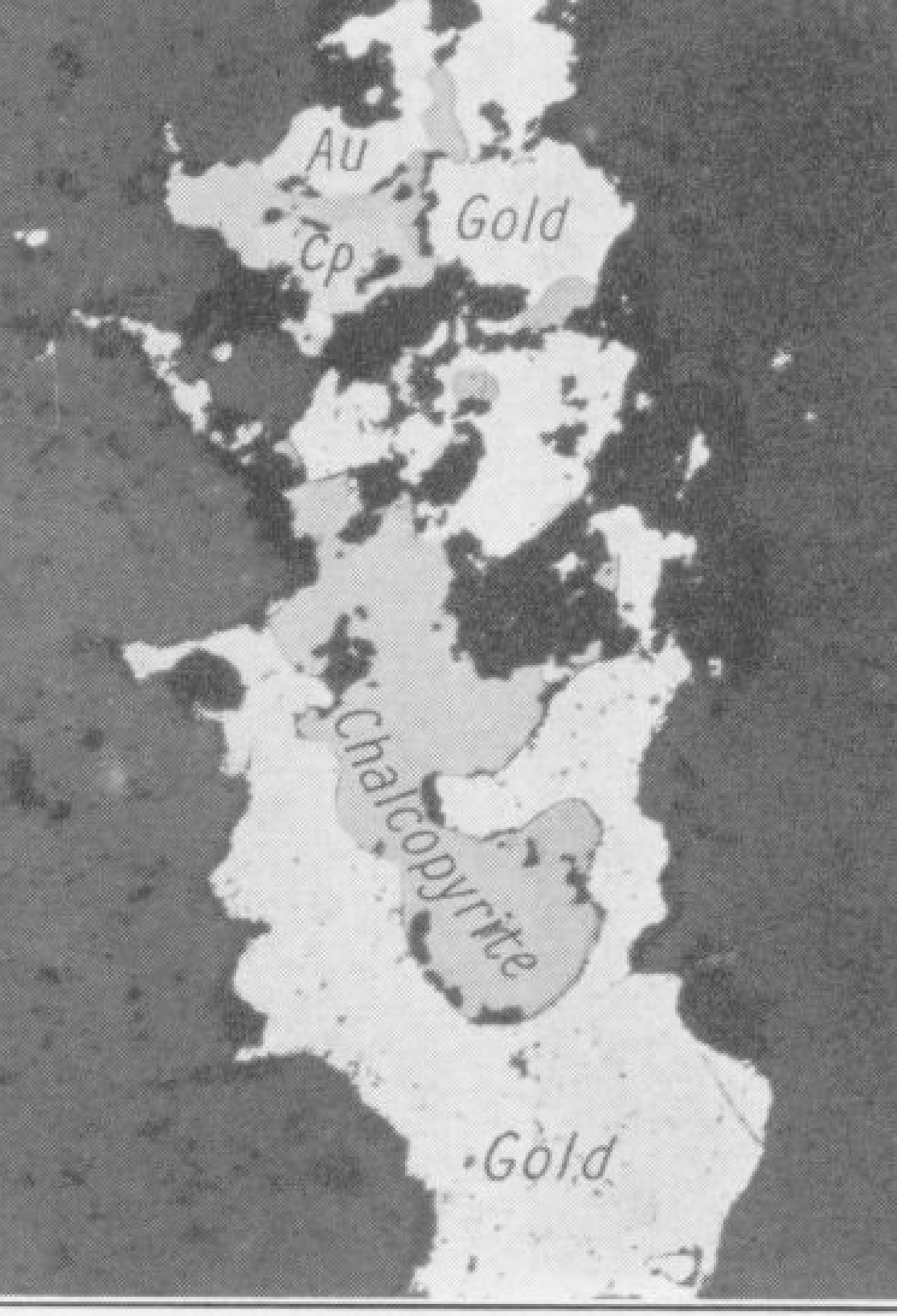

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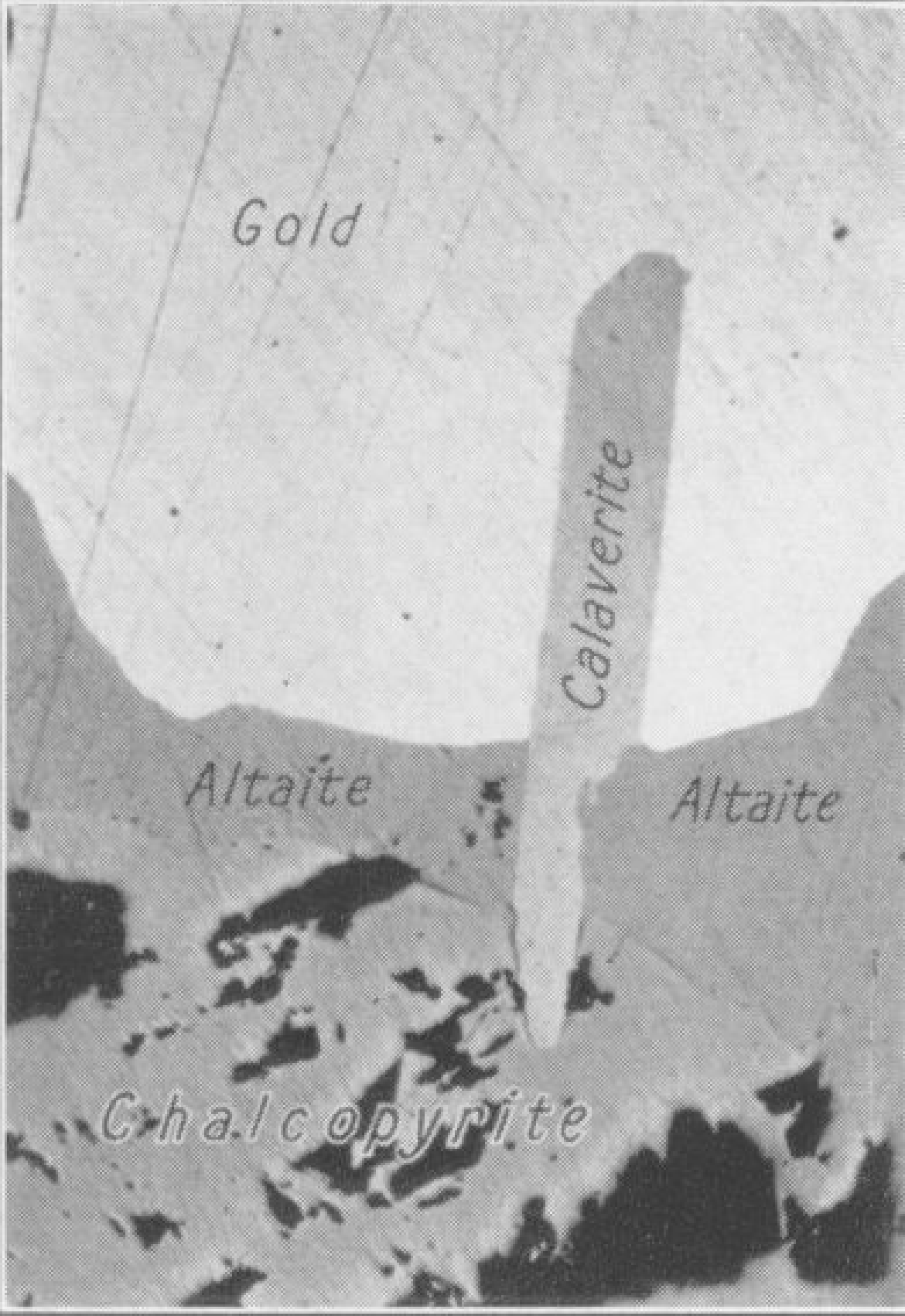

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Gold

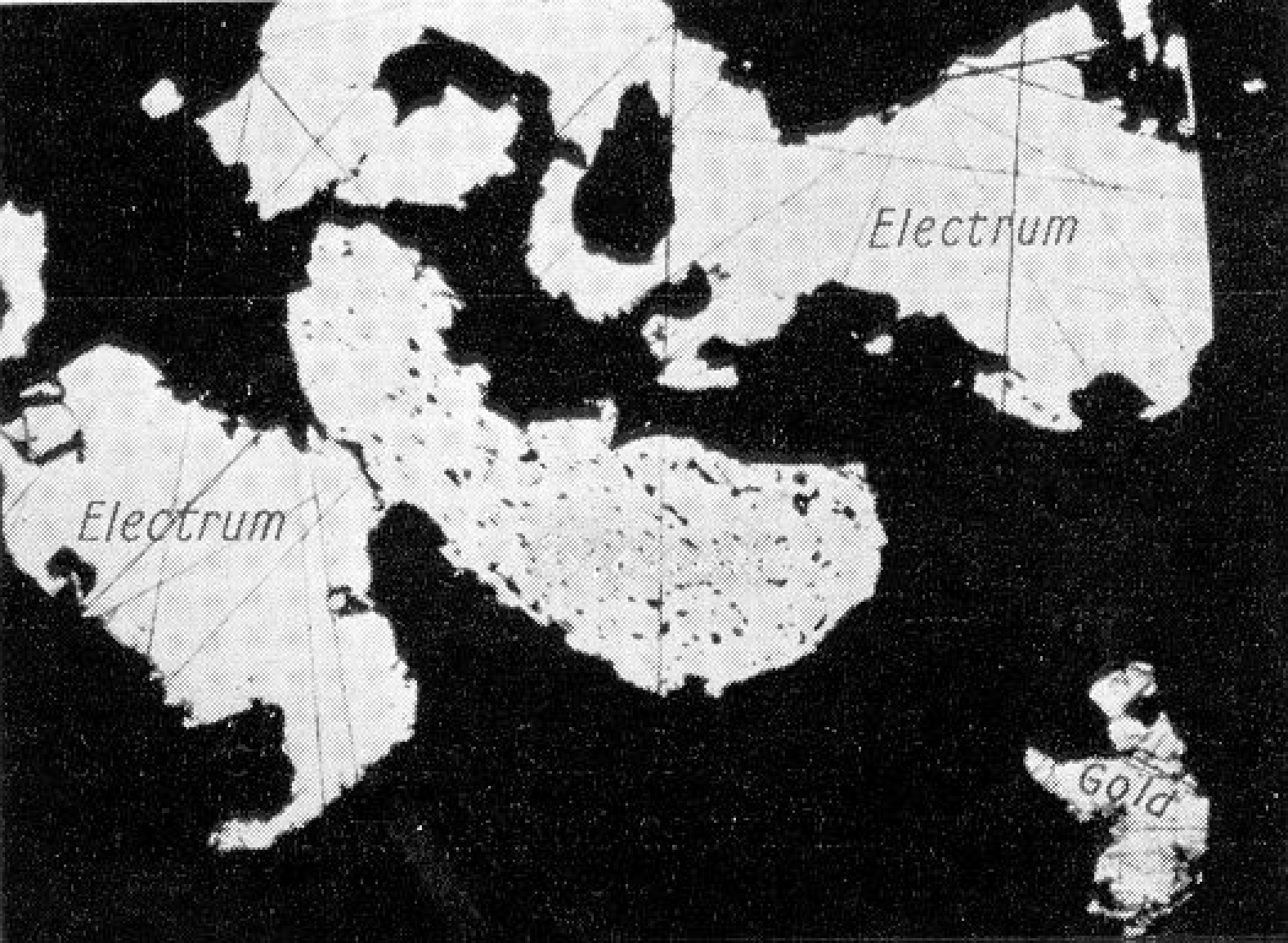



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Quartz
Carbonate
Quartz


Au
Cp
Gold
Chalcopyrite
Gold


Gold
Calaverite
Altaite
Altaite
Chalcopyrite


Electrum
Electrum
Gold



PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. ROBERT LAURIER, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FORTY-EIGHTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XLVIII, PART IX, 1939

Geology of the Windigo-North Caribou Lakes Area

By

J. SATTERLY

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COLOURED GEOLOGICAL MAPS

(In pocket at back of report)

Map No. 48h—North Caribou Lake Area, District of Kenora (Patricia Portion), Ontario. Scale, 1 mile to the inch.

