ONTARIO
DEPARTMENT OF MINES
AND NORTHERN AFFAIRS

HON. LEO BERNIER
Minister of Mines and Northern Affairs

D. P. DOUGLASS, P.ENG.
Deputy Minister

ANNUAL REPORT ON MINING OPERATIONS IN ONTARIO

During Calendar Year 1969

By
G. S. RIDDELL, P.Eng.
Engineer of Mines

Ontario Department of Mines and Northern Affairs Volume 79

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INTRODUCTORY LETTER

TO THE HONOURABLE LEO BERNIER
Minister of Mines and Northern Affairs

SIR:

The undersigned has the honour to submit to you the Seventy-ninth Annual Report of the Ontario Department of Mines and Northern Affairs, of the mining operations in the Province of Ontario in 1969.

Respectfully submitted,

D. P. DOUGLASS
Deputy Minister of Mines and Northern Affairs

DEPARTMENT OF MINES
AND NORTHERN AFFAIRS
TORONTO, 1971

CONTENTS

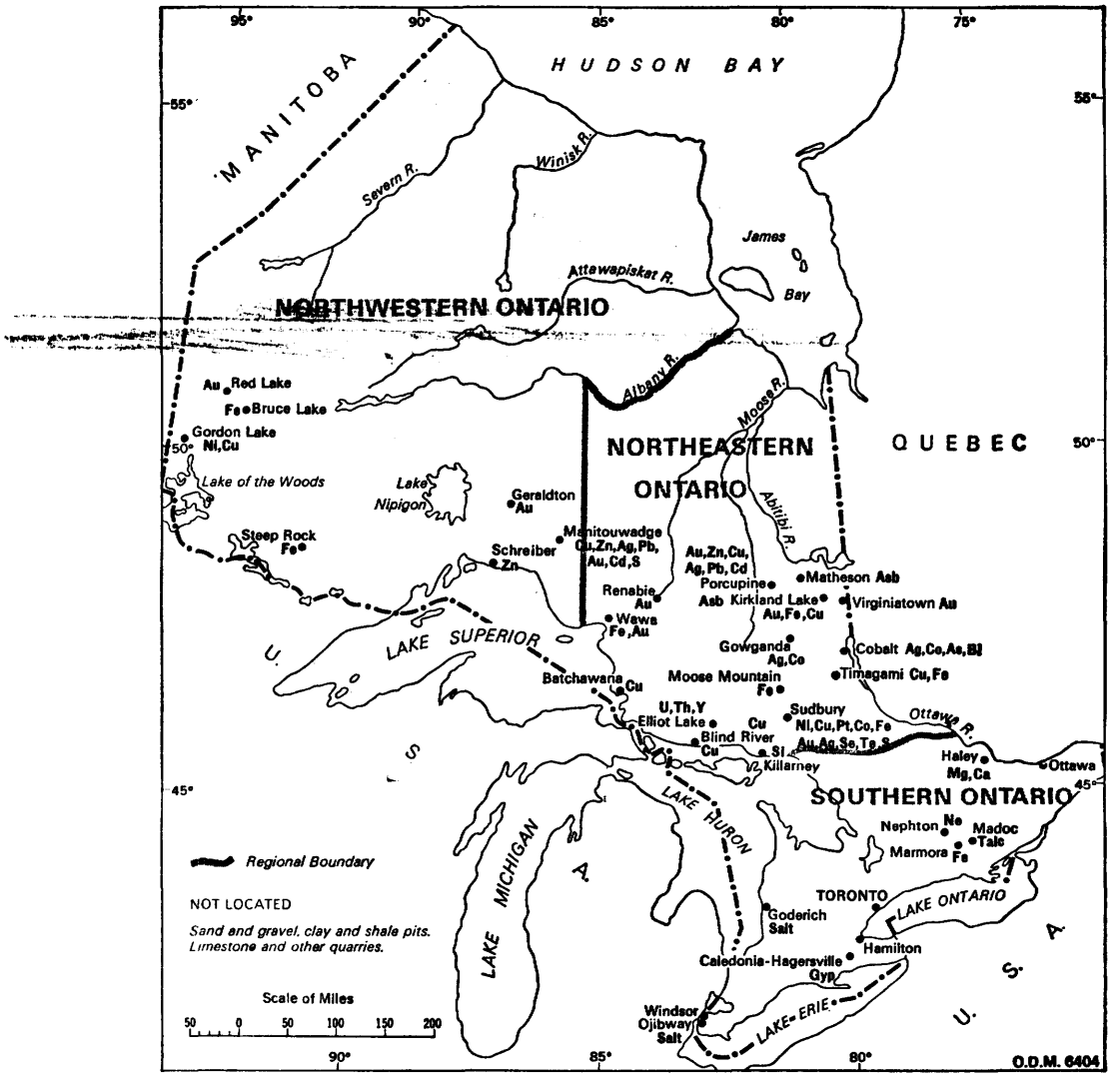
ANNUAL REPORT
MINING OPERATIONS

By

G. S. RIDDELL, P.Eng.
Engineer of Mines

Inspection Branch, R. L. Smith, P. Eng. Director

PRINCIPAL MINING AREAS OF THE PROVINCE OF ONTARIO



KEY TO SYMBOLS

Ag —Silver	Fe —Iron	Salt—Salt
As —Arsenic	Gyp—Gypsum	Se —Selenium
Asb—Asbestos	Mg —Magnesium	Si —Silicon
Au —Gold	Ne —Nepheline Syenite	Talc—Talc
Bi —Bismuth	Ni —Nickel	Te —Tellurium
Ca —Calcium	Pb —Lead	Th —Thorium
Cd —Cadmium	Pt —Platinum	U —Uranium
Co —Cobalt	S —Sulphur	Y —Yttrium
Cu —Copper		Zn —Zinc

METALLICS

BISMUTH

The production of bismuth, in 1969, amounted to 2,269 pounds valued at $11,209. In 1968, there was no recorded production of this metal.

CADMIUM

Production of cadmium in Ontario started in 1964 with 187,604 pounds valued at $607,853. By 1968, it increased to 2,732,729 pounds valued at $7,788,278; and by 1969 it increased to 3,075,505 pounds valued $10,825,778. When compared to 1968 output, the 1969 production of cadmium increased by 12.5 percent, the value of production increased by 39 percent and the value per pound rose from $2.16 in 1968 to $3.52 in 1969.

CALCIUM — see MAGNESIUM AND CALCIUM

COBALT — see NICKEL-COPPER and SILVER-COBALT

COPPER — see NICKEL-COPPER

GOLD

The value of gold output in the 1965-1969 period declined by 10.9 percent. The main reason for this decline may be attributed to substantial depletion of gold ore reserves, accompanied by an increasing cost of mining in the presence of the fixed price for gold.

In 1969, there were 20 operating mines in Ontario including Wilmar Mines Ltd., Annco Mines Limited both operated by Cochenour Willans Gold Mines Limited. In February 1969, Surluga Gold Mines Ltd. terminated its operation. The gold mines reported milling 4,332,790 tons of ore and recovering 1,181,757 ounces of gold and 271,445 ounces of silver, for a total value of $45,064,310 in 1969.

Gold recovered as a by-product of nickel-copper operations and base metal mines amounted to 47,909 ounces. Thus, the total gold production in Ontario in 1969 amounted to 1,229,666 ounces valued at $46,346,112 — a decrease of about 11 percent. The average recovery value per ton of ore milled was $10.40.

In 1969, the 20 gold mines operating in Ontario employed 4,900 people and paid them $27,556,447 in wages and salaries.

DIVIDENDS AND BONUSES PAID BY GOLD MINING COMPANIES

Year	Porcupine	Kirkland Lake Larder Lake and Sudbury	Northwestern Ontario	Total
1912-64	$405,970,265	$317,577,331	$81,990,909	$805,538,505
1965	15,607,781	3,842,603	3,663,087	23,113,471
1966	16,263,952	3,854,144	2,494,570	22,612,666
1967	16,919,941	3,101,888	2,701,137	22,722,966
1968	16,554,496	5,240,328	2,177,480	23,972,304
1969	7,827,098	5,599,992	2,177,550	15,604,640
Total	$479,143,533	339,216,286	95,204,733	913,564,552

ANNCO MINES LIMITED

Annco Mines Limited was incorporated in July 1963, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,906,668 shares have been issued. The directors and officers were: J. E. J. Fahlgren, president, general manager and director; E. C. Cochenour, and G. T. Smith, vice-presidents and directors; M. C. Mosher, F. J. Mills and S. J. Zacks, directors, J. B. McLellan, secretary-treasurer. The head office and mine address is Cochenour.

The property comprises 184 acres lying south and adjoining the central part of the Cochenour property in Dome and Balmer townships, Red Lake area, District of Kenora. The company was formed to acquire the five claim property from Wilmar Mines Limited and is controlled by Cochenour Willans Gold Mines Limited.

Mining operations continued throughout 1969.

Development work completed during the year consisted of 88 feet of drifting and 316 feet of raising. Total development footage to 31 December 1969 was as follows: 5,677 feet of drifts; 2,062 feet of crosscuts; 5,093 feet of raises. Some seven diamond-drillholes totalling 335 feet were completed from underground.

A total of 12,359 tons of ore was hoisted and milled at an average of 34 tons per working day in the Cochenour mill.

Company Annual Report

See Cochenour Willans Gold Mines Limited for further information contained in that company's annual report for the year ending 31 December 1969, which pertains to Annco Mines Limited.

Employment and Management

J. E. J. Fahlgren president and general manager was in charge, and the operation was carried on by the Cochenour Willans organization.

AUNOR GOLD MINES LIMITED

Aunor Gold Mines Limited was incorporated in May 1939, with an authorized capitalization of 2,000,000 shares of $1 par value; all shares have been issued. The directors and officers were: D. E. G. Schmitt, president, general manager and director; W. S. Row, vice-president and director; R. V. Porritt, K. C. Gray and A. W. Stollery, directors; B. H. Grose, secretary; E. K. Cork, treasurer. The head office is at 1700

Bank of Nova Scotia Building, 44 King Street West, Toronto 1; the mine address is Box 2001, Timmins.

The company's property consists of 11 claims in Deloro township, Porcupine area, District of Cochrane.

Mining and milling continued throughout 1969.

SHAFTS, AUNOR MINE

Shaft	Claim No.	Inclination	No. of Compartments	Collar Depth	Vertical Depth below Surface
				feet	feet
A1	HS850	Vertical	3	Surface	3,082
A2	TRS828 } HR1246 }	62°	2 (inactive)	2,110	2,907
D2	TRS825	Vertical	3	Surface	3,030
D3	TRS825	Vertical	4	2,888	5,395

Development work in 1969 consisted of 1,725 feet of drifting, 50 feet of crosscutting and 10 feet of raising. Total development footage to 31 December 1969 was as follows: 79,591 feet of drifts; 14,320 feet of crosscuts; 33,340 feet of raises. Development work by Aunor on Delnite property in 1969 consisted of 501 feet of drifting, 154 feet of crosscutting and 307 feet of raising. Total development footage on Delnite property to 31 December 1969 by Aunor was 4,091 feet of drifts; 1,205 feet of crosscuts; 1,971 feet of raises. Diamond-drilling in 1969 consisted of 405 holes totalling 33,178 feet from underground and 1 hole 493 feet from surface. Included in the total were four holes from underground, totalling 2,174 feet and one hole from surface totalling 493 feet drilled for hydraulic backfill purposes.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Production

Tonnage and grade of ore treated during the last six months was lower due to ground conditions which caused difficulties in mining. A fault, encountered in a stope above the 3500-foot level, which was scheduled for substantial ore production, resulted in considerable dilution from overbreak. In another stoping section of higher grade ore, the planned production rate could not be maintained because of difficulties due to wall pressure. Work to circumvent the adverse conditions is underway and more normal production rates should be reached after the first quarter of 1970.

Ore broken and drawn off from stopes amounted to some 219,740 tons. In addition stope preparation and development produced 37,070 tons and 10,725 tons respectively.

Development

Lateral development was continued to provide for stope preparation down to the 4000 level.

Diamond-drilling to outline ore zones for stope layouts was increased. Two long drill holes to probe for parallel mineralized zones at the 3500 level did not find ore.

Ore Reserves

At 1 January 1970, ore reserves, after normal allowance for dilution, were estimated at 858,000 tons averaging 0.32 ounces of gold per ton compared with 865,000 tons at 0.32 ounces at the beginning of 1969.

Mill

The following tabulation shows production and performance for the year as compared with 1968 and the period since production started in January 1940.

		1969	1968	Total to date
Milled	ton	260,793	269,123	6,147,032
Milled per calendar day	ton	714	735	561
Average gold content	oz./ton	0.292	0.360	0.332
Average tailings loss	oz./ton	0.013	0.015	0.012
Gold recovery	percent	95.4	95.5	96.4
Gold production	ozs.	72,680	92,680	2,043,769
Value of total production	$	2,747,900	3,508,200	74,470,600
Value per ton	$	10.54	13.04	12.11

General

The supply of classified mill tailings for mine backfill purposes was insufficient for current stope requirements. Therefore, normal supply was supplemented with reclaimed tailings from a storage dam and with truck-hauled pit sand which increased expense and caused some delays in the schedules for filling and mining.

Backfill placed in the mine totalled 89,360 tons of classified mill tailings and 23,200 tons of sand.

Employment and Management

The average number of employees was 368: 241 underground and 127 on surface. J. G. Sparrow was manager.

CAMPBELL RED LAKE MINES LIMITED

Campbell Red Lake Mines Limited was incorporated in August 1944, with an authorized capitalization of 4,000,000 shares of $1 par value of which 3,999,500 shares have been issued. The company is controlled by Dome Mines Limited. The directors and officers were: C. W. Michel, chairman of the board and director; J. B. Redpath, president and director, B. R. MacKenzie, secretary and director, W. F. James, and J. K. McCausland, directors; E. J. Andrecheck, treasurer. The head office is at Suite 702, 360 Bay Street, Toronto 1. The mine address is Balmertown.