Map No. 48j—Windigo Lake Area, District of Kenora (Patricia Portion), Ontario. Scale, 2 miles to the inch.

Geology of the Windigo-North Caribou Lakes Area

By J. Satterly

INTRODUCTION

During the field season of 1938 a geological reconnaissance was made of the Windigo–North Caribou Lakes area in the Patricia portion of the district of Kenora. The area mapped is covered by the western part of the North Spirit sheet (No. 53C) and parts of the southwest, northwest, and northeast quarters of the Windigo sheet (No. 53B) of the Topographical Survey of Canada. All the main water routes were travelled, but in the granite areas no attempt was made to traverse in the bush. All the larger belts of volcanics and sediments found, however, were traversed at approximately half-mile intervals. The contacts between the formations as shown on the accompanying maps are, therefore, based on river or shore geology and traverses, but owing to the extremely heavy overburden many of the contacts are assumed or approximate.

The season's mapping extended or amplified knowledge of previously known belts and showed for the first time a very large belt of volcanics and sediments designated in this report as the Weagamow-Eyapamikama-Opapimiskan Lakes belt.

No important discoveries have been made in the area, but as yet there has been no detailed prospecting.

Acknowledgments

The writer was assisted in the field by G. M. Robson, J. C. G. Moore, and C. Robertson, and is greatly indebted to these men for their untiring energy and enthusiasm at all times. G. M. Robson, as senior assistant, did independent work throughout the season and is responsible for the geological mapping of a large area west and southwest of Weagamow lake, including the belts of volcanics and sediments listed in this report as the Upper Windigo, Dawes Falls, and McCoy belts.

In 1937, T. J. C. Sandborn, Harry Sandborn, Charles Libert, and Albert Zeemel gave the writer sketch maps and other information concerning the belts of volcanics and sediments in the area, which considerably helped the field programme in 1938. During the 1938 season, C. H. and P. H. Riordon supplied further useful information. To Robert Auguston, Blake Young, Olson Mattson, and Karl Bayly the party is indebted for help, many courtesies, and hospitality. The writer expresses his thanks to all these men for their friendly co-operation and their interest in the field work.

Access and Canoe Routes

The area is most satisfactorily reached by airplane from some point on the Canadian National railway, such as Hudson or Sioux Lookout. Several air transportation companies have bases at these towns. The distance from Sioux Lookout to Windigo and North Caribou lakes is 175 and 200 miles, respectively.

By canoe, the area can be reached via Lac Seul, the Root river, Lake St. Joseph, the Cat river to Cat lake and Whitestone lake, the Kishikas river, and

thence to the MacDowell river. This trip would probably take two to three weeks. The more important canoe routes in the area are described below.

Weagamow Lake to North Caribou Lake

A well-travelled Indian route from Weagamow lake to North Caribou lake follows the North Caribou river via Seeseep lake. There are 7 short bouldery

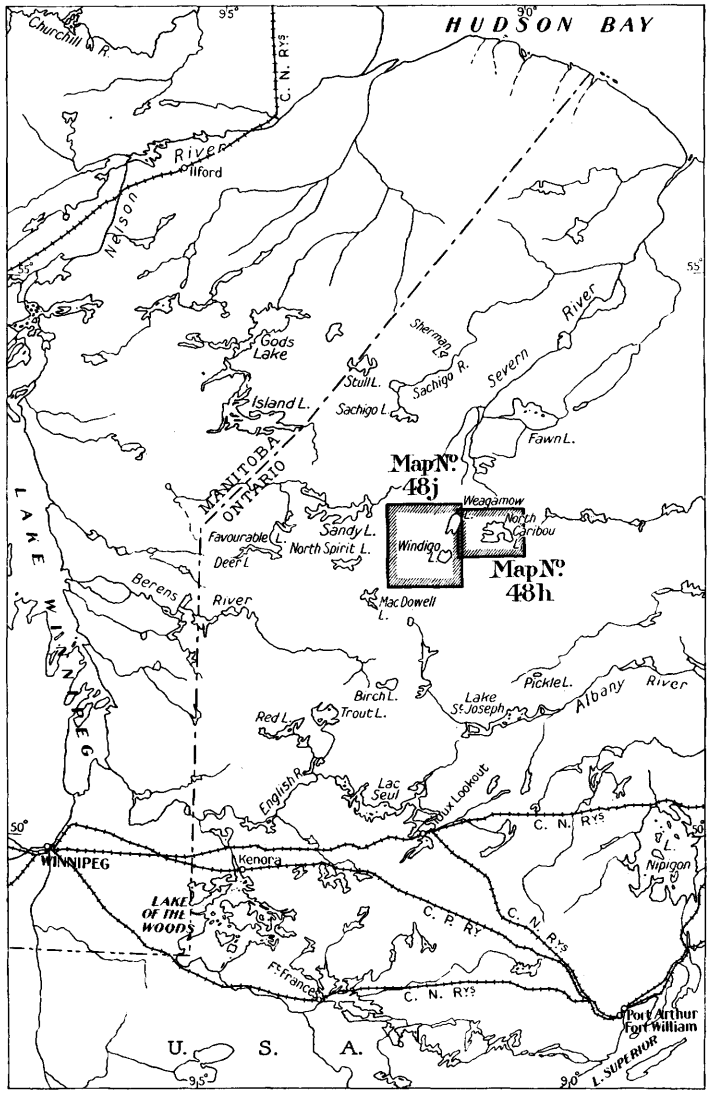


Fig. 1—Key map showing the location of the Windigo–North Caribou Lakes area. Scale, 120 miles to the inch.

rapids on the North Caribou river between Weagamow and Seeseep lakes. From Seeseep lake two routes may be used to reach North Caribou lake. That generally used by the Indians starts from the southwest bay of Seeseep lake, where a 20-chain portage crosses a neck of land to Hodgson lake. From this lake a second portage, 4½ chains in length, leads over a boulder ridge to North Caribou

lake. The alternative route follows the North Caribou river. This river empties into Seeseep lake near the eastern end of the south shore by a bouldery rapid, which may be portaged or lined up according to water conditions. Cemetery lake is then followed for 3 miles, at the end of which a 5-chain portage past another bouldery rapid leads to North Caribou lake.

North Caribou Lake to Skinner Lake via Opapimiskan Lake

An Indian route from North Caribou lake to Skinner lake starts from the south shore of the east bay of the inverted T-shaped lake expansion off the southeast end of North Caribou lake. Here a muskeg portage of 37 chains leads to a small lake, and from this lake a 38-chain portage takes one to a swampy stream. After paddling 15 chains east the traveller reaches Opapimiskan lake. Skinner lake is then reached by paddling down the Opapimiskan river. When used by



Hudson's Bay Company post at Cat lake. This is the administrative post for all outposts in the Windigo Lake area.

the writer in August, 1938, this stream, although narrow, had a good flow of water. There are 8 rapids between Opapimiskan and Skinner lakes, of which four entail portages.

North Caribou Lake to Skinner Lake via Wapuskeya Lake

The route to Skinner lake via Wapuskeya lake used by the Indians begins in a small bay on the east shore of North Caribou lake. It crosses a height-of-land to Atim lake and thence via Okow and Dinnick lakes to Wapuskeya lake. Wapuskeya lake drains by the Atim river to Skinner lake. There are 5 rapids on this river, and 2 of these entail portages.

Skinner Lake to Beaverhouse (Misamikwash) Lake

The route from Skinner lake to Beaverhouse lake was not travelled by the writer. The airplane map indicates that Skinner lake drains eastward by the Opapimiskan river to the Pipestone river. There are 5 rapids which, according

to information supplied by prospectors, must be portaged. On the Pipestone river between the junction of the Opapimiskan river and Beaverhouse lake there are reported to be 7 rapids, one group of 3 below Asinne lake requiring a 40-chain portage.

Opapimiskan Lake to Zeemel Lake and the Paseminon River

Zeemel lake may be reached from the south bay of Opapimiskan lake by two portages. The first climbs to a small lake, and the second crosses an old burned area to the west end of Zeemel lake.

The Indian route to the Paseminon river starts from the bay of Opapimiskan lake and requires two portages. The Paseminon river flows eastward into the Pipestone river just above the south end of Wastayanipi lake. The airplane map shows 4 rapids on this part of the Paseminon river.

Eyapamikama Lake

The eastern part of Eyapamikama lake may be reached by a narrow channel from the northeast corner of Seeseep lake; the west end of the lake, by a 42-chain portage from a small lake expansion on the North Caribou river between the second and third rapids above the Agutua arm of Weagamow lake. Two Indian routes to Makoop lake lead northward from Eyapamikama lake. One of these begins near the east end of Eyapamikama lake and crosses via a small lake to the south bay of Schade lake. It is believed that Schade lake represents the headwaters of the drainage to Makoop lake. The other route starts from the north shore of Eyapamikama lake and leads via Stanley lake to a bay of De Blicquy lake, which is part of the Schade river.

Cat Lake to Weagamow Lake

A canoe route north from Cat lake passes through Whitestone, Nemebina (Sucker), Kishikas (Big Cedar), Pakhoan (Little Cedar), Shinbone, and Upper Windigo lakes to Windigo lake. One rapid occurs on the river between Upper Windigo and Windigo lakes. From the northeast shore of the latter lake the Shewunegum portage, 3¼ miles in length, leads to Agutua lake, which drains northward by the Agutua river. Between Agutua lake and Wapikiskapika lake there are 9 rapids, 8 of which entail portages. Weagamow lake may be reached from Wapikiskapika lake by a 42-chain portage from the northwest shore or via the Agutua arm. Tyrrell travelled this route in the reverse direction in 1912 and describes it in his report.[1]

An alternative route to the above begins on the Kishikas river at a point between the second and third rapids above Francis lake, where an Indian route goes eastward. It is reported to have three portages between small lakes, and the route then follows a stream to Upper Windigo lake.

The Kishikas River via the MacDowell River to Nikip Lake

From Greenshields lake on the Kishikas river the traveller may go downstream passing 6 rapids and then leave the Kishikas river and by 2 portages, 28 and 60 chains in length, reach Kinasao (Fish) lake. This lake drains into Ochek (Fisher) lake, an expansion of the MacDowell river. The MacDowell river flows into the Windigo river, which empties into Nikip lake and has 24 rapids, most of which must be portaged. The portages are all good, and the route appears to be well travelled.

[1] J. B. Tyrrell, Ont. Bur. Mines, Vol. XXII, 1913, pt. 1, pp. 169-171.

The Kishikas River

The Kishikas river is not frequently travelled below Francis lake, for only 5 portages were found although there are 44 rapids, many of which can be run with suitable water conditions.

MacDowell Lake

MacDowell lake may be reached by ascending MacDowell river. Above Ochek lake there are 2 portages 15 and 57 chains in length. A route through MacDowell lake to North Spirit lake has been described by Bateman.[1] There is reported to be a route from McCoy lake, to North Spirit lake, but no definite information regarding it was obtained.

Windigo Lake to the MacDowell River

The route from Windigo lake to the MacDowell river follows the Windigo river to the point just above Dawes falls where the MacDowell joins it. There are 25 rapids entailing 17 portages along this route.

Previous Geological Work

Little geological mapping had been carried out in the area prior to 1938. Camsell[2] mapped and described the water route from Cat lake north to the Kishikas river and the Windigo river almost to Nikip lake. A belt of volcanics passing through Dawes falls is briefly described.[3]

J. B. Tyrrell[4] on the Hudson Bay exploring expedition crossed the area. In the map accompanying his report Tyrrell indicates a belt of volcanics on Upper Windigo lake and granite between Windigo and Weagamow lakes.[5] As his Indians took him over the portage into the south end of Weagamow lake, rather than past the mouth of the North Caribou river, the belt of volcanics that extends many miles to the east was not seen.

Bibliography

The list below also includes works dealing with the territory close to the area:—

J. D. BATEMAN, "Geology of the North Spirit Lake Area," Ont. Dept. Mines, Vol. XLVII, 1938, pt. 7.

CHAS. CAMSELL, "Country around the Headwaters of the Severn River," Geol. Surv. Can., Vol. XVI, 1904, pt. A, pp. 143-150.

W. G. MILLER, "Reports on the District of Patricia," Ont. Bur. Mines, Vol. XXI, 1912, pt. 2.

J. SATTERLY, "Geology of the Sandy Lake Area," Ont. Dept. Mines, Vol. XLVII, 1938, pt. 7.

J. B. TYRRELL, "Hudson Bay Exploring Expedition, 1912," Ont. Bur. Mines, Vol. XXII, 1913, pt. 1, pp. 161-209.

Topography and Drainage

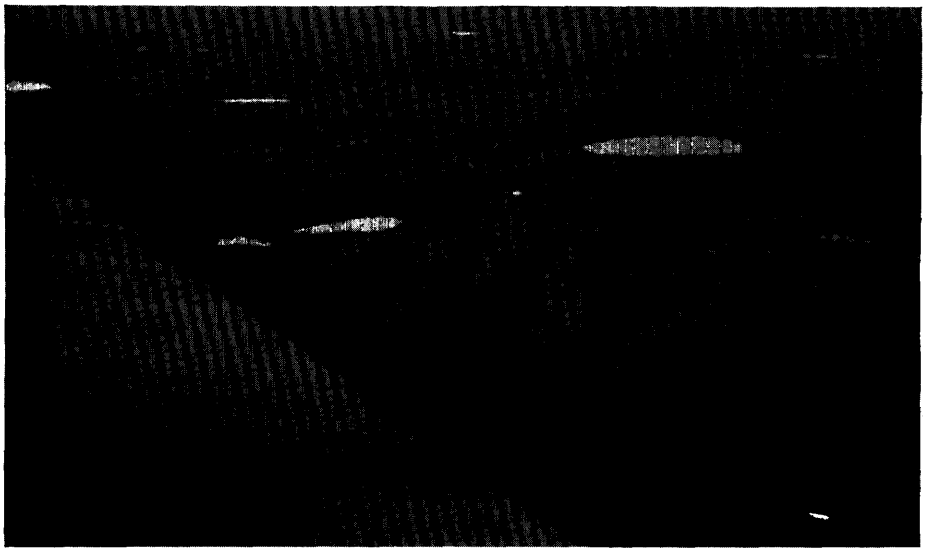
The area lies wholly within the pre-Cambrian shield and displays many of the features so characteristic of that physiographic province. The country is flat or gently rolling with many low hills composed of materials of glacial origin. In some localities boulder ridges form prominent features of the landscape, rising to heights of 300 to 400 feet above the general level. These ridges occur to the east of Windigo lake and east and south of Upper Windigo lake. Morainal hills from 50 to 200 feet in height occur between Opapimiskan and Zeemel lakes. The

[1]J. D. Bateman, Ont. Dept. Mines, Vol. XLVII, 1938, pt. 7, p. 46.
[2]Chas. Camsell, Geol. Surv. Can., Vol. XVI, 1904, pt. A, pp. 143-150.
[3]Chas. Camsell, op. cit., p. 148.
[4]J. B. Tyrrell, op. cit., pp. 161-209.
[5]Ibid, "Map Showing Route of the Nelson River Exploring Expedition."

writer observed from an airplane what appears to be typical kettle topography south of Upper Windigo lake. Between the low hills or ridges the country is mainly swamp, much of it being spruce or tamarac muskeg.

Owing to the heavy mantle of glacial debris few outcrops rise to great heights. A few prominent hills of the volcanics and sediments occur along the north shore of Upper Windigo lake, but a short distance from the shore the outcrops are flat and occur in low ground.

In the Weagamow-Eyapamikama-Opapimiskan Lakes belt of volcanics and sediments the metamorphosed pillow lavas forming the borders of the belt make elongate ridges at a number of localities. The hills of the north band of volcanics are on Atikomik lake, and along the south shore of Capella lake extending east-



Aerial view of kettle topography south of Upper Windigo lake.

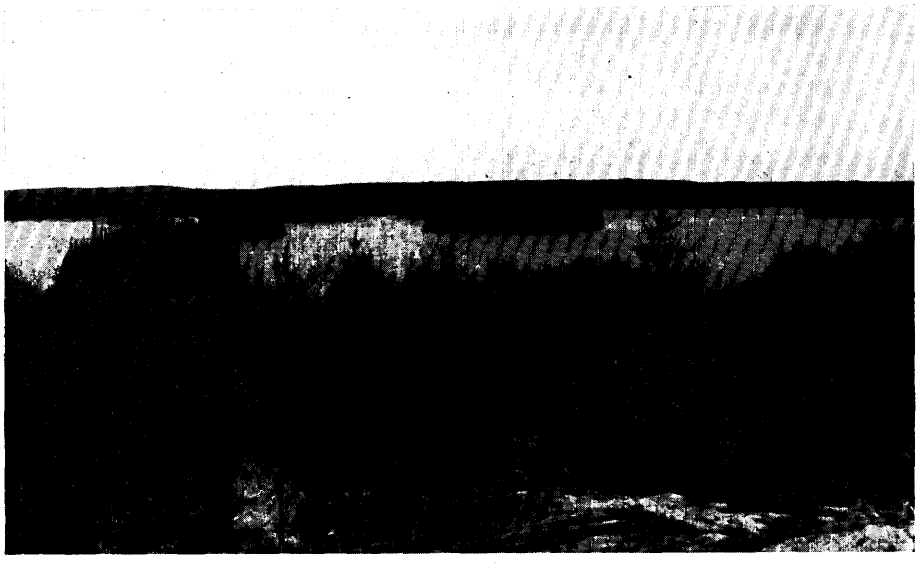
ward for 6 miles, where they rise 200 feet above the general level. South of Schade lake, bare burnt hills rise 100 feet above the lake level. In the south band of volcanics a 200-foot ridge lies just northwest of and parallel to Randall lake. A burnt ridge of pillow lava forms a 75-foot hill on the northeast shore of Opapimiskan lake.

Most of the mapped area drains northward by the Windigo river into the Severn river and so to Hudson bay. The MacDowell river in its journey from MacDowell lake to the Windigo river is joined from the west by the McCoy river from McCoy lake and enters the Windigo river above Dawes falls at approximately latitude 52° 45'N. The Windigo river, which drains Upper Windigo and Windigo lakes, has one other tributary, the Kishikas river, which rises close to latitude 52°N. Nipik lake also receives large supplies of water from Magiss, Senia, Opakopa, and Weagamow lakes; Weagamow lake in its turn receives, via the Agutua arm, the waters of those lakes drained by the North Caribou river, namely Seeseep, Eyapamikama, and North Caribou. North of Nipik lake the Windigo river flows through the lake expansion Sakwaso.

The eastern and southeastern part of the area drains into the Pipestone river, which becomes the Winisk river below Beaverhouse lake. The chief tributaries

of the Pipestone river within the area are the Paseminon river, on which are Libert and Zeemel lakes, and the Opapimiskan river draining Opapimiskan and Skinner lakes. Skinner lake receives its water by the Atim river from Atim, Okow, Dinnick, and Wapuskeya lakes.

Despite the widespread distribution of the glacial overburden, which in places is heavy, a large number of the lakes have shore lines obviously shaped through the influence of the underlying rock structure. In the belts of sediments and volcanics this is very apparent. The long axis of Eyapamikama lake is approximately the axis of a syncline trending nearly east and west. A number of small lakes to the north of Eyapamikama lake lie on or parallel to geological contacts. This is also true of the small elongate lakes to the north of Opapimis-



View looking north over Capella lake from the greenstone hills to the south. Notice the even sky-line typical of the pre-Cambrian shield. In the foreground is thick second-growth of small jackpine and birch. The islands in the lake have not been burnt and are forested with spruce.

kan lake. Parts of the channel of the North Caribou river parallel the strike of the volcanics.

Randall lake lies along the contact between the volcanics and the granite, and a group of small elongate lakes to the northeast of it lie parallel to or are at geological contacts.

Lakes in the granite areas exhibit the characteristic rounded shape and irregular shore line. Such lakes are Windigo, Weagamow, Opakopa, Magiss, Senia, Nikip, Petownikip, and Sakwaso. Owing to the heavy overburden many of these lakes have smooth stretches of shore line, which are underlain by clay, sand, or boulders or which are swampy. North Caribou lake has the typical granite shore line where this rock outcrops, but the northern half of the lake represents a submerged drumlin area and consists of long points and bays with numerous rounded elongate islands, all oriented parallel to the direction of glacial movement, namely S. 45° W.

Below are listed the heights of some of the lakes in the area. The information is derived by estimating the amount of fall of the rapids or by the use of the

aneroid barometer and is based on an assumed altitude of Weagamow lake as 1,100 feet above sea-level, which is believed to be approximately correct.