The company owns 27 claims, about 1,175 acres in Balmer township, Red Lake area, District of Kenora.

Mining and milling continued throughout 1969.

The vertical four compartment No. 1 shaft, located on claim KRL20071, is 3,281 feet in depth below the collar.

Development work in 1969 was as follows: 4,276 feet of drifting, 524 feet of crosscutting, 2,364 feet of raising. Total development footage to 31 December 1969 was as follows: 174,417 feet of drifts; 29,157 feet of crosscuts; 56,784 feet of raises. Diamond-drilling in 1969 consisted of 203 holes totalling 29,543 feet from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Mining

In all 241,831 tons of a grade of 14.83 dwt. were drawn from the stopes and sent to the mill.

Broken ore totalling 115,200 tons remains in the stopes, an increase of 5,700 tons from the previous year.

The main stoping operations were above the 14th or 2,050-foot level. Ore removed by cut-and-fill mining increased from 22 percent to 28 percent of the total ore mined.

Ore Production

The mine produced 261,609 tons of ore during the year which averaged 14.52 dwt. The stopes produced 241,831 tons averaging 14.83 dwt. and development work produced 19,778 tons averaging 10.65 dwt.

Ore Reserves

The ore reserves are estimated at 1,331,100 tons, an increase of 42,700 tons over last year. The ore reserves include 115,200 tons of broken ore. Potential ore exposed by lateral work but not sufficiently determined by normal raising practice is not included in the ore reserves.

Mill

The following are the results of milling operations:

Ore treated	ton	261,609
Average per calendar day	ton	717
Average grade of ore treated	dwt per ton	14.52
Recovery	dwt per ton	13.50
Recovery	percent	92.97

Costs

The expenditure on mining was $1,272,188 or $4.86 per ton milled.
The expenditure on development was $550,802 or $2.10 per ton milled.
Operating costs (including Mint handling charges) were $11.62 per ton milled.

Employment and Management

The average number of employees was 281; 145 underground and 136 on surface. Joseph Chisholm was general manager.

COCHENOUR WILLANS GOLD MINES LIMITED

Cochenour Willans Gold Mines Limited was incorporated in April 1936; in 1965 the authorized capitalization was increased to 4,000,000 shares of $1 par value, of which 3,584,655 shares have been issued. The directors and officers were: E. C. Cochenour, chairman of the board and director; J. E. J. Fahlgren, president, general manager and director; S. J. Zacks, vice-president and director; F. J. Mills, secretary-treasurer and director; M. C. Mosher and G. T. Smith, directors; B. C. Lemon and J. B. McLellan assistant secretaries. The head office and mine office is at Cochenour.

The property consists of 49 claims in Dome township, Red Lake area, District of Kenora.

Mining and milling continued throughout 1969.

SHAFTS, COCHENOUR WILLANS MINE

Shaft	Claim No.	Inclination	Number of Compartments	Vertical Depth below Surface
				feet
No. 1	K.R.L. 322	Vertical	3	2,768
No. 2	K.R.L. 462	Vertical	3	446

Development work in 1969 consisted of the following: drifting, 841 feet and raising 111 feet. Total development footage on Cochenour property to 31 December 1969 was as follows: 117,215 feet of drifts; 71,990 feet of crosscuts and 77,134 feet of raises. Diamond-drilling consisted of 63 holes, totalling 7,630 feet from underground and one hole for backfill totalling 174 feet.

Added equipment included one submersible pump and accessories and one mucker loader complete.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

During the year 71,574 tons of ore were milled producing 20,036.575 fine ounces of gold and 9,840.700 fine ounces of silver. The total value of this bullion was $773,891 for an average recovery of $10.81 per ton milled. The price received for gold averaged $37.68 Canadian per fine ounce and for silver $1.92 per ounce. All bullion was shipped to the Royal Canadian Mint.

The company and its subsidiaries qualified for Emergency Gold Mining Assistance. Total income estimated to be received under the provision of this Act is $205,874 or $10.27 per ounce of gold.

The actual production and estimate of Emergency Gold Mining Assistance income for each mine is as follows:

	Tons	Gold Ounces	Silver Ounces	Total Value
Cochenour Willans	14,147	2,229.185	112.15	$ 84,250
Annco	12,359	3,606.271	160.95	136,202
Wilmar	45,068	14,201.119	9,567.60	553,439
Total	71,574	20,036.575	9,840.70	$773,891

Emergency Gold Mining Assistance (Cost Aid)

Cochenour Willans	$ 22,905
Annco	37,054
Wilmar	145,915
	$205,874

All Time Production

	Period	Tons	Recovered Grade per Ton	Value
Cochenour Willans	1939-1969	2,096,077	$19.55	$40,981,011
Annco	1965-1969	132,391	13.93	1,843,807
Wilmar	1967-1969	81,608	10.91	890,346
		2,310,076		$43,715,164

Costs

In addition to the general increase in costs following adjustments in wage rates which averaged approximately six percent during the year and the inflationary increases in the cost of material supplies and services, the operating costs were further affected by other major operating changes, such as — the development program at the Wilmar, the cost of introducing backfill from surface to convert all mining at the Wilmar to backfill stoping which had to be loaded and trucked to the plant, change-over of the milling plant to better treat the metallurgy of the Wilmar ore which is now the main mill feed, and the extra costs to stabilize rock conditions at the Annco which interrupted normal mining procedure. At the Cochenour all mining was by the shrinkage method and some 9,000 tons were broken in the stopes at the year end.

While the overall total operating expenditures for the three mines are comparable to that of 1968, the cost per ton reflects high increases by reason of the reduced tonnage milled, which was 28 percent below that of the preceding year. The condition will correct itself in 1970.

Schedules of operating costs

	1969		1968
	Total Tons	Per Tons Milled	Per Tons Milled
Cochenour operation			
Tons Milled		14.147	43,690
Development	$ 42,420	$ 2.999	$ 1.295
Mining	117,471	8.303	6.466
Milling	52,201	3,690	2,854
General and administrative	77,779	5.498	1.911
Marketing	509	.036	.050
Total operating costs	290,380	20.526	12.576
Deduct — Est. E.G.M.A.	22,905	1.619	1.951
	$267,475	$18.907	$10.625
Annco Operation			
Tons milled		12,359	27,922
Development	8,555	0.693	.204
Mining	128,935	10.432	8.669
Milling	45,604	3,690	2,854
General and administrative	29,790	2.410	1.498
Marketing	893	.072	.089
Total operating costs	213,777	17.297	13.314
Deduct — Est. E.G.M.A.	37,054	2.998	3.495
	$176,723	$14.299	$ 9,819
Wilmar operation			
Tons milled		45,068	28.018
Development	$ 94,281	$ 2.092	$ .156
Mining	398,518	8.843	6.882
Milling	166,304	3.690	2.854
General and administrative	103,688	2.300	1.509
Marketing	3,378	.075	.052
Total operating costs	766,169	17.000	11.453
Deduct — Est. E.G.M.A.	145,915	3.238	2.275
	$620,254	$13.762	$ 9.178

Milling

Results of the milling operations are set out below with comparative figures for the preceding year.

		1969	1968
Milled	ton	71,574	99,620
Operating time of total time	percent	82.96	93.21
Average milled daily	ton	196	272
Average gold assay of head	ounces	0.280	0.269
Average gold assay of tails	ounces	0.019	0.028
Extraction	percent	93.59	89.59

The Cochenour Mine

The main development was carried out on the 20th level to explore the "04" area. This work developed some low grade chert ores which have since been mined out, but due to the tenor of the grade of these ores, further development is not considered. Diamond-drilling in the "17 and 20" block area did not prove up mineable ore structures.

Mining is continuing on two low grade North/South structures, each of which have approximately 150 feet of strike length. These are shrinkage stopes.

Some surface diamond-drilling exploration is planned for 1970, to investigate a series of fold-fault structures in the north-east part of the Cochenour property where no previous exploration has been undertaken.

The Annco Mine

Mining is continuing in two stoping blocks. Ore reserves above the 22nd level and available for mining at the end of 1969 total 35,000 tons averaging 0.35 ounces gold per ton. No further exploration was undertaken on levels below the 22nd level. The talcose ore structures have been intersected in diamond-drilling to a depth of 175 feet below the 22nd level.

The Wilmar Mine

Mining operations progressed throughout the year on the 1300, 1900, and 2050-foot levels with development mining in the latter part of 1969 on the 1450-foot level. Stoping blocks on these levels are of good dimensions and mining costs are continuing to improve. All stopes are now converted to cut-and-fill mining. The in-stope load haul dump equipment has proved very efficient and if overall mining operations achieve a profit making level, additional units will be considered.

All development goals planned for 1969 were completed, which include the following:

1) Completion of waste-ore pass from the 1600 to the 1450-foot level, and installation of a loading pocket on the 1600-foot shaft station.
2) Completion of crosscut and drifting on the 1450-foot level to reach and develop the talc-breccia ore structures from the No. 1E. to the No. 4E. ore blocks. Raise development and sub-drifting was also carried out which produced 2,422 tons of development muck averaging 0.30 ounces gold per ton.
3) Started waste-ore pass from the 1900 to the 1750-foot level which was completed early in 1970.
4) Completion of 1900-foot level drifting to reach the 1900 #6E. stoping block.
5) Completion of the 1600 crosscut to the breakthrough position of the 1750 to 1600-foot level waste-ore pass.
6) Commenced crosscut drifting on the 1750-foot level, advancing a distance of 160 feet.

The 1969 development program and previous development has made an estimated 90,000 tons of ore grading 0.35 to 0.40 ounces gold per ton available for mining. Extraction rates for 1970 are projected to supply 60,000 tons of ore per year.

The Wilmar operation is now expected to attain a profit making level. If proven successful by June 30th, drift development on the 1750-foot level to the No. 6E. ore block and the exploration of the Diorite Dyke structure at this horizon will resume. Some of the better intersections in the Diorite Dyke structure were 0.53/12', 0.44/26.5', 0.23/7.8', and 1.35/8.0' (ounces gold per ton/core length in feet.) A south breccia structure in the No. 6E. block will also be explored, which was intersected by diamond-drilling.

No further work was conducted on the granodiorite structure outlined on the 1300 level in the west part of the property. This structure has a low grade production potential and warrants further exploration and development should the price of gold rise to $60.00 per ounce value.

The Consolidated Marcus Exploration

No exploration work was undertaken on this property during 1969. The surface exploration program being conducted on the east part of the Cochenour property has delineated some fold-fault structures which are located at the mutual property boundaries. If considered necessary, some surface diamond-drilling may be conducted on the Marcus property during 1970.

Employment and Management

The average number of employees at the Cochenour, Annco and Wilmar operations was 129; 50 underground and 79 on surface. J. E. J. Fahlgren, president and general manager, was in charge.

DICKENSON MINES LIMITED

Dickenson Red Lake Mines Limited was incorporated in November 1944; in June 1947 the capitalization was increased; in June 1949 the company was reorganized, and the name changed to New Dickenson Mines Limited; in October 1960 the name was changed to Dickenson Mines Limited on amalgamation of New Dickenson Mines Limited and Lake Cinch Mines Limited. The authorized capitalization was 3,750,000 shares of $1 par value of which 3,750,000 shares have been issued. The directors and officers were: A. W. White, president and director; C. R. Diebold, vice-president and director; F. A. Fell, general manager and director; J. J. Jodrey, S. C. Smith, H. V. White and M. L. Urquhart, directors; H. R. Heard, secretary-treasurer; J. Geddes, assistant secretary. The head office is at Suite 416, 25 Adelaide Street West, Toronto 1. The mine address is Balmertown.

The property comprises 31 claims in Balmer township, Red Lake area, District of Kenora.

Mining and milling continued throughout 1969.

SHAFTS, DICKENSON MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Total Depth below Surface
				feet	feet
Detta	KRL19502	Vertical	3 (inactive)	—	280
No. 1	KRL19497	Vertical	(3 to 8th Level) (4 to bottom)	—	3,589
No. 2	KRL19503	Vertical	4	3,365	4,614

A total of 2,966 feet of drifting, 859 feet of crosscutting, and 1,373 feet of raising was completed. Total development footage to 31 December 1969 was as follows: 95,304 feet of drifts; 69,476 feet of crosscuts; 56,615 feet of raises. Diamond-drilling consisted of 146 holes totalling 24,005 feet from underground.

Robin Red Lake Mines Limited

Development work done by Dickenson Mines Limited on the adjoining Robin Red Lake Mines Limited property consisted of 1,774 feet of drifting and 207 feet of raising in 1969 from the Dickenson property. The total development to 31 December 1969 was as follows: 5,183 feet of drifting and 874 feet of crosscutting and 207 feet of raising. Some 2,904 feet of diamond-drilling was completed from underground.

A total of 6,270 tons of ore was hoisted and milled.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Production

174,272 tons of ore were milled which yielded 77,977.3 fine ounces of gold and 6,945 fine ounces of silver. The total value of this bullion was $2,998,000 or a recovery of $17.20 per ton milled. The average value received was $38.28 per ounce for gold and $1.81 per ounce for silver. In addition, benefit received and receivable under the Emergency Gold Mining Assistance Act is estimated to be $568,370 or $7.29 per ounce of gold.

To date the mine has produced 1,503,624.0 ounces of gold and 128,397.5 ounces of silver with a total value of $54,313,900 for an average value received from the Mint and the Bank of Nova Scotia of $36.02 per ounce of gold and $1.18 per ounce of silver; total tons milled amount to 3,069,812 for a recovery of 0.49 ounces of gold per ton.

Analysis of Operating Costs

	Total	1969 Per Ton Milled	Per Ounce	1968 Per Ounce
Shaft Sinking (No. 2 Shaft)	———	———	———	$ .97
Exploration and development	$ 313,185	$ 1.80	$ 4.02	5.89
Mining	1,376,667	7.90	17.65	17.55
Milling	549,767	3.15	7.05	7.51
Mine general expense	382,488	2.19	4.91	5.44
Head office expense	143,359	.82	1.83	2.09
Interest on bank loans	23,335	.14	.30	.96
Marketing charges	15,375	.09	.20	.25
	$2,804,176	$16.09	$35.96	$40.66

Mining

Broken ore totalling 66,627 tons remained in the stopes, a decrease of 3,655 tons from the previous year. Also, 1,934 tons remained in ore bins and ore passes at year's end.