	Feet
Weagamow lake	1,100
Seeseep	1,135
Eyapamikama	1,135
Schade	1,195
North Caribou	1,140
Atim	1,150
Okow	1,140
Dinnick	1,135
Wapuskeya	1,110
Skinner	1,090
Opapimiskan	1,135

On the North Spirit Lake sheet (No. 53C) of the Topographical Survey of Canada, altitudes of the following lakes are shown:—

	Feet
Petownikip lake	1,015
Pakhoan	1,200

As Nikip and Sakwaso lakes are lake bodies joined to Petownikip lake, their altitudes are therefore also 1,015 feet above sea-level.

The amount of rock outcrop in the area varies, but remarks regarding the distribution of the outcrops will be confined to the belts of volcanics and sediments. Throughout the entire length of the Weagamow-Eyapamikama-Opapimiskan Lakes belt the sediments are exposed sparingly, most of the outcrops being along or close to the sediments-volcanics contact or occasionally along the lake shore. The volcanics outcrop frequently along the north border of the belt and form the high ridges mentioned above, but in the south band of volcanics outcrops are fewer except to the northwest of Randall lake, where they form a conspicuous ridge. Heavy overburden extends south-southeast from Eyapamikama to Okow lake, and exposures are believed to be very scarce in this section. North of Opapimiskan lake outcrops are fairly numerous, but south of the lake to and on Zeemel lake they are rare owing to glacial deposits.

In the Dawes Falls belt of volcanics outcrops occur sparingly east from Dawes falls on the Windigo river. West of the falls near the river they are also few in number but fairly abundant from 4 to 5 miles north of the river. Seven miles west of the falls, the course of the MacDowell river is north, and outcrops are common just west of this part.

The Upper Windigo Lake belt and its continuation to the west has scattered outcrops, but much of the country is low and swampy.

Natural Resources

Climate

The summer of 1938 was the wettest the writer has experienced in three years of geological mapping in the Patricia portion of the district of Kenora. The party was in the field from June 3 to September 20, and rain fell on 60 out of the 110 days, distributed by months as follows: June, 15; July, 19; August, 21; and September, 5.

Agriculture

Owing to the bouldery nature of much of the glacial overburden, most of the area is quite unsuited to agricultural development. The Indians and traders maintain small gardens for their own needs. Potatoes were seen growing on a

small island in Windigo lake, and it is reported that the Indian chief on Windigo lake used to maintain a fair-sized garden on the river between Upper Windigo and Windigo lakes some years ago. Robert Auguston, a free trader, was growing potatoes on Weagamow lake. These were planted about July 1, blossomed at the end of that month, and were ready to dig by September 20. Olson Mattson on MacDowell lake dug potatoes on August 30 which had been planted about the end of June.

Wild berries are plentiful in some sections during August and September and include saskatoons, blueberries, and raspberries.

Forests

The forest consists of spruce, balsam, poplar, birch, and jackpine, their distribution being dependent on the age of the forest, the kind of subsoil, and



Pillow lava outcrops and glacial debris in recently burnt country east of McGruer lake.

the amount of water. Practically the whole region has been burnt over at various times, and all stages may be seen from the complete removal of forest and soil to the different stages of second growth. Many of the burnt areas are confined to the higher ground, the swamps and muskegs being still green bush. A burnt area with bad windfall was encountered north of the MacDowell river west of Dawes falls.

A recently burnt section exposing bare rock or sand and boulders extends for 15 miles west from the east end of Schade lake in a belt parallel to and north of Eyapamikama lake.

Stands of large trees are not common. A forest of jackpine, birch, and poplar with trunk diameters of 6 to 10 inches occurs south of Keeyask lake. The bark on the birch trees in this forest is used by the Indians for making their canoes. A good stand of spruce and jackpine timber occurs between Opapimiskan and Zeemel lakes.

Water Powers

Owing to the general flatness of the area the rivers, despite the large number of bouldery rapids, have no great fall at any one locality, the average being about 5 feet. A notable exception is Dawes falls, which has a drop of 12 feet. At this point the waters of the Windigo, Kishikas, McCoy, and MacDowell rivers flow over a hornblende schist and no doubt could be harnessed for power development if required. None of the rapids seen on the North Caribou, Windigo, Kishikas, or MacDowell rivers above Dawes falls have sufficient height to be of any value for power development.

As noted previously, the year 1938 is believed to have been particularly wet, and lake levels were well maintained. The water level in Weagamow lake dropped only half a foot between August 4 and September 20.



Indian women and children at the village on North Caribou lake.

Fish and Game

The lakes and rivers abound with pike, pickerel, and whitefish. Sturgeon are reported to be plentiful in the Windigo river below Dawes falls and in Nikip lake. Ducks, though not scarce, would doubtless be more common still but for the food requirements of the Indians.

Fur-bearing animals were not seen in any numbers by members of the party, but bear, moose, otter, and muskrat were observed. Trappers, however, state that fisher are abundant north of Nipik and Magiss lakes, and red, cross, and silver fox, beaver, martin, mink, and muskrat in the surrounding country. Caribou are reported to be numerous in the winter season.

Inhabitants

Indians constitute the only large group of people in the region. The tribe is a mixture of Ojibway, Cree, and Saulteaux stock and speak a language that varies even locally. Practically none speaks any English. These Indians live on Windigo, Weagamow, and North Caribou lakes and belong to the North

Caribou Lake band. The chief of this band is Senia Sakchekpow, and the two councillors are Samuel Sawanis and John Quequeish. There are in the band 61 families, comprising 44 men, 54 women, 51 boys, and 61 girls, a total of 210 Indians.[1]

The band were taken into treaty on July 18, 1930, on the Windigo river, when what is known as Treaty No. 9 was extended northward to cover the whole of the Patricia portion of the district of Kenora.[2]

It is stated that the band asked, at that time, to have their reserve laid out on the south shore of North Caribou lake. Under the terms of Treaty No. 9 they are entitled to a reserve of an area sufficient to provide 128 acres per head. This reserve was surveyed during the summer of 1938. The boundary line runs 4.4 miles south from observation station No. 6 of the Topographical Survey on the south shore of North Caribou lake, east 8.1 miles, north 5.7 miles to the south shore of North Caribou lake, and west by the south shore of the lake to the observation station.

Few permanent white inhabitants live in the area. The Hudson's Bay Company maintains outposts on Windigo, Weagamow, and North Caribou lakes, which are managed by Indians under the supervision of I. W. McCauley, manager of the Cat Lake post.

Three free traders have posts in the area, that of Blake Young being on Ochek lake on the MacDowell river, that of Robert Auguston on the northeast shore of Weagamow lake, and that of Karl Bayly at the abandoned Indian village on Nikip lake.

GENERAL GEOLOGY

The bed rock of the area is entirely pre-Cambrian in age and is overlain by a mantle of Pleistocene unconsolidated deposits of glacial or glacio-fluviatile origin. These deposits vary from thin to very thick, and the mantle in places completely masks the distribution of the underlying rock formations.

The oldest rocks are a group of volcanics overlain by a group of sediments, both of which have been so extensively metamorphosed that the original structures are frequently obliterated. The volcanics are considered, on lithological characteristics, to be of the Keewatin type, and the sediments from their relationship to the volcanics and the character of the basal conglomerate to be the equivalent of the Timiskaming type. The sedimentary belts contain sills of a basic intrusive. These older groups lie in or are cut by granite and granite gneiss, tentatively called Algoman(?). The youngest rocks in the area, the dikes of diabase, are similar to the types found elsewhere in the shield and known to be Keweenawan in age.

The volcanics and sediments occur in tightly folded synclinal belts within granite or granite gneiss. These belts may be listed for convenience as follows: (1) Upper Windigo Lake, (2) Dawes Falls, (3) Weagamow-Eyapamikama-Opapimiskan Lakes, and (4) McCoy Lake.

Rock types of great similarity were encountered in the first three belts.

Table of Formations

RECENT:	Peat, beach deposits, river deposits.
PLEISTOCENE:	Boulder clay, silt, sand, gravel, boulders.

[1]Private communication from the Indian Affairs Branch, Dept. Mines and Resources, Ottawa.

[2]"The James Bay Treaty, Treaty No. 9" (1931), Ottawa, pp. 29, 30, 34.

Great unconformity

PRE-CAMBRIAN

KEWEENAWAN(?): Diabase and basalt dikes.

ALGOMAN(?): Porphyry, felsite.
Pegmatite, aplite.
Pink granite.
Grey biotite granite, in part gneissic.
Diorite.

Intrusive contact

POST-TIMISKAMING, PRE-ALGOMAN(?): Gabbro-diorite.

Intrusive contact

TIMISKAMING TYPE: Conglomerate, arkose, quartzite, greywacke, slate; biotite, garnet, andalusite, cordierite schist or gneiss.

Great unconformity, but no discordance

KEEWATIN TYPE: Andesite, pillow lava, basalt, acid lava, quartz porphyry, pyroclastics, gabbro-diorite, amphibolite, hornblende schist, chlorite schist, serpentinized greenstone, carbonate-talc schist, iron formation, sediments.

Keewatin Type

Intermediate and Basic Lavas

The greater part of the volcanic assemblage is composed of a fine-grained, pale- to dark-green rock, which for the purposes of this report is called andesite, although much of it if chemically analysed might prove to be more basic. The term basalt is applied to fine-grained, light- to dark-grey rocks with a specific gravity of 3.00. Many of the lavas exhibit pillow structures, which in most localities are deformed. Well-preserved pillow lavas are exposed in the burnt outcrops just northeast of McGruer lake, north of Eyapamikama lake. Here, the pillows range in size from 4 by 8 inches to a maximum of 1 by 8 feet. These pillows have vesicular centres. Other exposures of good pillow lava occur on the channel between Eyapamikama and Seeseep lakes, on Doubtful lake, and on Upper Windigo lake. Elsewhere all stages of deformation may be seen and many outcrops show a ribbed structure, the ribs representing the selvages of the pillows. A similar type of deformation was seen in the Sandy Lake area and the resemblance to bedded tuffs noted.[1] Where a succession of flows could be observed it was found that owing to the extreme metamorphism there was no evidence of chilled contacts or brecciated tops. The alternation of medium- to coarse-grained amphibolite with ribbed rocks, originally pillow lavas, suggests, however, that the amphibolite was once a coarse phase of the interior of a flow and that the combination of the two rock types represents a single flow. South of Schade lake there appear to be a very large number of flows now upturned with steep dips to the south.

Epidote segregations are not uncommon in these lavas, masses with a maximum size of 3 by 12 inches being observed in outcrops 2 miles east of McGruer lake.

Basalts occur interbedded with the andesites on the North Caribou river and on the Agutua arm of Weagamow lake. They are typically light- to dark-grey, chert-like rocks similar to the type seen on Sandy lake,[2] an analysis of which appears in the report on that area.