175,647 tons of ore were hoisted. This ore tonnage consisted of: 10,333 tons grading 0.418 ozs./ton obtained from development; 159,044 tons grading 0.454 from stopes and stope development; and 6,270 tons grading 1.157 ozs./ton derived from Robin development. Waste hoisted amounted to 20,253 tons.

Ore Reserves

At 31 December 1969, positive ore reserves, broken and in place, were calculated to be 474,669 tons having an average grade of 0.505 ounces of gold per ton. This compares with 513,281 tons grading 0.507 ozs./ton at 31 December 1968.

Milling

Summary of mill operations with the previous year given for comparison:

	1969	1968
Tons treated	174,272	160,825
Percent operating time	98.87	97.77
Tons treated per day	477.5	439.4
Average value millheads in ounces of gold per ton	0.485	0.480
Assay of mill tails in ounces of gold per ton	0.037	0.038
Recovery in ounces of gold per ton	0.448	0.442
Percent recovery	92.43	92.00

Employment and Management

The average number of employees was 253; 145 underground and 108 on surface. D. C. Rance was mine manager.

DOME MINES LIMITED

Dome Mines Limited was incorporated in July 1923, to succeed Dome Mines Company Limited. The authorized capitalization was 2,000,000 shares of no par value, of which 1,946,668 shares have been issued. The directors and officers were: C. W. Michel, chairman of the board, treasurer and director; J. B. Redpath, president and director; C. P. Girdwood, vice-president, general manager and director; B. R. MacKenzie, secretary and director; W. R. Biggs, F. W. Pershing, A. T. Lambert, A. B. Mathews and W. F. James, directors. The head office and mine office address is South Porcupine. The secretary's office is at Box 30, Toronto-Dominion Centre, Toronto 1.

The company owns 62 claims and parts of the beds of the Porcupine and Simpson Lakes in Tisdale, Whitney, Bond and Shaw townships, Porcupine area, District of Cochrane.

Mining and milling continued throughout 1969.

SHAFTS, DOME MINES

Name or No.	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
				feet	feet
No. 1 shaft	12866	Vertical	3 (inactive)	Surface	105
No. 2 shaft	12864	Vertical	3 (inactive)	Surface	805
No. 3 shaft	12864	Vertical	(4 to 10th level 6 to bottom)	Surface	2,456
No. 4 winze	—	Vertical	Inactive	1,587	2,053
No. 5 winze	—	Vertical	3	2,026	3,137
No. 6 shaft (internal)	—	Vertical	5	2,000	4,062
No. 7 winze	—	Vertical	3	3,950	5,323
No. 1 Dome Ext.	13191	Vertical	Inactive	Surface	222
No. 1 Foley O'Brien	13403	Vertical	Inactive	Surface	70
No. 2 Foley O'Brien	13403	Vertical	Inactive	Surface	160
No. 3 Foley O'Brien	lot 2, con. II Tisdale	Vertical	Inactive	Surface	240
Foley-O'Brien winze	—	70°	Inactive	160	250
No. 1 Temiskaming shaft	lot 3, con. II Tisdale	Vertical	Inactive	Surface	260
No. 2 Temiskaming shaft	lot 3, con. II Tisdale	Vertical	Inactive	Surface	60

Development work in 1969 consisted of 5,609 feet of drifting, 1,677 feet of crosscutting and 4,135 feet of raising. Total development footage to 31 December 1969 was as follows: 488,240 feet of drifts; 219,254 feet of crosscuts; 265,070 feet of raises. Diamond-drilling in 1969 consisted of 507 holes totalling 81,185 feet from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

The expenditure on development was $1,019,288 or $1.44 per ton as compared with $1,349,041 or $1.89 per ton milled in 1968.

The expenditure on mining was $5,120,936 or $7.26 per ton as compared with $4,836,545 or $6.78 per ton milled in 1968.

The total operating charges for the year were $7,691,592 or $10.90 per ton as compared with $7,708,647 or $10.81 per ton milled in 1968.

The operating cost per ounce of gold produced was $42.81 as compared with $42.67 in 1968.

Mining

The 705,500 tons of ore milled during the year were produced as follows:

	Tons	Average Grade dwt. per ton
From stopes	649,600	5.45
From development	55,900	2.77
Total	705,500	5.23

Ore Reserves

Ore reserves at the close of the year were estimated at 1,819,000 tons with an average grade of 5.41 dwt. as compared with 1,926,000 tons with an average grade of 5.59 dwt. for 1968.

	Tons — 1969	Tons — 1968
Unbroken ore	1,654,000	1,742,000
Broken ore	165,000	184,000
	1,819,000	1,926,000

Ankerite ore comprises 33 percent of the reserves. This ore is more refractory to the milling process than the normal ore in the mine.

Mill

Following are the milling results:

ore treated	ton	705,500
Average per day worked	ton	1,982
Average grade of ore treated	dwt per ton	5.23
Recovery	dwt per ton	5.09
Recovery	percent	92.30

Operations at the mine continue to be adversely affected by cost increased due to inflation and by a severe shortage of experienced labour and suitable manpower for training. Among the main items causing higher costs are increased wage rates and employee benefits, Workmen's Compensation assessments, Ontario Hydro rates, supplies, sales taxes and transportation charges.

The application of long-hole mining to low grade orebodies continued with increasing emphasis during the year. Due to the distances involved from ore passes to shafts, some modifications to standard load-haul-dump methods are being employed. Greater use of ANFO for long-hole blasts has a beneficial effect on costs and is used wherever ground conditions warrant. These major projects undertaken in recent years are already contributing effectively to improved productivity and efficiency of operations.

Employment and Management

The average number of employees was 889: 599 underground and 290 on surface. C. P. Girdwood was general manager.

GOLSIL MINES LIMITED

Golsil Mines Limited was incorporated in June 1959, with an authorized capitalization of 10,000,000 shares of no par value, of which 6,232,118 shares have been issued. The officers and directors were: W. C. Arrowsmith, president and director; A. J. Lewis, vice-president and director; J. A. Murphy, secretary-treasurer. The head office and mine address is Suite 509, 55 York Street, Toronto 1, Ontario.

This gold-silver-lead-zinc property comprising 45 claims is located at Favourable Lake in the South Trout area, approximately 125 miles north of Red Lake. The mine was formerly operated by Berens River Mines Limited which produced $8,801,845 from 560,607 tons of ore milled between 1939 to 1948. Total development footage by Berens River Mines at the time of closure in 1948 was as follows: 22,487 feet of drifts, 15,666 feet of crosscuts, 10,154 feet of raises.

Mining operations progressed from April to September 1969.

SHAFTS, GOLSIL MINES

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
				feet	feet
No. 1	KRL45330	Vertical	3	Surface	1,898
No. 1 winze	KRL45330	Vertical	3	1,700	3,246
No. 2	KRL45333	Vertical	3	Surface	765

Underground operations were suspended in March 1967 when a fire destroyed the building housing the dry and power plant. Development footage completed in 1969 consisted of 180 feet of drifting. Total development footage completed on the property to 31 December 1969 was 23,707 feet of drifts; 16,021 feet of crosscuts and 10,154 feet of raises. Some 15 diamond-drillholes totalling 2,000 feet were completed from underground. The drilling on the 740-foot level located some parallel zones to the north of the main zone.

Employment and Management

The average number of employees was 3; 2 underground and 1 on surface. W. C. Arrowsmith, president, was in charge.

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 shares have been issued. The directors and officers were: D. E. G. Schmitt, president, general manager and director; W. S. Row, vice-president and director; R. V. Porritt, W. G. Brissenden and J. H. Stovel, directors; B. H. Grose, secretary; E. K. Cork, treasurer. The executive office is at 1700 Bank of Nova Scotia Building, 44 King Street West, Toronto 1; the mine address is Pamour.

The property comprises eight claims in Whitney township, Porcupine area, District of Cochrane, adjoining the west boundary of the Pamour Porcupine mine.

Mining and milling continued throughout 1969.

SHAFTS, HALLNOR MINE

	Claim No.	Inclination	No. of Compartments	Collar Depth	Vertical Depth from Surface
				feet	feet
Main shaft	N. ½ lot 7, con. V Whitney twp.	Vertical	3	Surface	3,477
2230 winze	Whitney twp.	45°	2	3,354	3,742
No. 3 shaft	Whitney twp.	Vertical	3	3,198	5,066

Development work in 1969 consisted of 2,497 feet of drifting, 1,140 feet of crosscutting, and 214 feet of raising. Total development footage to 31 December 1969 was as follows: 78,136 feet of drifts; 25,813 feet of crosscuts; 28,615 feet of raises. Diamond-drilling consisted of 134 holes, totalling 25,378 feet from underground and three holes totalling 2,000 feet, from surface.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Development

The major portion of development driving was to explore the 20 veins. On the 30th (4600') level, advance on the vein 573 feet, of which 412 feet was ore. On the 31st (4750') level, advance on the vein was 378 feet, of which 56 feet was ore grade. This drift was not completed.

Stoping

Ore broken in stopes amounted to 121,290 tons and 122,120 tons were trammed. The broken ore reserve at year end was approximately 9,800 tons. Tonnage hoisted in No. 3 shaft from below the 22nd (3350') level amounted to 81 percent of the total as compared with 78 percent for 1968.

The hydraulic fill system conveyed 46,765 tons of classified tailings from the mill to stopes below the 21st (3200') level. In addition, 2,470 tons of development rock was placed for backfill.

Mill

The mill operation was continuous throughout the year. The primary ball mill operated 97.6 percent of the possible running time and averaged 357 tons per day, slightly less than in 1968.

Ore treated was 130,440 tons averaging 0.40 ounces of gold per ton. The recovery was 95.9 percent and production was 49,475 ounces of gold and 2,604 ounces of silver.

From commencement of milling in June 1938 to the end of 1969 the mill treated 3,884,300 tons of ore yielding 1,522,235 fine ounces of gold and 109,914 ounces of silver having a combined value of $55,823,900.

Ore reserves

At 1 January	1970		1969	
	ore tons	gold oz. per ton	ore tons	gold oz. per ton
Above 8th level	10,300	0.25	10,900	0.22
18th to 22nd level	16,200	0.25	1,900	0.23
22nd to 29th level	155,300	0.42	132,600	0.42
Total	181,800	0.39	145,400	0.40

Allowance for normal dilution has been made in the above estimates.

Employment and Management

The average number of employees was 216: 136 underground and 80 on surface. L. S. Brooks was manager.

HOLLINGER MINES LIMITED

Hollinger Consolidated Gold Mines Limited was incorporated in May 1916. The name was changed from Hollinger Consolidated Gold Mines Limited to Hollinger Mines Limited in May 1968. The authorized capitalization was 5,000,000 shares of $5 par value, of which 4,920,000 shares have been issued. The directors and officers were: J. R. Timmins, honorary chairman of the board and director; A. A. McMartin, chairman of the board and director; A. L. Fairley Jr., president, chief executive officer and director; J. A. McDougald, vice-president, chairman of the executive committee and director; N. A. Timmins Jr., vice-president and director; P. C. Finlay, vice-president, treasurer and director; Hon. Edouard Asselin, Duncan McMartin, M. C.

G. Meighen and D. M. Dunlap, directors; C. G. Cowan, secretary; C. B. Ross, general manager of Hollinger and Ross mines. The mine office and head office is at Timmins. The general office is at 44 King Street West, Toronto 1.

The Timmins property operated by the company, consists of 26 claims located in Tisdale township, Porcupine area, District of Cochrane, and includes part of the ground underlying the town of Timmins. The company has numerous holdings and interests. It owns and operates the Ross mine in Hislop township, District of Cochrane.

Hollinger Mine

There were no mining operations conducted on the property during the year. However an average of 79 employees worked on surface under the direction of C. B. Ross, general manager.

Ross Mine

The Ross property comprises 456 acres located in Hislop township. The mine address is Holtyre.

Mining and milling continued throughout 1969.

SHAFTS, ROSS MINE

	Location	Inclination	Number of Compartments	Collar Depth	Sinking 1969	Vertical Depth below Surface
				feet	feet	feet
No. 1 shaft	N. ½ lot 1, con. II, Hislop twp.	Vertical	3	Surface	203	3,113
No. 2 winze	N. ½ lot 1, con. II, Hislop twp.	Vertical	2	291	—	1,526

The main No. 1 shaft was sunk 203 feet in 1969 to a depth of 3,113 feet below the collar. The 3,000-foot level, and 3,072 spill level were established at those depths below the collar.

Development work in 1969 consisted of 481 feet of drifting, 2,561 feet of crosscutting and 1,047 feet of raising. Total development footage to 31 December 1969 was as follows: 51,269 feet of drifts; 50,381 feet of crosscuts; 36,956 feet of raises. Diamond-drilling consisted of 88 holes totalling 20,456 feet from underground.

Major construction in 1969 consisted of an addition to the hoistroom to house a 10 ft. double drum hoist and a buried flume to drain off excess water from the tailings pond.

Added equipment included one motor generator set for the underground trolley and one dump truck on surface.

A total of 149,296 tons of ore was hoisted; 149,338 tons were milled at a daily average of 437 tons per operating day.

Company Annual Report

The following, pertaining to the Hollinger and Ross mines, was taken from the company annual report for the year ending 31 December 1969.

Gold Mining

Bullion production from the Ross mine at Holtyre, Ontario, the company's only operating gold mine, amounted to $855,142 in 1969, compared to $888,570 in 1968. The mill treated 149,338 tons compared to 158,729 during the previous year. A small operating loss, after receipt of Emergency Gold Mining Assistance payments, was incurred by the mine largely as a result of mining ore of lower-than-average grade for a number of months. This course was dictated by the necessity of following a mining sequence and was corrected during the latter part of the year, when recovery per ton increased considerably.

The shaft at the Ross was deepened to the 3,000-ft. level and most of the work connected with the program was completed by the end of the year. Exploratory diamond-drilling on 2,850-ft. level confirmed the downward extension of ore zones. Proven ore reserves at the end of 1969 were estimated at 449,000 tons, having a grade of .1912 oz. per ton. In addition, it is estimated that there were 474,000 tons of probable and possible ore, having a grade of .175 oz. per ton.

It is expected that results will improve in 1970 as the planned recovery per ton will be higher and should approximate the grade of the ore reserve. A moderate operating profit is expected.

The Hollinger mine at Timmins, Ontario has ceased to operate but a small amount of Hollinger ore was mined by McIntyre Porcupine Mines Ltd. on a royalty basis. Income accruing at the Hollinger mine came from royalties and from the sale of company houses, equipment and scrap. There will be additional revenue from these sources in 1970.

The Emergency Gold Mining Assistance Act will expire on December 31, 1970 unless extended by the federal government. Hollinger is lending support to the efforts of the Mining Associations to convince the Canadian government of the need for continued assistance to the gold mining industry. The company also notes that civic groups in gold mining communities are making representations to have the assistance continued because it is needed to support the economy of their areas. The community leaders are to be commended for their efforts. It is hoped that the government will extend the Act because the Ross mine, as an example, could not continue in operation without assistance.

Employment and Management

There were no mining operations carried out at the Hollinger Timmins mine but 79 men were employed on surface. C. B. Ross was general manager.

The average number of employees at the Hollinger Ross mine was 106; 44 underground and 62 on surface. J. J. Caty was resident manager.

KERR ADDISON MINES LIMITED

Kerr-Addison Gold Mines Limited was incorporated in April 1936; in November 1963 on amalgamation of Kerr-Addison Gold Mines Limited, Anglo-Huronian Limited, Bouzan Mines Limited and Prospectors Airways Company Limited, the name was changed to Kerr Addison Mines Limited. On amalgamation in 1968 with Quemont Mines Limited and Normetal Mines Limited the authorized capitalization was increased to 12,500,000 shares of no par value, of which 9,524,449 shares have been issued. The directors and officers were: W. S. Row, chairman of the board and director; J. H. Stovel, president and director; Edward Futterer, vice-president and director; K. C. Gray, A. Powls, J. R. Bradfield, H. H. Leather, J. A. H. Paterson, J. P. W. Ostiguy, R. V. Porritt, W. H. Rea and W. D. Smith, directors; P. H. Kavanagh, vice-president (exploration); B. C. Bone, treasurer, R. D. Stewart, secretary. The head office is at Suite 1600, 44 King Street West, Toronto 1. The mine address is Virginiatown.

The company's main property comprises 53 claims, which includes 19 claims acquired from Chesterville Mines Limited, in McGarry township, Larder Lake area, District of Timiskaming. Operations at the Chesterville property terminated in December 1952.

Mining and milling continued throughout 1969.

SHAFTS, KERR ADDISON MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Total Depth from Surface
				feet	feet
No. 3	T1751	Vertical	5	surface	3,995
No. 4	T2018	Vertical	3	3,850	6,022

Development work in 1969 consisted of 164 feet of drifting, 228 feet of crosscutting, and 812 feet of raising. Total development footage to 31 December 1969 was as follows: 218,014 feet of drifts; 86,480 feet of crosscuts; 170,994 feet of raises. The total footage includes some development work on Chesterville and Arjon properties. Diamond-drilling in 1969 consisted of six holes, totalling 276 feet from underground.

Construction was commenced on a new tailings retaining dam and basin on claim L-26862.

Added equipment included a grizzly feeder model 48 x 168 ins. installed as part of a crushing, screening and conveying section on surface.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

During 1969, 472,865 tons of ore were milled at an average grade of 0.33 ounces of gold per ton, down from 510,474 tons containing 0.36 ounces during 1968. Due to a lack of available working places, the daily milling rate declined from 1,417 tons during the first half to 1,125 tons during the last half of the year. Production was 151,513 ounces of gold compared to 179,943 ounces in 1968.

Gold sales of 83,327 ounces during the first half of the year were sold on the free market at an average price of $46.13 (C.F.) per ounce. Production during the second half, amounting to 68,186 ounces was sold to the Mint at an average price of $37.70 per ounce with an estimated rate of assistance under the Emergency Gold Mining Assistance Act of $8.09 per ounce.

The decreased tonnage treated, the increased tonnage of square-set mining both underhand and overhand, and the decrease in tonnage mined by cut-and-fill and higher labour and material costs were responsible for an increase in costs of 64 cents per ton.

Mining Development and Mining

Drifting, raising and crosscutting totalling 1,272 feet and stoping operations were confined to the Numbers 6, 14, 16 and 21 orebodies between the 1300 and 4600-foot levels.

Ore broken by square-set methods accounted for 53.8 percent of all broken ore, down from 67.9 percent in 1968. Pillar mining represented 32.1 percent of tonnage compared to 38.3 percent in 1968. The amount of underhand square-set mining increased by 27,000 tons over 1968.

A variation in the mining method is being introduced which will eliminate pillars in some areas of transverse square-set stoping operations. New equipment for raising may be introduced which would alter the present method and should reduce the cost of this difficult operation.

Ore Reserves

At the end of 1969, ore reserves including allowance for dilution were as follows:

	Tons	Ounces of Gold per ton
Total ore reserves at the end of 1968	3,249,128	0.463
Total ore reserves at the end of 1969	2,491,848	0.503

Pillars containing 323,000 tons with an average gold content of 0.22 ounces per ton were removed from ore reserves for economic reasons.

Employment and Management

The average number of employees was 684: 467 underground and 217 on surface. W. G. Hargrave was manager.

LAKE SHORE MINES LIMITED
(MacLeod Mosher Division)

MacLeod-Cockshutt Gold Mines Limited was incorporated in September 1933. In June 1967, MacLeod-Cockshutt Gold Mines Limited, Consolidated Mosher Mines Limited, and the former producing Hard Rock Gold Mines Limited were amalgamated to form MacLeod Mosher Gold Mines Limited. In December 1968 Lake Shore Mines Limited took over all assets of MacLeod Mosher on a basis of 1 share of Lake Shore for 4 shares of MacLeod Mosher which became the MacLeod Mosher Division of Lake Shore Mines Limited. All companies are controlled by Little Long Lac Gold Mines Limited interests. The authorized capitalization of Lake Shore Mines Limited was increased to 3,500,000 shares of $1 par value of which 2,901,522 shares have been issued. The directors and officers were: R. C. Stanley, Jr., president and director; J. C. L. Allen, vice-president and director; J. D. Bryce, P. A. Allen and P. K. Hanley, directors; A. G. Wilson, secretary. The head office is at Suite 400, 112 King St. W., Toronto 1. The mine address is Geraldton.

The MacLeod Mosher Division property comprises 61 claims in Ashmore and Errington townships, District of Thunder Bay. Mining and milling progressed from 1 January to 31 December 1969.

SHAFTS, MacLEOD MOSHER MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
				feet	feet
MacLeod					
No. 1	TB10040	Vertical	3	Surface	2,250
No. 2	TB10038	Vertical	4	Surface	1,921
No. 3	TB10040	45°	3	1,571	1,875
Mosher					
No. 1	TB10046	Vertical	3	Surface	2,530
No. 2	TB10065	Vertical	4	Surface	52
No. 3	TB10061	Vertical	3	2,022	3,173

Development work in 1969 consisted of 443 feet of drifting and 188 feet of crosscutting and 13 feet of raising. Total development footage on both properties to 31 December 1969 was as follows: 130,592 feet of drifts; 40,503 feet of crosscuts; 42,851 feet of raises. Five diamond-drillholes totalling 544 feet were completed from underground.

MacLeod Mosher Mines Limited hoisted 492,852 tons of ore which was milled at a daily average of 1,361 tons.

Company Annual Report

The following is taken from the Lake Shore Mines Limited annual report pertaining to the MacLeod Mosher Division for the year ending 31 December 1969.

Production

During the year 492,852 tons of ore were milled yielding 44,294 fine ounces of gold and 4,378 ounces of silver. The total value of this bullion plus $486,670 estimated E.G.M.A. including adjustments for 1967 and 1968 was $2,167,322 for a recovery of $4.40 per ton.

To date the mine has produced 1,847,083.028 fine ounces of gold and 140,051.43 ounces of silver. Total tons milled amounted to 13,541,038 for a recovery of 0.136 ounces of gold per ton.

Mining

Dilution due to caving in the "F" zone reduced the mine grade from 0.129 ounces of gold per ton in 1968 to 0.105 ounces per ton in 1969. Pillar removal was the main cause of the dilution.

Ore Reserves

At December 31, 1969 proven and probable ore reserves were calculated to be 869,873 tons having an average grade of 0.107 ounces of gold per ton (.090 ounces recovered grade). This compares with 977,230 tons having an average grade of 0.129 ounces of gold per ton (0.112 ounces recovered grade) the year before.

Operating Costs

Operating costs for 1969, before provision for depreciation totalled $2,187,284 as compared to $2,229,333 in 1968.

	Cost per ton milled 1969	1968
Development	$ .14	$ .35
Mining	2.33	2.43
Milling	.93	.97
Marketing expenses	.02	.02
General expenses at property	.61	.66
Mine office and supervision	.20	.20
Provincial mining tax	—	.02
Administrative	.21	.15
Total	$4.44	$4.80

Employment and Management

The average number of employees was 185: 105 underground and 80 on surface. P. J. McCarthy was general manager.

MACASSA GOLD MINES LIMITED
(Macassa Division)

Macassa Mines Limited was incorporated in April 1926 and Bicroft Uranium Mines Limited was incorporated in April 1955. In November 1961, the two companies were amalgamated under the name of Macassa Gold Mines Limited with an authorized capitalization of 4,000,000 shares of $1 par value of which 3,043,665 shares have been issued. The directors and officers were: J. D. Bryce, president and director; R. C. Stanley Jr., vice-president and director; M. R. MacPherson, mine manager and director; J. C. L. Allen, P. K. Hanley, C. C. Huston and P. A. Allen, directors; A. G. Wilson, secretary-treasurer; Lyle Sharpe, comptroller. The head office is at Suite 400, 112 King Street West, Toronto 1. The mine address of the Macassa Division is Box 550, Kirkland Lake.

Macassa Division

The Macassa Division property comprises 11 claims in Teck township, Kirkland Lake area, District of Timiskaming.

Mining and milling operations continued throughout 1969.

SHAFTS, MACASSA DIVISION

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth from Surface
				feet	feet
Elliot shaft	L1617	Vertical	2 (inactive)	Surface	523
No. 1 shaft	L2837	Vertical	3	Surface	3,043
No. 1 winze	L2837	Vertical	3	3,000	4,824
No. 2 shaft	L4186	Vertical	3	Surface	4,633
No. 2 winze	L4185	Vertical	3	4,625	6,927

Development work during the year consisted of 3,973 feet of drifting, 164 feet of crosscutting and 1,243 feet of raising. Total development footage to 31 December 1969 was as follows: 180,430 feet of drifts; 56,512 feet of crosscuts; 40,871 feet of raises. Diamond-drilling in 1969 consisted of 72 holes totalling 10,412 feet from underground.

Added equipment included the following:

1 aluminum and steel skip bucket, 40 cu. ft.
1 exhaust fan, model 418, 4,600 cfm.
2 rock drills model S23

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Operating costs

	1969		1968	
	Tons Milled	Ounces Produced	Tons Milled	Ounces Produced
	86,265	41,210	104,408	52,671
	Cost Per Ton	Cost Per Ounce	Cost Per Ton	Cost Per Ounce
Development	$ 3.365	$ 7.044	$ 2.801	$ 5.553
Mining	13.452	28.159	11.926	23.640
Milling	4.212	8.817	3.608	7.152
Undistributed mine operating expense	.922	1.930	.889	1.761
	$21.951	$45.950	$19,224	$38.106
Add:				
Depreciation	.375	.784	.335	.663
Ontario mining tax	—	—	.178	.353
Head office administration	.996	2.086	.821	1.628
	$23.322	$48.820	$20.558	$40.750

Employment and Management

The average number of employees was 242: 157 underground and 85 on surface. M. R. MacPherson was mine manager.

MADSEN RED LAKE GOLD MINES LIMITED

Madsen Red Lake Gold Mines Limited was incorporated in March 1935; in June 1940, the capitalization was reduced to 3,500,000 shares of $1 par value of which 3,499,528 shares have been issued. The directors and officers were: P. H. McCloskey, president and director; H. S. Robinson, vice-president and director; D. W. Falconer, H. H. Mackay and F. W. Hewitt, directors; Miss Margaret Masterson, secretary-treasurer. The head office is at Suite 1109, 55 Yonge Street, Toronto 1. The mine address is Madsen.

The Company's main property comprising 115 claims, is located in Baird and Heyson townships, Red Lake area, District of Kenora, about 7½ miles southwest of the Town of Red Lake.

Mining and milling operations continued throughout 1969.

SHAFTS, MADSEN RED LAKE GOLD MINE

Shaft	Claim No.	Inclination	Number of Compartments	Depth from Surface
				feet
No. 1	KRL11505	Vertical	2 (inactive)	583
No. 2	KRL12528	Vertical	5	4,176

Development work in 1969 consisted of 1,432 feet of drifting, 1,661 feet of crosscutting and 771 feet of raising. Total development footage to 31 December 1969 was as follows: 173,170 feet of drifts; 35,012 feet of crosscuts; 71,072 feet of raises. Diamond-drilling in 1969 consisted of 115 holes, totalling 23,813 feet from underground. Added equipment in 1969 consisted of a diesel locomotive, 38 h.p. at 1700 r.p.m.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December, 1969.

Production

The following figures show the production for 1969 and comparable figures for 1968:

		1969	1968
Gold	oz.	60,579.378	56,196.218
Silver	oz.	10,133.04	10,095.74
Gross value of bullion	$	2,302,950.62	2,141,924.67
Average price gold	$	37.70	37.70
Average price silver	$	1.91	2.30

Under the provisions of Emergency Gold Mining Assistance Act, it is estimated that the Company is entitled to receive $622,000, or $10.27 per ounce compared with $577,400, or $10.27 per ounce in 1968.