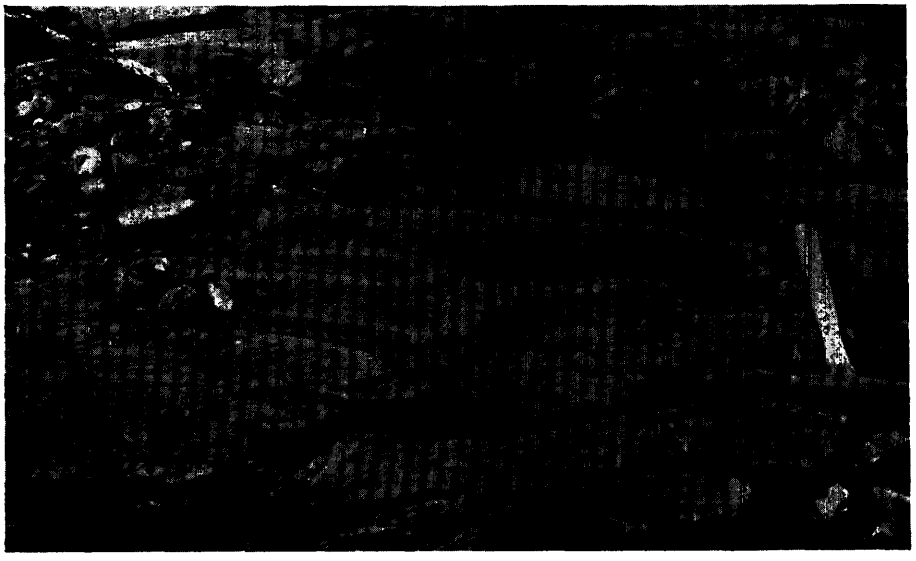
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[1]J. Satterly, Ont. Dept. Mines, Vol. XLVII, 1938, pt. 7, p. 11.
[2]Ibid, pp. 11, 12.

Acid Lavas

Acid lavas outcrop sparingly. They form no large areas and occur as narrow interbeds in the intermediate and basic lavas. The rocks weather to cream or buff, are very fine grained, and usually quite schistose. They were found south of Erichsen lake, at a few localities north of Eyapamikama lake, and northeast of Randall lake.

Pale, light-green lavas mapped as andesite should, perhaps, be included here. Such lavas form part of the south band of the Eyapamikama belt and outcrop just north of, and parallel to, the north shore of Seeseep lake. They are also exposed on the Agutua arm of Weagamow lake.



Pillow lava east of McGruer lake. The pillow extending to the left of the hammer shows a well-defined selvage and vesicular interior. The camera was facing south, and the shape of the pillow shows that tops are to the south.

Quartz Porphyry

Highly sheared, frequently carbonatized, fine-grained rocks with small quartz eyes occur interbedded with the volcanics at a number of localities on or near the North Caribou river. It is not known whether these quartz porphyries are intrusive or extrusive in origin.

Pyroclastics

Breccias outcrop sparingly and were found only on the Agutua arm of Weagamow lake and the North Caribou river.

On the south shore of the North Caribou river just west of the fifth rapids above Agutua arm, a breccia occurs as an interbed in a grey basalt. It consists of small, angular, green, fine-grained andesite(?) fragments in a cream-coloured, fine-grained acid volcanic matrix.

A reef just above the first rapids on the North Caribou river is a breccia composed of minute to 3-inch rounded fragments of a cream-weathering, grey, very fine grained acid volcanic in a green groundmass of andesitic composition. Somewhat similar types occur on the Agutua arm. One outcrops on an island

just below the above-mentioned rapids, and the other on the east shore about a quarter of a mile north northeast of the rapids.

Breccias outcrop at two other localities in the northern part of the Agutua arm. One occurs at the extreme north end of the arm, where an islet exposes a dark-grey basalt breccia with the angular fragments ranging from a quarter of an inch to 2 inches in width, although one, triangular in form, measures 3 inches across its widest diameter and 12 inches in length. Interbedded with this breccia is a 3-foot sill of black basalt striking N. 85° E., with a vertical dip. The other exposure is at the Indian encampment on the point near the outlet of the Agutua arm about one mile northwest of the first rapids on the North Caribou river. Here 1- to 3-inch angular fragments of a white-weathering, fine-grained acid volcanic lie in a matrix of andesitic composition.

From the general angular nature of the fragments it is believed that all the above rock types are agglomerates, though those containing rounded fragments may be volcanic conglomerates.

Basic Intrusives

The gabbro-diorites assigned to this group are very similar to those known to be post-Timiskaming in age. Where such rocks were found in the assemblage of volcanics it was not possible to secure evidence from which their age relations might be determined. It is possible all of them are post-Timiskaming in age. The gabbro-diorites are fine- to medium-grained, dark-green rocks, usually massive in texture. Their origin in many cases remains in doubt, and they may represent the coarse phases of a lava flow or metamorphosed basic lavas, or they may be sill-like intrusives. They seem to outcrop most abundantly around and on the Agutua arm, on the North Caribou river and south of it, at a few localities in the Dawes Falls volcanic belt, and on the southwest shore of Upper Windigo lake.

Metamorphosed Equivalents

As has been noted under the basic and intermediate lavas, many of the flows through deformation and metamorphism have been altered to amphibolite. Much of the amphibolite is foliated, and all gradations are found between massive amphibolite and hornblende schist. Amphibolite is an abundant rock type in all the belts of volcanics. As mentioned earlier in the report some appear to represent metamorphosed coarse portions of flows. All may not, however, be of this origin; some may have been originally basic intrusives. Garnet amphibolite was observed just northeast of Opapimiskan lake and east of McGruer lake.

Where the flows have been greatly sheared chlorite schist has developed. One such locality is on the MacDowell river 7 miles west of Dawes falls. Massive rocks outcrop east and west of the river, which here flows almost due north. Thus it would appear that the river follows a north-south shear zone in the volcanics.

Serpentinized greenstone was seen at one locality between Randall lake and the Agutua arm of Weagamow lake and another on the Agutua arm northeast of the narrows leading to Wapikiskapika lake. The rock is very dark green in colour, massive, and has a brown, deeply weathered surface. The outcrop at the first locality appears to lie between two tongues of diorite, and it is assumed that the diorite magma is responsible for the serpentinization.

Carbonate-talc schist occurs on a small island in the southern part of the Agutua arm of Weagamow lake, and forms two outcrops lying to the west of the winter trail from the Agutua arm. The rock weathers light-grey and is very soft and highly sheared. Its origin is in some doubt. The west contact of a

granite tongue, largely covered by the waters of the Agutua arm, lies three-quarters of a mile to the east of the outcrops described. The island outcrop is considered to be just south of the granite tongue. Both these occurrences are believed to be due to hydrothermal alteration by this granite stock.

Iron Formation

Little of the widespread local magnetic attraction can be definitely assigned to the influence of iron formation, as outcrops of this rock type are confined to a few localities south of Opapimiskan lake, on Upper Windigo lake, and northeast of Dawes falls.

South of Opapimiskan lake iron formation occurs as interbeds in the volcanics. The bands range from 50 to 100 feet in width and consist of blue-grey, banded, magnetite rocks or interbanded buff quartzose and magnetite bands ranging from paper-thin to one-quarter of an inch in thickness. The rocks are locally drag-folded. When studied in thin section under the microscope the magnetite bands are found to consist of a mosaic of magnetite and quartz, and the buff bands of an aggregate of tremolite and quartz.

The other occurrences of iron formation are narrow, being less than 10 feet in thickness.

Sediments

Throughout the belts of volcanics, narrow interbeds of sediments are found. The beds usually range from 5 to 15 feet in thickness, but northeast of Randall lake a maximum width of nearly 150 feet was seen. There is a wide range of types, but an impure quartzite is the most common variety. Other rock types noted are conglomerate, greywacke, biotite schist, and garnet-biotite schist. On the North Caribou river at the fifth rapids above the Agutua arm, Weagamow lake, a banded green quartzite forms an interbed in schistose volcanics. This rock type occurs as pebbles in the Timiskaming-type conglomerate.

Timiskaming Type

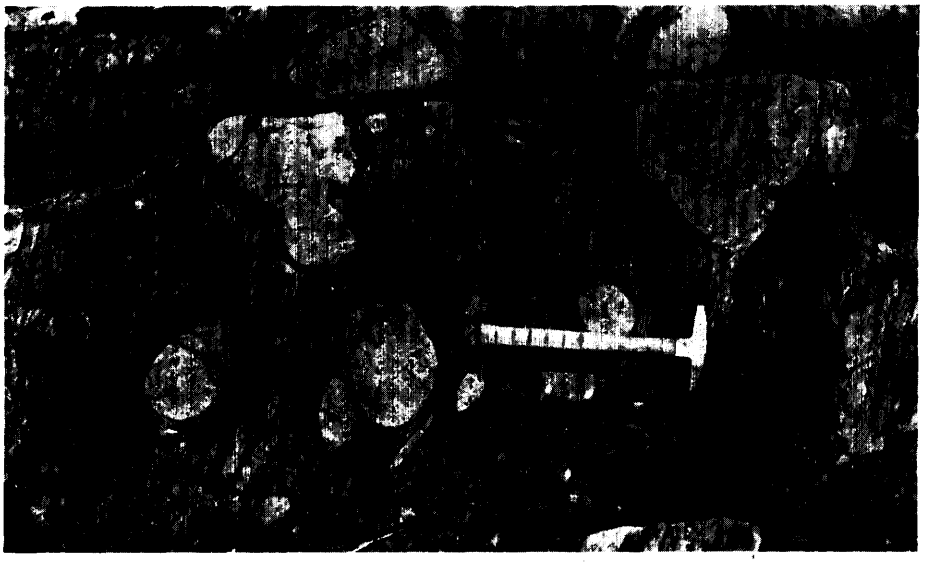
In the Weagamow-Eyapamikama-Opapimiskan Lakes belt the sediments considered to be of Timiskaming type overlie the Keewatin-type volcanics and consist of a lenticular basal conglomerate, overlain by interbedded quartzite, arkose, and greywacke, with slate forming the uppermost member of this series. The slates outcrop in the centre of a syncline.

At the top of the volcanic series and lying between them and the sediments proper there is a narrow band of sediments, which appear to form a transition series between the processes of vulcanism and sedimentation. They are finely banded sediments consisting of alternating layers of hornblende-rich and quartz-rich material, and may be termed impure quartzites. These sediments outcrop at a number of localities along the contact between the volcanics and sediments north of Eyapamikama lake. Usually these so-called transition sediments are 10 feet or less in thickness, but south of Pollux lake they are about 300 feet thick. South of Schade lake the actual contact with the volcanics is well exposed. Here a deformed pillow lava, striking N. 85° W. and dipping 80° S., is followed to the south by 10 feet of banded hornblende-mica quartzites, which are followed by a sheared pebble-boulder conglomerate containing lenticular boulders of white granite. Some of these boulders measured 6 by 12 inches, and one very elongated boulder measured 3½ by 21 inches. Greenstone is present in the conglomerate as mere linear shreds. The presence of large granite boulders indicates a considerable time interval between the deposition of the conglomerate and that

of the volcanics. It seems, therefore, justifiable to consider the sediments as a distinct group separate from the volcanics and to place the so-called transition series of sediments at the top of the volcanic series.