Operating Costs

	1969		1968	
Tons milled	238,473		265,268	
Ounces produced	60,579.378		56,196.218	
	Total Cost	Per Ton Milled	Total Cost	Per Ton Milled
Property exploration	$ 32,632.77	$ 0.137	$ 37,691.38	$ 0.142
Mine development	322,199.28	1.352	260,054.65	0.980
Mining	1,172,853.19	4.918	1,265,238.10	4.770
Crushing and conveying	68,799.82	0.288	77,880.77	0.293
Milling	370,609.79	1.554	364,154.32	1.373
General expense	224,243.81	0.940	224,651.97	0.847
Employee benefits	357,490.29	1.499	368,580.70	1.389
Administration expenses	84,590.98	0.355	85,640.93	0.323
Marketing charges	12,763.34	0.054	15,170.27	0.057
	$2,646,183.27	$11.097	$2,699,063.09	$10.174
Deduct: estimated E.G.M.A.	622,000.00	2.608	577,400.00	2.177
Net operating cost	$2,024,183.27	$ 8.489	$2,121,663.09	$ 7.997

Backfill

The deslimed mill tailings placed as backfill amounted to 88,497 tons for a total of 1,887,905 tons to date.

Ore Reserves

The estimated ore reserves for 1969 and comparable figures for 1968 are shown in the following table:

	December 31, 1969			December 31, 1968		
	Tons	Grade	Ounces	Tons	Grade	Ounces
Surface to 11th level	7,000	0.207	1,449	6,860	0.207	1,424
11th to 17th level	162,000	0.291	47,142	90,030	0.228	20,574
17th to 23rd level	109,000	0.234	25,506	239,810	0.287	68,923
23rd to 24th level, #8 zone	50,000	0.350	17,500	.....	....	.....
Total Reserves	328,000	0.279	91,597	336,700	0.270	90,921

The broken ore in cut-and-fill stopes is not included in the above reserve figure.

Ore mined which was not included in the reserve figure and free ore drawn from old workings amounted to 180,000 tons.

Milling

The milling data for the current year, the two previous years, and the total since the commencement of milling operations are shown in the following table:

		1969	1968	1967	Aug. 11, 1938 to Dec. 31, 1969
Treated	ton	238,473	265,268	277,566	7,455,094
Operating time of total time	percent	83.26	91.19	95.42	94.97
Treated per calendar day	ton	653.35	724.78	760.45	650.19
Average gold assay heads	oz.	0.274	0.23255	0.27632	0.31143
Average gold assay tails	oz.	0.02004	0.02070	0.02401	0.01989
Recovery	percent	92.69	91.10	91.31	93.61

Ore Zone Number Eight

This new ore zone located 920 feet north of the shaft was intersected on May 1st by the 24th level crosscut.

Dimensions and grade of the zone on the 24th level are: length 240 feet, true width 35 feet and grade 0.35 ounces per ton.

Ore values were intersected in diamond-drill holes and mine workings over substantial widths for a distance of 750 feet down dip beginning at the 23rd level.

Employment and Management

The average number of employees was 260: 127 underground and 133 on surface. K. R. North was manager.

McINTYRE PORCUPINE MINES LIMITED

McIntyre Porcupine Mines Limited was incorporated in March 1911; in December 1959 the authorized capitalization was increased to 3,000,000 shares without par value, of which 2,390,682 shares have been issued. The directors and officers were: M. A. Cooper, chairman of the board and director; J. K. Godin, president and director; D. L. Bohannan, Norman D'Arcy, A. E. Feldmeyer, F. R. Burton, J. O. Hambro, H. B. Keck, Hon. E. C. Manning, W. M. Keck, Jr., D. G. C. Menzel and G. H. Steer, directors; J. B. Anderson, vice-president (operations), W. T. Kilbourne, vice president (corporate affairs), W. P. Hammond, vice-president (exploration); F. T. McKinney, secretary, and O. J. Shore, treasurer. The head office is at Suite 1200, 55 Yonge Street, Toronto 1. The mine address is Schumacher.

The company has numerous holdings in Ontario, the chief of which is the McIntyre mine, comprising 3,542 acres in Tisdale township, Porcupine area, District of Cochrane. In 1960 Castle-Tretheway Mines Limited was purchased by McIntyre and became the Castle Division of McIntyre which was leased to Siscoe Metals of Ontario Limited and is reported in the SILVER-COBALT section of this report.

The company mine and process gold and copper ore from separate orebodies at the McIntyre mine. Mining and milling of both types of ore progressed from 2 January to 31 December 1969.

SHAFTS, McINTYRE MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical depth from surface
				feet	feet
No. 1	13307	Vertical	3 (inactive)	Surface	307
No. 2	13307	Vertical	2 (inactive)	Surface	183
No. 3	13307	Vertical	2 (inactive)	Surface	183
No. 4	13307	Vertical	2 (inactive)	Surface	998
No. 5	13307	Vertical	(2 to 1,375 ft.) (4 below 1,375 ft.	Surface	2,389
No. 6	13710	Vertical	(3 to 1,000 ft.) (4 below 1,000 ft.)	Surface	3,015
No. 7	13318	Vertical	2 & 3 (inactive)	Surface	989
No. 8	13318	Vertical	2 (inactive)	Surface	288
No. 9	13068	Vertical	2 (inactive)	Surface	204
No. 10	13068	Vertical	2 (inactive)	Surface	185
No. 11 or main	13318	Vertical	5	Surface	4,131
No. 12	—	Vertical	4	3,875	7,111
No. 14	—	Vertical	4	3,750	7,336
No. 15	—	Vertical	4	6,825	8,094
No. 16	—	Vertical	4	5,500	6,848

Development for gold ore during the year consisted of 1,821 feet of drifting and 598 feet of crosscutting. Total development footage for gold ore to 31 December 1969 was as follows: 674,421 feet of drifts; 310,569 feet of crosscuts; 62,412 feet of raises. Development for copper ore in 1969 consisted of 10,789 feet of drifts and crosscuts, 2,162 feet of raises. Total development for copper ore to 31 December 1969 was 96,919 feet of drifts and crosscuts; 29,402 feet of raises. Diamond-drilling in 1969 consisted of 427 holes totalling 49,718 feet from underground and 21 holes. Totalling 11,942 feet from surface.

New construction in 1969 consisted of a ore dump, copper transfer chute and pocket, underground; a new loading chute for copper concentrate; a new garage and a new 12 in. woodstave line to the tailings disposal area.

Added equipment was as follows:

3 pumps, (two-720 u.s. gpm 900' head. one-550 us. gpm. 1250' head)
3 pump motors (two-200 hp. one 250 hp.)
7 motor starters plus associated controls
3 fans with motors and controls, underground (one-50 hp. two-10 hp.)
1 steam jenny, propane fired
1 tractor, diesel mf- 3165
2 trolley motors, 4 tons
18 mine cars, 4½ tons
2 loaders, 912LHD, 2 yd.
1 automatic absorbtion assay unit, model 303

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

During the year 741,440 tons of copper ore was milled from which 10,812,958 pounds of copper, 11,245 ounces of gold and 78,630 ounces of silver were recovered. Gold ore milled totalled 330,670 tons for a production of 92,162 ounces of gold and 9,710 ounces of silver. Value of metals produced was $12,092,000. Operating income after write-offs, and including Emergency Gold Mining Assistance, was $3,724,581. Without Emergency Gold Mining Assistance the gold mine could not operate.

Copper Operations

	1969		1968	
	Total	Per lb. Copper	Total	Per. lb. Copper
Copper, gold and silver produced	$8,573,000	$0.79	$6,203,000	$0.58
Operating costs:				
Mine development and exploration	752,000	.07	730,000	.07
Breaking and stoping	1,616,000	.15	1,321,000	.12
Milling	709,000	.07	675,000	.06
Marketing expenses	1,243,000	.11	1,014,000	.09
Royalty under Ontario Mining Tax Act	242,000	.02	51,000	.01
Depreciation	162,000	.01	150,000	.02
Amortization of preproduction development expenditures	186,000	.02	184,000	.02
	4,910,000	.45	4,125,000	.39
Operating income — copper	$3,663,000	$ .34	$2,078,000	$ .19

Gold Operations

	1969 Total	1969 Per Fine Ounce Gold	1968 Total	1968 Per Fine Ounce Gold
Gold and silver produced	$3,491,000	$37.87	$3,534,000	$37.92
Operating costs:				
Mine development and exploration	370,000	4.01	127,000	1.36
Breaking and stoping	3,102,000	33.67	3,424,000	36.75
Milling	790,000	8.57	736,000	7.90
Marketing expense	15,000	.16	18,000	.19
Municipal and provincial taxes and lease rentals	64,000	.69	61,000	.65
Depreciation	34,000	.37	60,000	.64
	4,375,000	47.47	4,426,000	47.49
Deduct Emergency Gold Mining Assistance	945,000	10.25	960,000	10.30
	3,430,000	37.22	3,466,000	37.19
Operating income — gold	$ 61,000	$ .65	$ 68,000	$ .73
Total operating income: copper and gold	$3,724,000		$2,146,000	

Copper Ore Reserves

	1969 Tons	1969 Copper Tons	1969 Copper Percent	1968 Tons	1968 Copper Tons	1968 Copper Percent
Defined by drilling	3,684,767	27,032	0.73	3,582,500	28,377	0.79
Broken	652,645	4,762	0.73	447,730	3,539	0.79
	4,337,412	31,794	0.73	4,030,230	31,916	0.79

Gold Ore Reserves

	1969 Tons	1969 Fine Ounces Gold	1968 Tons	1968 Fine Ounces Gold
Estimated in place	648,000	217,255	629,900	207,840
Broken ore	38,950	9,412	42,000	9,910
	686,950	226,667	671,900	217,750
Average grade per ton		.330		.324

Employment and Management

The average number of employees was 691; 414 underground and 277 on surface. A. A. Adamson was mine manager.

PAMOUR PORCUPINE MINES LIMITED

Pamour Porcupine Mines Limited was incorporated in March 1934 with an authorized capitalization of 5,000,000 shares of no par value; all shares have been issued. The directors and officers were: D. E. G. Schmitt, president, general manager and director; W. S. Row, vice-president and director; R. V. Porritt, P. D. P. Hamilton, J. H. Stovel, Edward Futterer and K. C. Gray, directors; B. H. Grose, secretary; B. K. Cork, treasurer. The executive office is at 1700 Bank of Nova Scotia Building, 44 King Street West, Toronto 1. The head office and mine office is at Pamour.

The company's main property, totalling 42 claims is in Whitney and Murphy townships, Porcupine area, District of Cochrane. It includes the former LaPalme Porcupine, Three Nations and Porcupine Grande properties.

Mining and milling continued throughout 1969.

SHAFTS, PAMOUR MINE

	Claim Number	Inclination	Number of Compartments	Collar Depth	Vertical Depth from Surface
				feet	feet
No. 1 shaft	P13793	Vertical	2 (inactive)	Surface	220
No. 2 shaft	P13793	Vertical	2 (inactive)	Surface	110
No. 3 shaft	P13783	Vertical	5	Surface	3,144
No. 4 shaft	Porc. Grande	Vertical	3	600	2,437
No. 5 shaft	N. Whitney claim	—60°	1	Surface	60
No. 6 shaft	N. Whitney claim	Vertical	2	Surface	120
No. 7 shaft	N. Whitney claim	Vertical	2	Surface	250

Development work during the year consisted of 3,639 feet of drifting, 1,954 feet of crosscutting, and 4,100 feet of raising. Total development footage to 31 December 1969 was as follows: 197,340 feet of drifts; 51,763 feet of crosscuts; 140,590 feet of raises. Some 256 diamond-drillholes totalling 41,683 feet were completed from underground.

A sewage lagoon was excavated on the property and a scooptram with 5 yard bucket was installed on the 1,600 foot-east level.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969:

Lateral development consisted of 2,200 feet of exploration in lava formations, 1,651 feet in east greywacke and 89 feet in conglomerate.

In the east end of the mine 230 feet of the drifting was in ore averaging 0.13 oz. gold per ton over drift width.

Stoping

Stoping was carried on in the east and west sections of the mine with the former accounting for 89 percent of the tonnage mined. About 20 percent was mined from lava formations. Long-hole stopes produced 56 percent of the ore milled, shrinkage stopes 36 percent, flat-dipping slusher stopes 5 percent and cut-and-fill stopes 3 percent.

Ore Reserves

Estimates to proven ore reserves at the 1st of January 1970, including allowances for normal dilution were:

Broken:

	Tons	Gold Oz./Ton	Tons	Gold Oz./Ton
East end	419,190	0.103		
West end	113,670	0.092	532,860	0.100
In Place:				
East end	827,840	0.123		
West end	210,560	0.202	1,038,400	0.139
Totals:				
East ore	1,247,030	0.116		
West ore	324,230	0.163	1,571,260	0.126

After milling 621,940 tons, proven ore reserves decreased by 29,440 tons. The grade increased by 0.01 oz./ton.

Mill

		1969	1968
Milled	ton	621,940	624,495
Milled per calendar day	ton	1,704	1,706
Average gold content	oz/ton	0.147	0.124
Average tailings loss	oz/ton	0.008	0.009
Total recovery	percent	94.6	92.4
Gold production	oz	86,420	71,400
Value of total production	$	3,543,100	2,731,900

Employment and Management

The average number of employees was 338: 184 underground and 154 on surface. L. S. Brooks was manager.

PANGO GOLD MINES LIMITED

Pango Gold Mines Limited was incorporated in October 1959 with an authorized capitalization of 6,000,000 shares of no par value of which 1,650,005 shares have been issued. The directors and officers were: Stephen Kay, president and director; J. M. Maguire, secretary-treasurer and director; J. L. Tindale, Bruce Attenborough and W. L. S. Trivett, directors. The head office is at Suite 1601, 8 King Street East, Toronto 1; the mine address is Box 617, Wawa.

Prado Explorations Limited and Surluga Gold Mines Limited entered into a joint agreement on 1 March, 1969 to conduct an extensive exploration program on the Surluga property. The new company was named Pango Gold Mines Limited and Prado would acquire a 65 percent interest in the property when $650,000 was expended on exploration work and if production was resumed Surluga would receive 35 percent of the net profits. Pango staked additional claims to a total of 396 in Townships 28 and 29, Range 23/24, and Township 30, Range 22 in the District of Algoma, some two miles east of Wawa.

Mining operations at the property progressed from 1 March to 31 December 1969.

Development footage completed in 1969 consisted of 3,532 feet of drifts, 3,500 feet of crosscuts and 165 feet of raises. Total development footage to 31 December

1969 was as follows: 10,302 feet of drifts, 7,989 feet of crosscuts, and 2,490 feet of raises. Diamond-drilling during the year consisted of 308 holes totalling 34,781 feet from underground and 53 holes totalling 29,724 feet from surface. See Surluga Gold Mines Limited in this report for further information.

Added equipment comprised a battery locomotive, 3½ ton.

A total of 2,598 tons of ore from development drifting and crosscutting was hoisted and stockpiled.

Employment and Management

The average number of employees was 37: 16 underground and 21 on surface. C. J. Kuryliw was manager.

RENABIE MINES LIMITED

Renabie Mines Limited was incorporated in January 1941, with an authorized capitalization of 1,500,000 shares of $1 par value, of which 1,050,005 shares have been issued. The company is a subsidiary of Macassa Gold Mines Limited. The officers and directors were: John D. Bryce, president and director; R. C. Stanley Jr., vice-president and director; P. K. Hanley, J. C. L. Allen, P. A. Allen and C. C. Huston, directors; D. M. Lorimer, comptroller, A. G. Wilson, secretary-treasurer. The head office is at Suite 400, 112 King Street West, Toronto 1. The mine address is Renabie.

The property comprises 33 claims, about 886 acres, located in Rennie, Leeson, Brackin and Stover townships, District of Sudbury.

Mining and milling continued throughout 1969.

SHAFTS, RENABIE MINE

Shaft	Claim No.	Inclination	Number of Compartments	Total Depth below Surface
				feet
No. 1	S34314 (Leeson twp.)	Vertical	3	281
No. 2	S34317 (Leeson twp.)	Vertical	3	3,514

Development work during the year consisted of 1,104 feet of drifting, 1,770 feet of crosscutting, and 605 feet of raising. Total development footage to 31 December 1969 was as follows: 46,867 feet of drifts; 25,007 feet of crosscuts; 30,476 feet of raises. Diamond-drilling in 1969 consisted of 37 holes, totalling 12,790 feet from underground.

Major construction in 1969 consisted of the remodelling of four houses in the company townsite.

Major equipment included one dozer, caterpillar D6B, with semi-automatic controls, for the mill.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Production

The following figures show the production for 1969 with comparable figures for 1968 and 1967:

		1969	1968	1967
Gross recovery	$	1,113,700	1,393,115	1,723,591
Milled	ton	138,540	171,452	171,729
Recovery per ton	$	8.04	8.13	7.42

The average Mint Settlement value per ounce of gold was $37.67, compared to $37.68 in 1968. The average price for silver was $1.94 per ounce. Under provisions of the Emergency Gold Mining Act, it is estimated that the Company is entitled to receive $298,700 for the year, which is $2.15 per ton milled, or $10.27 per ounce recovered, compared to $381,320 for 1968.

Milling

The average tons milled per day in 1969 was 380 tons compared to 468 tons in 1968. Bullion recovery comprised 29,085.49 ounces of gold, and 9,257.95 ounces of silver. Recovery for the year averaged 94.8 percent.

No further work has been done on the semi-automatic density control system for the grinding circuit, due to a shortage of mechanics and all projects cancelled in September are on a salvage basis.

Ore Reserves

The position of the ore reserves at the year end after allowing for dilution and without including any ore below the 2600-foot level were as follows:

	Tons	Ounces Per Ton
Unbroken ore	58,280	0.235
Broken ore	42,745	0.191
Total	101,025	0.204

Operating Costs

The operating and other costs per ton and per ounce of gold recovered were as follows:

	1969		1968	
	Tons Milled	Ounces Recovered	Tons Milled	Ounces Recovered
	138,540	29,085.49	171,452	36,196.20
	per ton	per ounce	per ton	per ounce
Development and exploration	$2.45	$11.68	$1.88	$8.91
Mining	4.29	20.45	4.03	19.09
Milling	3.23	15.35	3.02	14.29
Undistributed operating charges including administration and head office	1.27	6.05	.99	4.72
Operating costs	11.24	53.53	9.92	47.01
Depreciation	.67	3.21	.55	2.61
Provision for taxes	.07	.33	.07	.32
	$11.98	$57.07	$10.54	$49.94

Employment and Management

The average number of employees was 157: 75 underground and 82 on surface. C. S. Green was mine manager.

SURLUGA GOLD MINES LIMITED

Surluga Gold Mines Limited was incorporated in March 1962 with an authorized capitalization of 5,000,000 shares of no par value, increased to 6,000,000 in 1968, of which 4,984,000 shares have been issued. The directors and officers were: W. D. Sutherland, chairman of the board and director; J. S. Hazell, president and managing director; Robert Davies, secretary and director; Richard Meyer, treasurer and director; N. J. Coolidge, T. R. Coolidge, R. H. Poole and W. D. Burden, directors. The head office and mine address was P.O. Box 617, Wawa.

The property comprises 74 claims in Township 29, Range 23, District of Algoma, about two miles east of Wawa and less than a mile from the paved Wawa-Hawk Junction highway. It also includes the former Minto and Jubilee properties.

Mining operations progressed from 1 January to 28 February 1969; milling from 1 January to 21 February 1969 with mining operations resumed on 1 March by Pango Gold Mines Limited.

The vertical, three compartment No. 1 shaft, located in claim SM59662 has a depth of 960 feet below the shaft collar. The 4th and 6th levels were established at depths of 542 and 802 feet below the collar.

Development work in 1969 comprised 159 feet of drifting and 352 feet of raising. Total development footage completed to 28 February 1969 was as follows: 6,759 feet of drifts, 4,488 feet of crosscuts and 2,325 feet of raises. Some 16 diamond-drillholes totalling 2,036 feet were completed from underground.

Surluga Gold Mines Limited encountered financial difficulties towards the end of February and was forced to suspend milling operations. Early in March control of the property was acquired by Prado Explorations Limited, and is included in this report under Pango Gold Mines Limited.

The milling plant purchased from Chimo Gold Mines Limited near Val d'Or, Quebec, had been transported and installed.

A total of 8,918 tons of ore was hoisted. The mill operated from 1 January to 21 February 1969, treating 7,994 tons at a daily average of 150 tons during the period of operation.

Employment and Management

The average number of employees was 114: 35 underground and 79 on surface. J. S. Hazel, president was in charge.

UPPER BEAVER MINES LIMITED

Upper Beaver Mines Limited was incorporated in May 1964, with an authorized capitalization of 60,000 preferred and 40,000 common shares each of $1 par value; 60,000 preferred and 3 common shares have been issued; it is a subsidiary company of Upper Canada Mines Limited. The directors and officers were: T. J. Day, president and director; J. W. McBean, vice-president and director; G. F. Day, director; K. H. Larkin, secretary-treasurer. The head office is at Suite 600, 250 University Avenue, Toronto 1; the mine address is Dobie.

The property consists of 37 claims in Gauthier township and 16 claims in McVittie township, Kirkland-Larder Lake area, District of Timiskaming, about six miles northeast of the Upper Canada mine site.

The mine operated throughout 1969.

SHAFTS, UPPER BEAVER MINE

Shaft	Claim No.	Inclination	Compartments	Collar Depth	Sinking 1969	Vertical Depth from Surface
				feet	feet	feet
No. 1	2586	Vertical	2	Surface	—	102
No. 3	2587	Vertical	2	Surface	56	605
Winze	2587	Vertical	2	500	—	1,290

Development work during the year consisted of 2,106 feet of drifting, 1,619 feet of crosscutting and 697 feet of raising. Total development footage to 31 December 1969 was as follows: 27,690 feet of drifts; 17,919 feet of crosscuts; 1,988 feet of raises. Diamond-drilling in 1969 consisted of 127 holes, totalling 27,698 feet from underground.

A total of 62,297 tons of ore was hoisted and milled at a daily average of 171 tons.

Company Annual Report

See Upper Canada Mines Limited for further information contained in that company's annual report for the year ending 31 December 1969, which pertains to the Upper Beaver mine.

Employment and Management

The average number of employees was 87: 78 underground and 9 on surface. J. H. Botsford was general manager at the Upper Beaver and Upper Canada operations.

UPPER CANADA MINES LIMITED

Upper Canada Mines Limited was incorporated in April 1929, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 3,499,827 shares have been issued. The directors and officers were: T. J. Day, president and director; J. W. McBean, vice-president and managing director; J. H. Botsford, general manager and director; K. H. Larkin, secretary-treasurer and director; E. T. Donaldson, J. A. W. Brown, and G. F. Day, directors. The head office is at Suite 600, 250 University Avenue, Toronto 1. The mine address is Dobie.

The company's property comprising 51 claims is located in Gauthier township, Kirkland Lake area, District of Timiskaming.

Mining and milling continued throughout 1969.

SHAFTS, UPPER CANADA MINE

Shaft	Claim No.	Inclination	Number of Compartments	Vertical Depth below Surface
				feet
No. 1	L6314	Vertical	3 and 4 (1,750-3,625 ft.)	6,296
No. 2	L6321	Vertical	3	1,877

During the year, 1,619 feet of drifting, 1,865 feet of crosscutting and 2,432 feet of raising was completed. Total development footage to 31 December 1969 was as follows:

170,091 feet of drifts; 43,770 feet of crosscuts; 50,452 feet of raises. Some 134 diamond-drillholes, totalling 24,159 feet were drilled from underground.

Major construction comprised an addition to mill, 32 x 23 feet, frame construction.

Added equipment consisted of the following:

1 sinking hoist, 42 x 30 ins.
4 Mancha trammer batteries
1 truck, five ton
1 diesel locomotive, 25 H.P.
1 autoloader, 2TG
1 ball mill, 8 x 5 ft.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

The net value of metals from the Upper Canada and Upper Beaver mines was $2,964,056.00. Cost Aid amounted to $406,373.00, making a total revenue from mining operations of $3,370,429.00, compared with $3,643,806.00 in 1968.

The Upper Canada mine produced 127,573 tons, grading $11.96 per ton at $35.00 gold; Upper Beaver mine produced 62,297 tons averaging 1.29 percent copper and $8.41 per ton in gold.

Summary of Gross Production

	Gold Oz.	Silver Oz.	Copper Lb.
Upper Canada mine	39,549.683	13,849.46	———
Upper Beaver mine	13,612.782	9,191.26	1,530,999
Total	53,132.465	23,040.72	1,530,999

Summary of Prices Received for Metals

	Gold Oz.	Silver Oz.	Copper Lb.
Upper Canada mine	$37.68	$1.92	———
Upper Beaver mine	42.25	1.92	$0.707

Upper Canada mine received an additional $10.275 per ounce of gold in Cost Aid.

Upper Canada Mine

Mine production of 127,573 tons at $11.96 is 18,734 tons lower than in the preceding year, due to the acute shortage of labour which affected every stage of the operation.

As reported in the preceding annual report, deep diamond-drilling below the 6150 level indicated that the 'L' zone orebodies re-occurred with no decrease in grade.

Preparations for deepening No. 1 shaft an additional 900 feet to establish 6 new levels to the 7050 ft. horizon were completed during the year, but because of the uncertain future of Cost Aid, and the sharp drop in the free market price of gold, this project has been indefinitely postponed.

Also for economic reasons, development of 'C' zone below the 2750 ft. level is postponed, although deep diamond-drilling to gain more information on this area is continuing.

Mine Production

	Tons	Grade	Value
Surface-1750	———	———	———
1750-2750	23,363	$ 8.93	$ 208,712.00
2750-3625	4,600	10.60	48,762.00
3625-4800	22,077	11.70	258,209.00
4800-6300	77,533	13.03	1,010,106.00
Total mine	127,573	$11.96	$1,525,789.00

Upper Beaver Mine

The lower levels continued to respond favourably to exploration and development. In order to increase the rate of development and to provide for additional mill tonnage, a 750 cfm. compressor was installed, an ore pass system was provided at the No. 1 shaft, and the surface changehouse was enlarged.

Mine Production

		Grade	
Level	Tons	Gold	Percent Copper
80	629	$12.46	.32
200	20,115	9.45	1.24
350	18,944	7.52	1.38
500	3,841	8.50	1.35
625	4,757	8.57	1.04
750	3,855	8.42	1.11
875	3,381	7.91	2.10
1000	674	4.82	1.57
1125	4,343	8.25	1.09
1250	1,758	6.87	.87
TOTAL	62,297	$ 8.41	1.29

Milling

The Upper Canada gold circuit averaged 349.5 tons per day. Mill heads were $11.96, tails were $0.901 and recovery was 92.47 percent. The mill operated 90.48 percent of total possible running time.

The Upper Beaver flotation circuit averaged 170.7 tons per day, producing 3,072.56 dry tons of concentrate grading 3.91 ounces of gold per ton, 2.48 oz./ton silver and 24.91 percent copper. An additional 1,606.087 ounces of gold were recovered from treatment of flotation tailings in the Upper Canada cyanide circuit. Recovery was 94.04 percent of the gold and 95.30 percent of the copper. The mill operated 94.90 percent of total possible running time.

In preparation for handling increased tonnage from the Upper Beaver mine, a 5 x 8 foot Hardinge mill was installed, replacing a 5 x 6 foot tube mill formerly used on the Upper Canada gold circuit before Upper Beaver was put into production. This grinding unit can now be returned to the Upper Canada circuit to increase production or extraction.

Employment and Management

The average number of employees was 271: 175 underground and 96 on surface. J. H. Botsford was general manager.