Conglomerate

From the distribution of the outcrops of conglomerate it is believed that it forms lenticular beds of no great thickness or length. A number of the exposures are quite small. Excellent and but slightly deformed conglomerate was only found in three localities: in a bay off the north shore of Seeseep lake, at the west end of Eyapamikama lake, and near Keeyask lake. The Seeseep lake occurrence has pebbles, cobbles, and boulders of greenstone, white granite with a maximum size of 1 foot, and occasional pebbles of sugary quartz, all in a green, fine-grained matrix.



Sheared boulder conglomerate at the sediments-volcanics contact between Schade and Eyapamikama lakes. The marks on the hammer handle are one inch apart.

In the conglomerate outcropping at the west end of Eyapamikama lake, 95 per cent. of the fragments are granite. Several granite types are present, but the fragments are mainly of a white-weathering, greyish-green, biotite granite, well-rounded and ranging in size from pebbles to boulders. One egg-shaped boulder, 12 by 16 inches in dimensions, was seen. Some of the granite contains opalescent grains of quartz, and the rock is essentially similar to the granite that outcrops to the west of this locality. The remaining 5 per cent. of the fragments are white vein quartz, a carbonate-sericite schist, dark ribbons of greenstone, and green-tinted quartz identical with an interbed in the volcanic series of banded green quartzite found on the North Caribou river.

The exposures just southeast of Keeyask lake are practically undeformed. They consist of conglomerate containing well-rounded pebbles and boulders, mainly of several different varieties of granite, some white vein quartz, greenstone, and black chert. Three of the granite boulders measured 5 by 10, 6 by 8, and 12 by 18 inches in dimensions.

In comparison to the above, highly deformed conglomerate may be seen just north of the north shore of Eyapamikama lake at a small creek 1 mile west of the east end of the lake. Here, all degrees of elongation may be observed. The greenstone fragments are represented by bands or shreds. The granite occurs as rounded to elongate fragments, ranging in size from 9 by 18 inches to 3 by 84 inches, the ratios of width to length ranging from 1 to 2 to 1 to 28.

On Upper Windigo lake outcrops of conglomerate on the mainland and on islands indicate two lenticular, arc-like bands. The pebbles in these conglomerate outcrops are of chert, granite, greenstone, and, rarely, iron formation. The largest fragment seen measured 4 by 6 inches and was of granite. Much of the conglomerate has been so squeezed, however, that the pebbles are extremely elongate and in places hardly recognizable as such.



Interbedded greywacke and quartzite on Eyapamikama lake. The marks on the hammer handle are one inch apart.

Arkose, Greywacke, and Quartzite

These rock types frequently occur interbedded as bands, which range from laminae to beds many feet thick. Typical arkose is to be seen between the North Caribou river and Eyapamikama lake. Here, it is a fine- to medium-grained greenish-grey rock containing small grains of quartz and showing little to no bedding. Locally it contains thin lenticular interbeds of greywacke or gravel-pebble conglomerate. Greywacke is exposed at many localities on Eyapamikama lake and forms ridges northwest of the west end of the lake.

The quartzite is usually impure and is frequently a micaceous variety rich in biotite. A distinct type of a blue-grey colour, showing excellent bedding and the original well-rounded sand grains, one-twentieth of an inch in diameter, outcrops on the 42-chain portage between the North Caribou river and Eyapamikama lake.

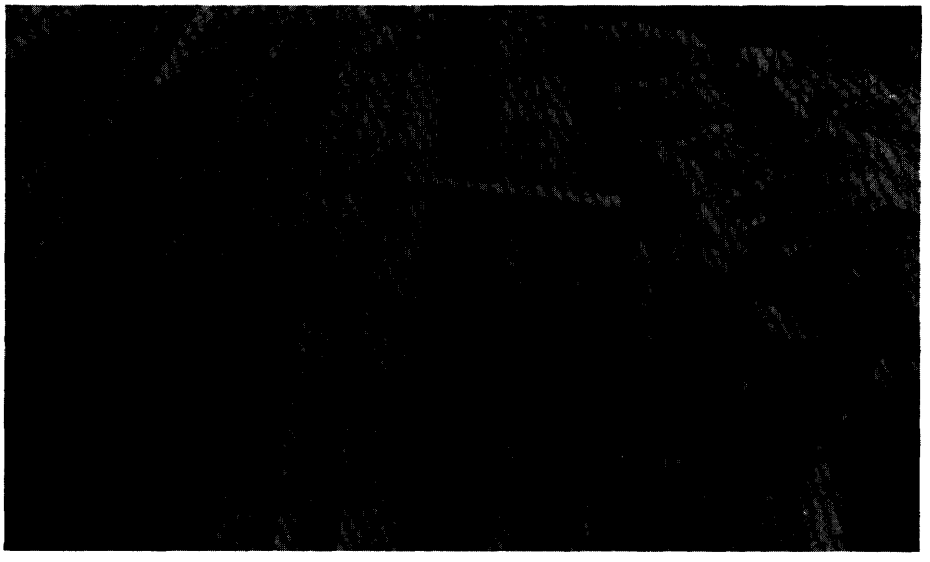
Slate

Slate forms a major part of the sedimentary series but, owing to its fissility, has been deeply eroded, and the area underlain by it is covered by water or

heavy overburden. It occupies the central part of a syncline, the axis of which lies along Eyapamikama lake. The slate is a typical dark-grey rock. Some green slate-like rocks outcropping between the North Caribou river and Eyapamikama lake have been mapped as slates.

Banded Sediments

An interesting type of sediment was observed in the Timiskaming series on Castor lake and between Eyapamikama and McGruer lakes. On Castor lake the banded sediment consists of narrow bands of dark-green amphibolite interbedded with grey to black impure quartzite or arkose. These bands range from 1 inch to 12 inches in width. A microscopic examination of thin sections of the arkose beds shows the presence of cordierite, andalusite, garnet, and staurolite as micro-



Banded quartzitic and hornblendic sediments on Castor lake. The marks on the hammer handle are one inch apart.

scopic grains or skeletal crystals, not visible to the naked eye in the hand specimen. These minerals indicate a fairly high degree of metamorphism. The amphibolite bands are thought to represent highly metamorphosed chloritic sediments.[1]

Limestone

Typical limestones were not observed. Ten chains northwest of the west end of Castor lake banded sediments are exposed. These consist of a 6- to 12-inch lenticular bed of pebble conglomerate and calcareous, banded, grey to buff quartzite, with beds 1 to 3 inches in thickness, composed of a green pyroxene, or a brown-weathering carbonate with a green pyroxene. These beds represent metamorphosed impure limestones.

Sedimentary Schists and Gneisses

At a number of localities the sedimentary rocks have been subjected to more extreme metamorphism, which has resulted in the development of different kinds of schists.

[1]cf. Alfred Harker, "Metamorphism," Methuen, London, 1932, pp. 264-267.

On Okow lake "knotted" schists are a common sedimentary type. The rocks weather with a knobby surface, the knobs being rounded crystals, which when examined in thin section under the microscope are found to be andalusite. These crystals range from one-quarter to one-half of an inch in diameter. The groundmass of the rock is composed of quartz, biotite, cordierite, small crystals of staurolite, and tourmaline. This association is described by Harker[1] as due to regional metamorphism under deficient shearing stress. These rocks are interbedded or associated with garnet-biotite schist, biotite schist, and staurolite-biotite schist.

Schists with knobby crystals were also observed at both the east and west ends of Eyapamikama lake, and just north of Miskeesik lake.

Biotite-quartz schist and arkose are the main rock types in the McCoy Lake belt of sediments.

Post-Timiskaming, Pre-Algoman(?)

Gabbro-Diorite

Gabbro-diorite outcrops at a number of localities in the band of Timiskaming-type sediments in the Weagamow-Eyapamikama-Opapimiskan Lakes belt. Most of these occurrences are isolated exposures, but in a few outcrops where such rocks are found in contact with the sediments it is believed that they are sill-like intrusives ranging from 100 to 300 feet in thickness. Their relationship to the granitic intrusives is not known, but they are, however, cut by dikelets of basalt considered to be Keweenawan in age.

These rocks were mapped at three different horizons in the sediments and are most common in that section of the above-mentioned belt that lies along or north of the north shore of Eyapamikama lake from Stanley lake east to a point north of the outlet of Eyapamikama lake. Three other exposures occur: one west of Stanley lake, the second at the east end of Eyapamikama lake on the north shore, and the third midway between Okow and Opapimiskan lakes.

The rocks are usually fairly massive, although sometimes foliated, fine- to medium-grained, light-grey and dark-green, and composed of about equal amounts of feldspar and amphibole. Owing to metamorphism some are now feldspar amphibolite, but they are believed to have been originally either diorite or gabbro.

Algoman(?)

Granitic Intrusives

The granitic intrusives underlie the greater part of the mapped area and show considerable diversity of structure and composition. No detailed study of them was made beyond grouping them under the following divisions: diorite, grey granite, pink granite, pegmatite and aplite, and porphyry and felsite. From previous experience it is thought that the granites are not true granites, but that the grey varieties are probably mostly quartz diorites and the pink, granodiorite. Much of the granite is gneissic, particularly at the margins of the batholiths adjacent to the volcanics-sediments belts; and if this gneissic structure is primary, then the batholiths may be said to be concordant intrusive bodies. At no place was any batholithic mass seen to cut across the structure of the belts of volcanics and sediments.

Diorite, believed to represent an early phase of the Algoman(?) igneous activity, was found in the neighbourhood of the Agutua arm, Weagamow lake.

[1]Alfred Harker, op. cit., pp. 230-235.

Here, it occurs as isolated outcrops or forms a number of small elongate stocks parallel to the regional structure. Within these stocks gradational phases between diorite and granite are found. The diorite is a light- to dark-green rock, frequently containing disseminated pyrite and, at times, chalcopyrite as well. Usually, it is quite massive, but in some outcrops it is jointed or sheeted, and in others various degrees of shearing were observed. In the sheared phases marked mineralogical changes have taken place, and the rocks are yellowish in colour owing to the epidotization of the feldspars.

The grey granite or granite gneiss has a widespread distribution and is the most common of the granitic intrusives. In many of its outcrops there is ample evidence of intense deformation, and shore lines for several miles expose large numbers of greenstone inclusions in a twisted granite gneiss matrix. The writer



Burnt outcrop of coarse amphibolite laced with irregular stringers of pegmatite, north of the east arm of Schade lake. The marks on the hammer handle are one inch apart.

believes that much of this type of granite gneiss may be older than Algoman, but no evidence is available to prove or disprove such a conclusion. From the abundance of inclusions in many widely separated localities it would appear that over wide areas erosion has barely deroofed the granite batholith.

What is considered to be a typical grey granite from a point just south of the Indian village on North Caribou lake may be described as a massive, medium-grained rock, white in colour on a freshly fractured surface speckled with black. It is composed of white feldspar, 50 per cent.; glassy grey quartz, 35 per cent.; and black flakes or flaky aggregates of biotite, 15 per cent. Studied in thin section under the microscope all the feldspar is found to be an oligoclase plagioclase. Accessory minerals are magnetite, apatite, and epidote. The rock should, therefore, be termed a biotite-quartz diorite.