WILMAR MINES LIMITED

Wilmar Mines Limited was incorporated in September 1958 with an authorized capitalization of 3,000,000 shares of .95c par value; of which 2,850,000 shares have been issued. The directors and officers were: J. E. J. Fahlgren president and general manager; E. C. Cochenour and G. T. Smith, vice-presidents and directors; M. C. Mosher and S. J. Zacks, directors; J. B. McLellan, secretary. The head office and mine address is Cochenour.

The property comprises 675 acres adjoining the Cochenour Willans property in Dome township, Red Lake area, District of Kenora and is controlled by Cochenour Willans Gold Mines Limited.

The vertical, four compartment winze located in claim KRL 8583 was collared 1,265 feet below the collar of Cochenour No. 1 shaft; it is 816 feet deep and reaches a depth of 2,081 feet below surface.

Development work in 1969 consisted of 602 feet of drifting, 626 feet of crosscutting and 940 feet of raising. Total development footage to 31 December 1969 was as follows: 8,623 feet of drifts, 6,393 feet of crosscuts and 2,372 feet of raises. Some 98 diamond-drillholes totalling 11,457 feet were completed from underground.

A total of 45,068 tons of ore was hoisted and milled at an average of 123 tons per working day in the Cochenour mill.

Company Annual Report

See Cochenour Willans Gold Mines Limited, for further information contained in that company's annual report for the year ending 31 December 1969, which pertains to Wilmar Mines Limited.

Employment and Management

J. E. J. Fahlgren was president and general manager, and the operation was carried on by the Cochenour Willans organization.

IRON ORE

The output of iron ore has increased by 24.1 percent from 8,475,218 short tons in 1965 to 10,516,786 short tons in 1969. With the exception of a slight drop in production during 1966, the iron ore production has been increasing steadily.

Ontario's iron ore production in the 1962-1966 period averaged 21.4 percent of Canada's total iron ore output.

In 1969, the Ontario's iron ore output represented 26.2 percent of the Canadian total. In 1968 and in 1967, Ontario share in the Canadian production of iron ore was 23 percent and 20.4 percent, respectively.

The value of Ontario's iron ore output rose steadily from $91.7 million in 1966 to $99.9 million in 1967, $127.1 million in 1968 and $128.2 million in 1969. The total value of iron ore extracted in Ontario since the inception of mining in the Province to December 31, 1969 amounted to $1,235,606,001. Nearly 60 percent of the 1969 production came from the Rainy River, Kenora and Sudbury districts.

The rapid development of the iron ore mining industry in Ontario to its present position is largely due to the introduction of the iron ore pelletizing process. A major advantage of the pelletizing process is that it makes possible the utilization of low grade ores. The iron ore pellet permit smooth and predictable furnace operation and is a significant factor in reducing costs of pig iron.

Total number of employees in the iron ore mining industry in Ontario decreased to 3,359 in 1969 from 3,485 in 1968 or by 3.62 percent and the total payroll decreased to $27,017,292 from $27,024,063 or by 0.03 percent.

THE ALGOMA STEEL CORPORATION LIMITED

In October 1960, Algoma Ore Properties Limited, Algoma Steel Corporation Limited and Canadian Furnace Company Limited were amalgamated under the name of The Algoma Steel Corporation Limited. The authorized capitalization is 30,199,760

shares of no par value, of which 11,608,434 shares have been issued. The directors and officers were: D. S. Holbrook, president, chairman and director; Douglas Joyce, vice-president (operations) and director; J. B. Barber, vice-president (finance) and director; M. McMurray, Sir Phillip Dunn, Ross Dunn, G. W. Humphrey, T. R. McLagan, W. E. McLaughlin, M. C. G. Meighen, Egon Overbeck, J. D. Barrington, Ulrich Petersen, and Gerhard Wagner, directors; D. M. Farrell, secretary; C. E. McClurg, treasurer. The head office is at 503 Queen Street East, Sault Ste. Marie.

ALGOMA ORE PROPERTIES DIVISION

The Algoma Ore Properties Division holds various iron properties in the Algoma District, including the formerly operated Helen mine, the George W. MacLeod mine and the Sir James mine, three miles east of the Helen, the Ruth and Lucy mine, and the Goudreau Pyrite property. The mines (excluding the Goureau Pyrite property) and the sintering plant, are at Wawa.

George W. MacLeod Mine

This property consists of 14 claims in Township 29, Ranges 23 and 24, District of Algoma. Mining operations continued from 1 January to 31 December 1969, except for lost time due to strike action from 2 August to 9 November.

SHAFTS, GEORGE W. MACLEOD MINE

	Claim No.	Inclination	Number of Compartments	Vertical Depth from Surface
				feet
No. 5	DJ24	Vertical	3	2,066
Ropeway	DJ24, 25, 30, 31	—22°	1	1,827

During 1969 a total of 7,629 feet of drifting, 1,364 feet of crosscutting and 2,602 feet of raising was completed. Total development footage to 31 December 1969 was as follows: 164,653 feet of drifts; 46,091 feet of crosscuts; 62,355 feet of raises. Some 23 diamond-drillholes, totalling 4,750 feet were completed from underground.

Major added equipment included the following:

2 drills, rock MSU 123
1 crane 20 ton capacity
1 dust collector, filter bag, 10,000 cfm.
1 fan, 110 inch, 50 cfm.
1 lubrication system.

A total of 1,877,105 n. tons of ore was hoisted and conveyed.

Sir James Mine

There was no production from the open pit mine in 1969.

Ruth and Lucy Mine

The property comprises 47 claims in Townships 28 and 29, Range 24, District of Algoma.

The Ruth and Lucy mine is located about 3.5 miles east of the Sir James open pit. A road has been built to the Ruth open pit where only diamond-drilling has been carried out so far. The Lucy open pit ore is trucked in 50-ton Euclid trucks to the Sir James plant where it is crushed and then transported by rail to the ore preparation and sinter plant in Wawa.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 2 August to 9 November.

A total of 331,146 n. tons of ore was broken and trucked to the Sir James plant.

Goudreau Pyrite

The property consists of 16 claims, located in Township 27, Range 26, in the Sault Ste. Marie mining divisions and includes the Rand No. 1 and Bear "A" and "C" groups of claims.

There was no operation at the property in 1969.

The total ore production from the George W. MacLeod, Ruth and Lucy mines was 2,208,250 net tons. The siderite iron ore is concentrated, sintered and screened before shipment to the steelplants. Most of the final product is shipped by rail and water to the Corporation's plants at Sault Ste. Marie and Port Colborne.

The sintering plant of the Division, located at Wawa, operated a total of 240 days during 1969 producing 319,618 net tons of sinter.

STEELWORKS DIVISION

The blast furnace section of the Division is located at Sault Ste. Marie. Operations continued throughout 1969 except for time lost due to strike action from 3 August to 5 November.

PRODUCTION OF IRON, STEELWORKS DIVISION

Furnace	1969 Days of Operation	1969 Production	1968 Days of Operation	1968 Production
		net tons		net tons
No. 3	202	199,802	255	224,851
No. 4	269	226,020	320	258,566
No. 5	265	511,330	362	763,023
No. 6	254	564,249	364	825,638
Total		1,501,401		2,072,078

The blast furnaces treated a total of 2,276,768 net tons of ore at a daily average of 8,464 tons and produced 1,501,401 net tons of pig iron.

CANADIAN FURNACE DIVISION

The Canadian Furnace Division, comprising a blast furnace and the ancillary equipment necessary to produce pig iron, is located at Port Colborne.

The blast furnace operation was continuous throughout 1969 and produced malleable, foundry, silvery, modular and basic pig iron in the various forms requested by the foundry industry. The company's operation as a supplier was improved with more shipments made outside Canada.

Notable changes during the year were the increased use of beneficiated material in the burden, extended period of injected fuel in the form of natural gas, and the treatment of water from the gas cleaning equipment to meet the Ontario Water Resources specifications.

The blast furnace processed a total of 341,565 net tons of ore at a daily average of 936 tons to produce 206,891 net tons of basic or pig iron.

Company Annual Report

The following is taken from the corporation annual report for the year ending 31 December 1969.

Sales

Shipments of steel products at 1.2 million tons were low as a result of the shutdown and the major portion of the decline was in export shipments which were approximately 54 percent lower at 151 thousand tons; off-shore shipments were again negligible. Demand for steel products was strong throughout the year and, although there is little possibility of recovering business lost because of the shutdown, estimated at over 300 thousand tons of steel products, orders on hand at the end of the year represented more than double the backlog at the start of the year.

Sales of pig iron increased slightly with higher shipments into the Canadian market where there were more settled labour conditions at customers' plants. Sales of Algoma Sinter were again entirely to customers in the United States and amounted to 112 thousand gross tons.

Base prices of rolled steel products were increased and there were minor revisions in freight allowances and extras; in some cases the increases represented the first for a number of years. The price realized for steel products sold rose from $126.98 per ton in 1968 to $129.39 in 1969.

Algoma co-operated in a study by the Federal Prices and Incomes Commission of price and cost increases in the Canadian steel industry but the Commission's Report has not been released at the date of printing this report. The industry has acted with great restraint on prices and in the last 10 years the percentage increase in the average price of Algoma's steel products, including increases to the end of 1969, has been less than one-sixth of the percentage increase in the hourly cost of labour.

The Algoma Central and Canadian Pacific railways conducted tests on performance in their operations of high-chrome rails produced by Algoma and preliminary results indicate that these rails have greatly improved resistance to wear compared to carbon steel rails now in use.

Production in 1969 and 1968 was:

		1969	1968
		(thousands of tons)	
Algoma Sinter	gross tons	1,142	1,723
Coal	net tons	2,301	2,253
Coke	net tons	1,226	1,523
Iron	net tons	1,705	2,189
Raw steel	net tons	1,725	2,261

The effect of the three-month shutdown of the Steelworks and Algoma Ore Division is apparent from the declines in production at those divisions.

Ore from properties owned and leased was again the major source of iron and almost 92 percent of the ore charged into the blast furnaces was from these properties. Use of an increased proportion of iron pellets and injection of natural gas into the furnaces improved output and reduced coke rates.

Further steps were taken to improve the quality of air and water discharged from operations by the establishment of an Environmental Control Group and development of a long term control program under which expenditures could amount to approximately $20 million through the mid-1970's. These expenditures will not produce any earnings and, in fact, there will be a net cost involved in the operation of the equipment. The corporation and other Canadian companies are pressing the Federal Government to institute an incentive for expenditures for the control of air quality similar to the rapid write-off applicable to facilities for the control of water quality.

At the Algoma Ore Division, 1.7 million tons of ore were extracted from the George W. MacLeod underground mine and 296 thousand tons from the Ruth and Lucy open pit mine; almost 94 percent of the sinter produced from this ore was used in the Corporation's blast furnaces.

Employment and Management

The average number of employees at the mines and sinter plant of the Algoma Ore Properties Division was 597: 147 underground and 450 on surface. D. Joyce, vice-president, operations, and J. E. Worley general superintendent were in charge.

The average number of employees at blast furnaces of the Steelworks Division, Sault Ste. Marie was 335. W. P. Dowhaniuk was superintendent.

The average number of employees at the Canadian Furnace Division of the company was 144. R. Fabbro was superintendent.

BETHLEHEM CHILE IRON MINES COMPANY
(Marmoraton Mining Company Division)

Marmoraton Mining Company Division is a wholly owned subsidiary of Bethlehem Chile Iron Mines Company formerly Bethlehem Steel Corporation. The officers were: E. P. Leach, president and director; H. Olsen, manager, Marmoraton Mining Company Division. The head office and mine offices are at Marmora.

The company owns iron properties in Marmora, Sophiasburgh, Hallowell and Rawdon townships, County of Hastings, a short distance east of Marmora.

Mining and milling continued throughout 1969.

The company maintained an average daily production of 1,500 tons of 65 percent iron pellets. Some 1.4 million tons of crude ore was mined and 3.8 million tons of stripping was removed in conjunction with the pit expansion. All the blasted ore and waste is trucked from the open pit using a fleet of 55 and 65 ton trucks. In 1970 the mine plans to replace all the 55 ton trucks with six new 105 ton trucks.

An aluminum sensitized slurry blasting agent of variable strength and density was successfully introduced early in the year and now all primary blasts are made using the slurry.

A total of 1,382,219 net tons was mined in the open pit; the mill treated 962,948 net tons of ore averaging 2,838 net tons per working day and produced 516,856 net tons of pellets.

Employment and Management

The average number of employees was 322: 96 in the open pit and 226 on surface. R. M. McCann, general superintendent was in charge.

CALAND ORE COMPANY LIMITED

Caland Ore Company Limited was incorporated in November 1957; it is a wholly owned subsidiary of the Inland Steel Company of Chicago. The officers were: C. B. Jacobs, president; W. B. Cummings, treasurer and assistant secretary; J. C. Carter, secretary. The head office is at 30 West Monroe Street, Chicago 3, Illinois 60603. The mine address is Atikokan.

The property consists of 48 claims, in Schwenger and Freeborn townships, District of Rainy River, of which 35 are held on a 99-year lease from Steep Rock Iron Mines Limited. The lease covers a section of the C orebody at the east end of Steep Rock Lake.

Mining and milling operations continued throughout 1969 except for lost time due to strike action from 4 May to 22 June.

The Falls Point mine is serviced by the vertical, eight-compartment shaft 1,333 feet deep, located on claim FF3513.

All underground work was suspended in December 1961. The total development footage at that time was as follows: 205 feet of drifts; 5,171 feet of crosscuts; 976 feet of raises on the 800, 1,000 and 1,200-foot levels. Some 16 diamond-drillholes totalling 6,672 feet were drilled from surface in 1969.

Added equipment in 1969 consisted of a Euclid truck, 65 ton capacity.

All production in 1969 was from the open pit and consisted of 2,118,440 net tons which was processed at a daily average of 14,812 net tons during the period of operation.

Employment and Management

The average number of employees was 386: 96 in the open pit and 290 on surface. P. P. Ribotto, vice-president, was in charge at the property.