The granite or granite gneiss frequently contains numerous dikelets of pegmatite as *lit par lit* injections.

This grey granite or granite gneiss underlies most of the territory around the following lakes: North Caribou, Petownikip, Sakwaso, Nikip, Opakopa,

Magiss, Senia, Weagamow, Agutua, and Windigo, and the McCoy, MacDowell, Windigo, and Agutua rivers.

The pink granite is a medium- to coarse-grained pink rock with a negligible ferromagnesian mineral content, and is often pegmatitic in character. The pegmatites appear to be genetically related to it. It occurs north of Weagamow lake to Atikomik lake, around Shinbone lake and extending northeast nearly to the southwest part of Windigo lake, and as isolated outcrops elsewhere.

A mixture of both grey and pink granites is found on the Kishikas river, the MacDowell river above Ochek lake, McCoy lake, and as small areas at other localities.

Pegmatite, Aplite

Pink pegmatite and aplite, but particularly the former, occur frequently as *lit par lit* injections in the grey granite and granite gneiss. To a lesser extent they are found as dikes cutting the granite, granite gneiss, volcanics, and sediments. Practically no large dikes of pink pegmatite were seen. As noted above, the pink granite mass around Shinbone lake has a pegmatitic character and might be mapped as pegmatite.

North of the east arm of Schade lake and just north of the mapped position of the granite-volcanics contact, a burnt ridge exposes a very coarse amphibolite, with the hornblende crystals averaging half an inch in diameter. This exposure is so laced with stringers of pink pegmatite that the outcrop is an equal mixture of the two rocks.

Porphyry, Felsite

Porphyry and felsite are not common in the area. Dikes were found, but no large masses. Along the south shore and south of Doubtful lake a grey quartz-feldspar porphyry occurs as dikes cutting pillow lava.

Quartz porphyry cuts volcanics and sediments in the down-faulted area of volcanics and sediments west of Upper Windigo lake.

A much fractured, very fine grained, buff-coloured felsite with disseminated pyrite forms a small island on the Agutua arm, Weagamow lake, just north of the rapids on the North Caribou river.

Keweenawan(?)

Diabase dikes were found at four localities. The dikes range from 25 to 130 feet in width and were rarely seen in contact with other rocks. They cut the sedimentary and volcanic series and the gabbro-diorite of post-Timiskaming age. It is not known whether they cut the granitic intrusives. On lithological characteristics, however, they are tentatively assigned to the Keweenawan. No special study was made of these rocks. They are medium-grained and dark in colour and are rusty weathering, as is characteristic of this species. A dike north of Opapimiskan lake, which is weathered and crumbles under the impact of a hammer, was examined in a thin section under the microscope and is an olivine diabase.

The dikes occupy fractures, which trend slightly east of north and dip vertically or nearly so.

An interesting series of outcrops occurs to the north and south of a small lake just south of the east end of Stanley lake. Here a dike cuts across sediments and a diorite sill of post-Timiskaming age. In the sediments the dike occupies a fairly straight fissure and has a width of 100 to 130 feet, but where it crosses the diorite the fissure is irregular and only 6 inches in width, and the dike rock has the texture of a basalt. It is apparent that the diorite offered considerable resistance to the fissuring forces.

Pleistocene

The deposits of Pleistocene age are entirely of glacial origin. The continental glacier left behind on its retreat a very variable thickness of clay, silt, sand, and boulders, which in places completely masks the underlying bed rock. Owing to this widespread distribution of unconsolidated sediments many of the lake shore lines are of a bouldery nature with few outcrops.

Striae indicating the direction of glacial movement are best preserved on the outcrops of volcanics, less so on the sediments, and but rarely on the granites, which frequently show evidence of the erosion of one-quarter of an inch of rock since glaciation.

Glacial movement, as indicated by striae, was not confined to one direction, but from east to west shows a decided swing from S. 35° to 45° W. on Eyapamikama and North Caribou lakes to S. 60° to 70° W. on Weagamow lake. Readings on Windigo and Upper Windigo lakes range from S. 30° E. through south to S. 10° W. These and other changes are brought out more clearly in Fig. 2, which shows all the readings obtained.



Moraine hills surrounding the south bay of Opapimiskan lake. The picture is taken from the top of an esker-like ridge on the west shore of the bay, looking south-southeast.

The opposing directions of glacial movement, as indicated by the readings on Windigo and Upper Windigo lakes compared with those from Eyapamikama and North Caribou lakes to Weagamow lake and the presence of a long range of boulder ridges between these areas, suggest to the writer the existence of two ice lobes.

Hummocky boulder topography and moraine hills around Opapimiskan and Zeemel lakes show that the glacial ice was stagnant in this region for a long time. The moraine hills and associated esker-like ridges rise from 50 to 125 feet above the lake level.

Most of the glacial debris in the vicinity of Weagamow, Eyapamikama, and North Caribou lakes is composed of sand, gravel, and boulders forming low knolls

and ridges, which may reach heights of 50 feet, and occasionally 150 feet above the general level. The moraine hills between Windigo and Agutua lakes rise to 300 feet. Between these areas of higher ground are swamps, and it is not known, except in a few localities, what the underlying drift is composed of. At these localities it is a boulder clay, and it is probable that all the low-lying areas are floored with this glacial sediment. Individual boulders of granite measure 10 feet or more in diameter. It is believed such large boulders are very nearly in place.

Field mapping shows that many of the boulder knolls and ridges are oriented in a direction parallel to the glacial movement. The numerous boulder islands in the northern part of North Caribou lake are similarly oriented. The area that extends from the middle of North Caribou lake north to Eyapamikama lake contains a very large number of these islands, narrow points, knolls, and ridges.



Concussion fractures on a glaciated surface of quartzite on the portage between Eyapamikama lake and the North Caribou river. The hammer handle points in the direction of the movement of the continental glacier. The bedding of the quartzite is represented by the fractures crossing from left to right. The marks on the hammer handle are one inch apart.

They are thought to be drumlins or drumloid forms. The northern part of North Caribou lake may then be considered as a submerged drumlin area.

A very interesting set of circular conchoidal fractures are to be seen on a smooth, glaciated quartzite outcrop on the 42-chain portage between Eyapamikama lake and the North Caribou river. These fractures would appear to be due to concussion caused by the pounding of boulders at the base of a waterfall. Whether the river was interglacial or post-glacial in age is a matter of conjecture. Possibly the drainage of an earlier Eyapamikama lake was here.

Recent

Owing to the general flatness of the country and consequent poor drainage, swamp areas constitute a large percentage of the total area. In many of the swamps of the muskeg type organic material has been accumulating for a considerable length of time, resulting in the formation of peat Disintegrated organic

material forms the bottoms of the many small lakes, and large numbers of them are gradually being filled with clay and organic material. On the lakes the work of the waves on the glacial boulder clay or other glacial deposits has brought about, with the removal of the clay, sand, or gravel, the formation of boulder shore lines and in many places the development of beaches of sand or gravel. River erosion of the glacial deposits has resulted in bouldery rapids and the deposition of the finer material at the river mouths as bars or as deltaic deposits.

STRUCTURAL GEOLOGY

Folding

The attitude of the volcanic and sedimentary series, their relationship to one another, and their occurrence in belts shows that they have been highly folded and now form synclines underlain and surrounded by granite. Structural data were only found in a few localities in the different belts, but it is believed that sufficient data were found to allow for reasonable explanations of the structures.

The Upper Windigo lake belt is exposed mainly north of the lake of that name and on islands in the lake. It consists chiefly of volcanics, apparently once largely pillow lavas. Infolded with the volcanics are two lenticular, arc-like bands of conglomerate, which are bowed towards the north. The belt pinches out at the west end of the lake and is reported to lens out to the east and north of Nango lake. Practically no structural data were found. All the rocks have vertical attitudes. Three horizons of pillow lava, one south of the northern conglomerate band, the second between the conglomerate bands, and the third south of the south conglomerate band would suggest a single horizon repeated by folding across approximately east-west axes, with the formation of at least two synclines and three anticlines. From the present arc-like form of the conglomerate horizons it is believed that following the folding a thrust from the south bowed the formations into the present shape. This thrust may have been caused by the granite batholith on and to the south of Upper Windigo lake.

A small belt, 1 mile in width and 4½ miles in length, occurs to the west of Upper Windigo lake. It consists entirely of volcanics to the south of the river, but on the river and north of it is a band of conglomerate. The rocks have vertical dips. The distribution of granite outcrops along the southeast edge of the belt with respect to exposures of volcanics and sediments is believed to support the hypothesis that a large fault exists along the river. The area of volcanics and sediments is thought to be a down-faulted remnant of the main Upper Windigo Lake belt, the movement being northeast and upwards on the east side of the fault, the thrust coming from the same source or mass of granite responsible for the arcing of the conglomerate bands on Upper Windigo lake.

The Dawes Falls belt is composed entirely of members of the Keewatin group. It extends east and west through Dawes falls on the Windigo river. To the east of the falls the belt is narrow, being approximately 1½ miles in width. To the west of the falls the belt widens to a known width of 7 miles, and the north boundary has not yet been mapped. It seems likely that this belt may join up in a west-northwest direction with a narrow belt mapped in 1937 on the southeast bay of Sandy lake. Throughout much of the belt the volcanics have steep to vertical dips. In the southern part of the wide part of the belt to the west of the north-south section of the MacDowell river the strikes swing from southeast-northwest through north to slightly east of north with dips as low as 45 degrees to the southwest. The widening is attributed to drag-folding due to an eastward

thrust, perhaps from the granite batholith lying to the west of the MacDowell river.

The McCoy Lake belt is composed entirely of sediments and forms a lenticular area about 2 miles in width and 9 miles in length in a northwest-southeast direction. The sediments have dips ranging from 50 degrees to vertical. The belt appears to be a tightly folded syncline.

The Weagamow-Eyapamikama-Opapimiskan Lakes belt consists of a great syncline of Keewatin and Timiskaming-type rocks, which has been traced for a length of 60 miles as a great arc around the northern and eastern parts of North Caribou lake, although the belt has no outcrops on the lake itself. It may be joined to the Dawes Falls belt, and it is known to extend farther south of Opapimiskan lake than mapped. Eyapamikama lake is apparently situated along the axis of the syncline. The belt ranges from 3 to 11 miles in width, the widest



Drag-folded banded sediments between Eyapamikama and McGruer lakes. The marks on the hammer handle are one inch apart.

part being at the west end of Eyapamikama lake. Northwest and southwest of this lake the belt is split into two belts, with the southwest belt again splitting into two smaller belts. That part between the North Caribou river and Weagamow and Randall lakes apparently represents a deep portion of the syncline, as it is riddled with small intrusive bodies of granite or diorite.

Lack of data precludes a more detailed analysis of the structure than that given above. Contradictory evidence in the sediments was found on the north shore of Eyapamikama lake due north of the outlet of the lake. The sediments have tops to the north with dips from 65° N. to vertical. It appears that there is a small anticline here on the north limb of the syncline of sediments. Dips of the sedimentary rocks would indicate that this minor anticlinal structure extends from the west end of Stanley lake east for 8 miles. Attention is drawn to the presence of several sills of diorite in this section. Their relationship to this minor structure is not known. From the distribution of the outcrops and the attitude of the sediments and volcanics north of the west end of Eyapamikama lake it is believed that there are a series of tight drag folds plunging eastwards.

Between Opapimiskan and Zeemel lakes the belt is 6 miles in width. This area has a heavy drift cover, and little structural data were obtained. It can be seen on the map that the strikes of the rocks show a marked swing from northwest-southeast on and just south of Opapimiskan lake to northeast-southwest on the Paseminon river, to slightly south of west on Zeemel lake. This widening of the belt may be explained as due to compressional forces across an axis trending approximately N. 70° W. and lying between Opapimiskan and Zeemel lakes, thus causing a cross-fold in the major synclinal structure. Such an interpretation fits the field evidence found in the bands of iron formation south of Opapimiskan lake, which dip 45° S.W. but which from the attitude of minor drag folds have tops facing northeast. The plunge of the structure as indicated by these drag folds is 45 degrees in a northwest direction.

Minor folding is widespread, although well-preserved drag folds were only seen at a few localities. South of McGruer lake banded sediments show excellent drag folds with vertical axes. Apparently in this outcrop the movements were entirely controlled by horizontal components working along vertical planes.

The granite batholiths are of the concordant type. In no place was granite seen to cut across the structure of the sediments or volcanics, unless the fault contact west of Upper Windigo lake is thought to be of such a type. At many localities the direction of foliation in the granite was observed to parallel that of the granite-volcanic or granite-sediment contacts. It therefore seems evident that over most of the area the granite batholithic invasion followed closely on the major folding of the volcanic and sedimentary groups.

Shearing

Owing to the great compressional forces responsible for folding the Keewatin and Timiskaming-type rocks into synclines, with marked deformation and metamorphism, many of the rocks are highly sheared. This shearing, however, occurred at such temperatures and pressures that the rocks, although foliated, are massive. Thus it is found that pillow lavas are represented by banded pseudo-stratified rocks which might be mistaken for poorly bedded tuffs or sediments. In places schists have resulted, the most interesting occurrence being the chlorite schist on the MacDowell river 7 miles west of Dawes falls. This is the only locality at which there is any known development of what may be called a shear zone. Other such zones may exist but have not been seen, presumably because they are covered with drift or swamp.

Faulting

Other than the fault noted to the west of Upper Windigo lake and described previously, little evidence of faulting was found in the area.

South of Schade lake a fault trending slightly east of north displaces the sediments-volcanics contact 30 feet. Very minor faulting with movements to be measured in inches was seen at a few localities.

Fissuring in the belt of volcanics and sediments north of the east half of Eyapamikama lake is indicated by vertical walls or fissures in outcrops, by a number of long narrow bays on the lakes, by rows of lakes trending approximately at right angles to the strike of the belt, and by Keweenawan(?) dikes. The long bay of Erichsen lake treads N. 40° E. On Schade lake two long bays occur, striking N. 30° E., and N. 20° E. South of Schade lake a nearly vertical wall with a maximum height of 15 feet cuts across pillow lavas in a northerly direction and faces east. West of Schade lake a string of three small lakes lie in a deep valley,

which cuts across the volcanic outcrops in a direction N. 17° E. Farther west, north of McGruer lake, an open fissure 5 feet in width cuts in a north-south direction across the structure of the volcanics.

Keweenawan(?) dikes fill fissures trending N. 30° E. on an island at the east end of Eyapamikama lake and N. 10° E. just east of the east end of Stanley lake.

There is no evidence of horizontal displacement in any of the above occurrences, but the vertical wall mentioned above may indicate some vertical displacement. It will be noted that in this section of the area the fissures range from north to N. 40° E. Owing to the presence of Keweenawan(?) dikes with strikes trending within the same range, it is considered that all these fissures had their origin in late pre-Cambrian time. Consequently unless there were late pre-Cambrian mineralizing solutions, which is not thought to be the case, these fissures are of no economic importance.

Minor fracturing in the Keewatin-type rocks is not uncommon at many localities.

ECONOMIC GEOLOGY

Upper Windigo Lake

No important finds were made in the season of 1938. About ten years ago a rush took place owing to the finding of a 3-foot milky-white quartz vein mineralized with pyrite and chalcopyrite at the junction of the volcanics and the granite on the south shore. It is reported that this vein panned visible gold. The claims were allowed to lapse, and no further discoveries have been made.

Little quartz was observed in the belt. Most of the veins are narrow, 1 to 6 inches in width, and all are of a barren glassy type.

Owing to the heavy overburden and the low percentage of outcrop, the part of the belt that was examined does not seem to hold out promising possibilities.

Dawes Falls

Unrecorded stakings were made in 1938 on a mineralized shear zone outcropping on the MacDowell river, but it is understood gold values were low. Traverses in this belt showed little quartz in the volcanics, and all observed was glassy in character and unmineralized.

Weagamow-Eyapamikama-Opapimiskan Lakes

A very large number of glassy quartz veins were observed in the volcanics. These veins are narrow, lenticular, and often folded. Much of the quartz is believed to be pre-Algoman in age. None showed any mineralization.

Fractures crossing the belt, at angles slightly east of north, are shown topographically by a number of long narrow bays on such lakes as Schade and Erichsen, and geologically by Keweenawan dikes. The presence of Keweenawan rocks in these fractures, which show little to no horizontal or vertical displacement, suggests a post-Algoman age for them. If such is the case, these fractures may be of little or no economic significance.

North and south of the North Caribou river a number of carbonate zones carrying small quartz stringers and a sparse sulphide mineralization were found. A grab sample from a zone north of the river failed to show a trace of gold on assay.

The diorite intrusives in the volcanics southeast of the Agutua arm, Weagamow lake, and southwest of the North Caribou river carry disseminated pyrite and a little chalcopyrite. No quartz veins were observed near these intrusives, but their contacts would seem to be worth investigation.

Fractures in the granite on the Agutua arm of Weagamow lake carry quartz-tourmaline stringers with no sulphide, but the adjacent granite is heavily mineralized with pyrite. This material, however, fails to show any gold values on assay.

Of considerable interest is the local magnetic attraction found at a number of places in this belt. Most of these occurrences can be definitely assigned to the contact between the volcanics and sediments. In the only outcrop found the rock was a mineralized carbonate zone (which as mentioned above showed no gold on assay), but presumably a portion more heavily mineralized with sulphide was concealed by swamp. The more important localities are the contact just north of Seeseep lake, the contact east of Stanley lake, and the east contact of the sedimentary belt between Okow and Opapimiskan lakes.

Prospecting Possibilities

Owing to the lack of outcrops, extensive swamp areas, bad burned areas with thick second growth or windfall, prospecting will have to be very thorough in order to be sure nothing has been missed. The contact between the sediments and the volcanics seems to offer the most promise for prospecting.

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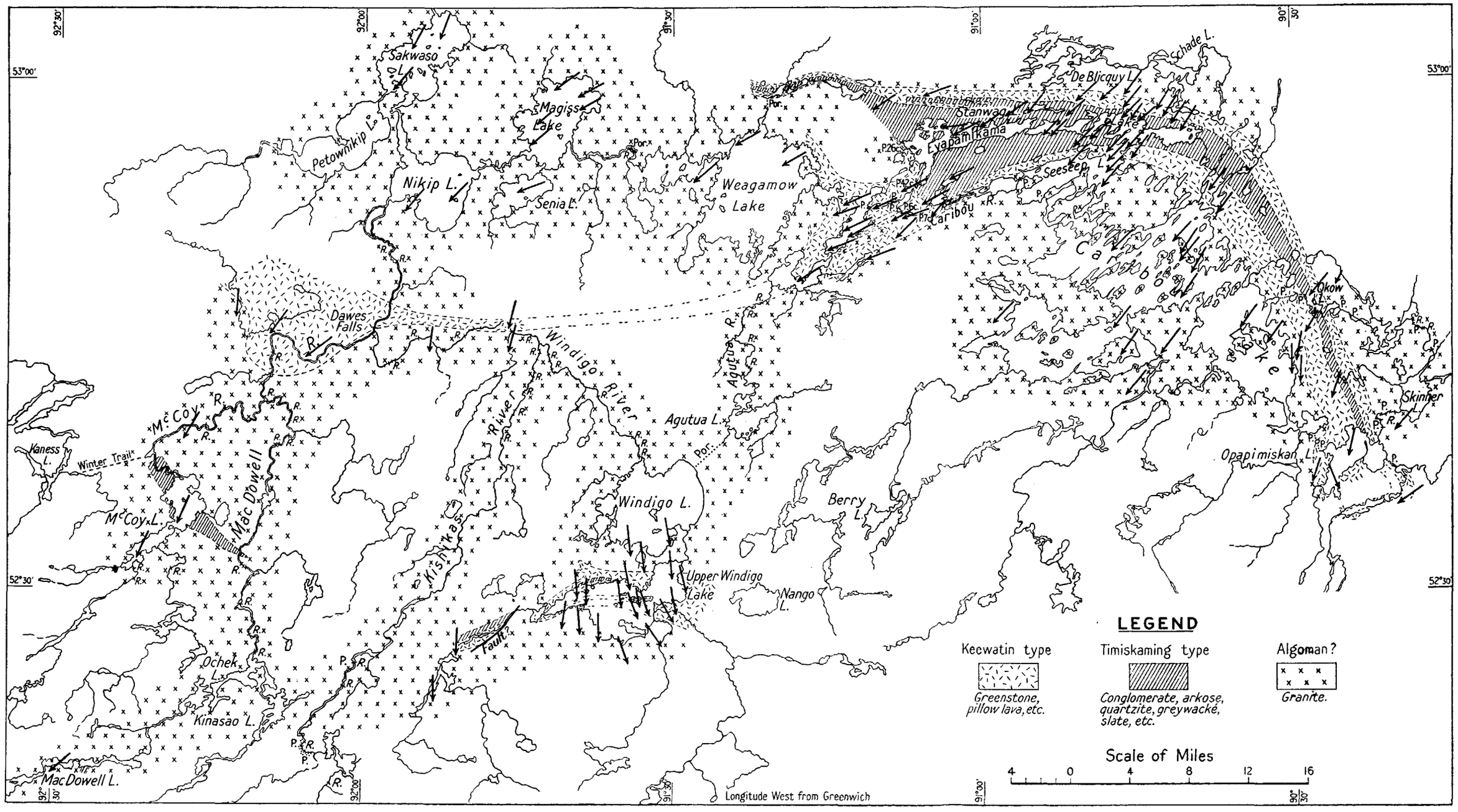


Fig. 2—Sketch Map of the Windigo–North Caribou Lakes Area Showing the Direction of Glacial Movement as Indicated by Striae.




















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