DOMINION FOUNDRIES AND STEEL LIMITED

Dominion Foundries and Steel Limited was incorporated in May 1917; the authorized capitalization was increased to 25,000,000 common shares of no par value and 500,000 preferred shares of $100 par value; 15,478,762 common and 228,720 preferred shares have been issued. The officers of the company were: F. H. Sherman, president, chief executive officer and director; R. R. Craig, executive vice-president (commercial); J. G. Sheppard, executive vice-president (financial); D. F. Hassel, vice-president (industrial relations); D. O. Davis, vice-president (engineering); D. A. Lindsay, vice-president (purchasing); W. C. Hassel, vice-president (works-manager); F. J. McMulkin, vice-president (research); W. J. Stewart, vice-president (product quality); D. M. Cauley, secretary; T. Van Zuiden, Treasurer.

Sherman Mine

The Sherman mine is a joint venture in which Dominion Foundries and Steel Limited of Hamilton owns 90 percent and Tetapaga Mining Company owns 10 percent. It is managed by Cliffs of Canada Limited. The head office and mine address is Box 217, Timagami.

The property comprising 200 claims is located in Briggs and Chambers townships Timagami area, District of Nipissing.

Open pit mining, concentrating and pelletizing continued throughout the year.

A flotation section was added in the concentrator building to increase recovery and to lower the silica content. An X-ray spectrometer sampling unit was purchased and installed, which supplies automatically iron and silica percentage content of the samples submitted. The developing, implementing and monitoring of a blasting control program has been started in order to minimize or eliminate blasting damage or complaints. Production is at the rated capacity of 1,000,000 gross tons of pellets annually from 3,500,000 tons of ore mined in the open pit.

Some five diamond-drillholes, totalling 2,953 feet were completed from surface.

A total of 4,382,072 net tons of ore was milled producing 1,314,367 net tons of concentrates, which gave 1,183,025 net tons of pellets.

Blast Furnace Division

The head office and plant address is P.O. Box 460, Hamilton.

Operations progressed from 1 January to 31 December 1969.

PRODUCTION OF IRON, DOMINION FOUNDRIES AND STEEL

Furnace	1968 Operated	1968 Production	1969 Operated	1969 Production
	days	net tons	days	net tons
No. 1	366	611,504	365	593,031
No. 2	365	615,073	365	699,429
No. 3	366	599,407	327	585,790
		1,825,984		1,878,250

The blast furnaces treated 2,633,072 net tons of ore, averaging, 7,214 tons per operating day, to produce 1,878,250 net tons of pig iron.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Capacity operations throughout the entire year resulted in an increase of 4.5 percent in ingot production to a new record of 2,278,564 net tons.

The total yearly iron ore requirements approximate 2,400,000 gross tons. Close to 1,000,000 gross tons of this material is supplied through daily unit car shipments of pelletized ore from the Sherman mine in Northern Ontario.

The company is committed to a six-year pollution abatement program estimated to cost $28 million. These expenditures will be in addition to the $14 million which has been spent over the last decade. When complete, the new program will eliminate practically all of the pollution problems created by Dofasco's steelmaking processes.

Major projects will include a $5 million hydrochloric acid recovery plant. A $3 million deep bed filtration system for the removal of impurities from hot mill water is scheduled for completion in late 1971. Orders have been placed for a Larry Car Scrubber System as part of the emission control program during the coke oven loading operation.

The projected $28 million expenditure is divided into several phases and more than half of the expenditures are expected in the first two years. While phase one is under construction, research will continue to determine the best methods of solving later phases since there are no proven technical solutions at the moment to some of the problems involved. Dofasco has every confidence that solutions will be found in the near future.

Major renovations and expansion of Dofasco's research facilities were completed in 1969. To complement present metallographic scanning equipment, additional facilities have been acquired for rapid chemical analysis using a computerized fluorescent x-ray technique. The new equipment will improve process and quality control in the iron and steelmaking processes.

The long standing pollution research fellowship with the Ontario Research Foundation has been extended to cover all aspects of environmental control.

Pilot plant testing has been completed on a method for the recovery of waste iron oxides. This process has been tested in a 125 ton-a-day unit and final engineering is now close to completion.

Studies of surface coatings for the flat-rolled products were expanded and promising results have been achieved in providing coatings suitable for forming operations while providing a satisfactory base for painting.

Work is proceeding on the development of improved formability and fatigue characteristics of flat-rolled steel used in the automotive industry.

Employment and Management

The average number of employees at the Sherman mine was 321: 264 on surface and 57 in the open pit. Cliffs of Canada Limited were managers with B. H. Boyum in charge.

The average number of employees in the blast furnace division was 337: W. M. Rombough was superintendent.

FERROX IRON LIMITED AND FERRO-MAGNETIC LIMITED

These subsidiaries of Magnetics International Limited are situated in Prescott.

Ferrox Iron Limited treats hematite concentrates from Quebec Cartier Limited using a drying, wet magnetic concentration, wet grinding and re-drying process to produce an average 12½ tons of high purity iron oxide per day. Further, the spray drying and paddle milling section of the plant produces 6 tons of soft ferrites daily. About 90 percent of concentrate production is shipped to the company's new plant at Ogdensburg, New York, for conversion to barium ferrite. The Ogdensburg plant began production in February, 1969.

R. F. Becker is vice-president of production, and W. J. D. Stone is executive vice-president.

Ferro-Magnetics Limited is active in research and development of high intensity magnetic separation processes to ores and concentrates.

Employment and Management

The average number of employees was 35; A. J. Kennedy was development manager.

GEO-MET REACTORS LIMITED AND MASTERLOY PRODUCTS LIMITED

Geo-Met Reactors Limited and Masterloy Products Limited are two subsidiary companies, of International Sulphur Company Limited of Calgary. The Masterloy plant is located five miles south of Ottawa, just east of Highway 31, on Doncaster Road, Gloucester township.

Further research work was continued and production of high cost ferro-alloys. Production has consisted mainly of columbium and molybdenum alloys, although some work has been done on others such as tungsten, vanadium, manganese, titanium, chromium and nickel-columbium.

During the year, a new $400,000 building and equipment facility was constructed, providing 14,000 square feet of plant and 3,200 square feet of office space. The plant features up-to-date air pollution control equipment. Four fold expansion of production capability over that of the previous plant is expected.

Employment and Management

The average number of employees was 15; M. C. Campbell was plant manager.

JONES AND LAUGHLIN MINING COMPANY LIMITED (Adams Mine)

Jones and Laughlin Steel Corporation was incorporated in December 1922. In 1966 the operation of the wholly owned Adams mine came under the direction of the Jones and Laughlin Mining Company Limited. The officers of the company were: W. M. Fiedler, president; Charles deCarlo, treasurer; E. C. Ford, secretary. The head office and mine address is Box 547, Kirkland Lake.

The property, known as the Adams mine, comprises 98 claims in Boston township, District of Timiskaming. It is about seven miles southeast of Kirkland Lake; the distance by road is approximately 15 miles. The ore is a banded magnetic iron formation containing an average of 25 percent iron. It is mined in open pits, crushed, ground and concentrated magnetically. The concentrate is pelletized and loaded in railroad cars for direct year round shipment to Jones and Laughlin plants.

Operations progressed from 1 January to 31 December 1969.

Major construction in 1969 comprised a pit lunchroom, 32 x 20 feet and an electrical dry 24 x 12 feet.

Added equipment consisted of a desliming tank at substations, 30-foot diameter; three haulage trucks, 50 ton capacity, and a 6 yard electrical shovel, model 1600.

A total of 4,552,849 net tons of ore was hauled to the primary crusher of which 739,097 tons were rejected at the coarse cobber. The concentrator milled 3,794,334 net tons at a daily average of 11,265 tons.

Employment and Management

The average number of employees was 416: 87 in the open pit and 329 on surface. R. E. Durocher vice-president and general manager was in charge.

NATIONAL STEEL CORPORATION OF CANADA LIMITED
(Moose Mountain Mine)

Lowphos Ore Limited was incorporated in July 1941; in 1966 the name was changed to National Steel Corporation of Canada Limited, Moose Mountain mine, with an authorized capitalization of 35,000 shares of no par value, all shares have been issued. The officers were: W. A. Marting, president; C. E. Nickels Jr., secretary; R. E. Beal, treasurer. The head office is at 1601, National Trust Building, 7 King St. E., Toronto 1. The mine address is Box 310, Capreol.

The company has a lease on the Moose Mountain iron property, approximately 6,064 acres, about 35 miles north of Sudbury, in Hutton township, District of Sudbury.

Crude ore production was all from No. 3 and No. 3a open pits. The magnetite ore is trucked in 45 ton Euclid trucks, concentrated, then pelletized with a yearly quota of 650,000 tons. The pellets are transported by Canadian National Railways from the property to Depot Harbour near Parry Sound on Georgian Bay where they are transferred to cargo ships for shipping to the National Steel Company at Detroit.

The open pit, concentrator and pelletizing plant operated from 1 January to 31 December 1969.

Some 18 diamond-drillholes totalling 4,848 feet were drilled from surface.

Major construction in 1969 consisted of facilities for cobber reject stacking. A R45 Euclid truck was added equipment.

A total of 1,965,218 net tons of ore was removed from the open pits; 1,670,376 tons were milled at a daily average of 4,576 tons. Some 741,794 net tons of iron concentrates were treated in two pelletizing units each operating for 329 days to produce 738,104 net tons of iron pellets.

Employment and Management

The average number of employees was 273: 71 in the open pit, 192 on surface, in the concentrator and pelletizing plant. K. J. Weber was general superintendent.

ONTARIO RESEARCH FOUNDATION
(Ore Dressing and Process Metallurgy Division, Sheridan Park)

The most significant event of the year was the relocation of the facilities of ORF's Rexdale Pilot Plan, including ore dressing and process metallurgy activities, to Sheridan Park. In addition to improved facilities and additional space being made available, the move allows a closer co-operation between the 10 departments of the Ontario Research Foundation.

The modern building houses bench-scale laboratories equipped for all aspects of mineral beneficiation, a high-temperature laboratory for pyrometallurgical investigations and a well-equipped chemical laboratory for analyzing ore, as well as metal samples. In the main building of the ORF nearby, facilities are available for X-ray diffraction and spectrography, electron microprobe analysis and electron and optical microscopy.

The ore-dressing pilot plant area is equipped with crushing and grinding circuits, including an autogenous mill five feet in diameter suitable for both wet and dry grinding. Pilot-scale concentrating equipment consists of gravity, magnetic separation circuits and a flotation section capable of processing up to one ton per hour. The flexible plant layout allows assembly of complex mill circuits according to the process requirements of the ores treated.

The most significant test runs during the year were; gravity and high intensity magnetic separation of a hematite-ilmenite ore; production of high-grade magnetite concentrate; flotation concentration of pyrite into acid-grade concentrates and grinding, magnetic separation, flotation and filtering of a magnetite ore.

During the year some 60 investigations were completed on a wide variety of ore-dressing problems.

Process metallurgy facilities include multiple-hearth furnace, rotary and shaft kilns for calcining, magnetic and reduction roasting, vacuum induction and arc furnaces for melting and refining studies, hot and cold rolling mills, hydraulic and mechanical presses.

A well-equipped powder metallurgy laboratory is capable of conducting powder characterization studies, compaction and sintering of metal powders and the testing of metal powder compacts.

During 1969 the following major research projects were undertaken; the reduction of hematite pellets in a shaft furnace; extensive studies on ilmenite concentrates for the recovery of high-grade titania; the development of methods for the production of powder-metallurgy parts from ferrous powders.

During 1969, the two former divisions — ore-dressing and process metallurgy — were reorganized into one division, process metallurgy, which includes the ore dressing section.

Employment and Management

Technical staff in the division totals 18, 7 in the process metallurgy area and 11 in the ore dressing area. The assistant director, Dr. H. G. Brandstatter, is in charge.

THE STEEL COMPANY OF CANADA LIMITED

The Steel Company of Canada Limited was incorporated in June 1910. The authorized capitalization was increased in 1953, and in 1962 and 1969 to 35,000,000 shares of no par value, of which 24,335,347 shares have been issued. The directors and officers were: V. W. T. Scully, chairman and chief executive officer; H. M. Griffith, president and director; Allan Graydon, G. A. R. Hart, W. H. Browne, A. M. Campbell, F. C. Mannix, W. H. Young, J. D. Gibson, J. R. Gordon, H. Greville Smith, D. R. McMaster, L. G. Rolland, H. S. Foley, E. C. Manning and T. G. Thode, directors; R. B. Taylor, vice-president and treasurer; N. J. Brown, vice-president and comptroller; H. J. Clawson, A. D. Fisher, A. R. McMurrich, J. P. Gordon, and G. H. G. Layt, vice-presidents; J. W. Younger, secretary. The head office is at Wilcox Street, Hamilton.

The Griffith Mine

This open pit iron mine is owned by the Steel Company of Canada Limited and is operated by Pickands Mather and Company as managing agents. The property comprises 63 patented claims, and four licenses of occupation which includes some 500 acres, leased from Iron Bay Mines Limited, all located in the Patricia Portion, District of Kenora. The iron property is located at Bruce Lake, about 30 miles south of the town of Red Lake; an access road about a mile long connects it with the Red Lake road. The mine address is Red Lake.

Mining and milling continued throughout the year.

Production from the open pit averaged about 13,400 tons per day of which about 9,800 tons is ore. The mill handled about 9,500 tons daily which produced approximately 2,600 tons of iron pellets. The pellets are shipped by rail to the Lakehead and then by water transportation to the Stelco plant at Hamilton.

During the year practically all the water inside the dyke cutting off the north orebody from Bruce Lake was pumped out. Another perimeter dyke is under construction and has advanced about 3,000 feet from the shore. This dyke is to prevent pollution of Bruce Lake during future dredging operations.

Several modifications to existing equipment in the concentrator were made during the year; however the only major construction project was the construction of a pellet cooler which is expected to be completed early in 1970.

A total of 4,046,688 net tons of ore was mined; 3,883,233 net tons were milled at a daily average of 10,638 tons.

Hilton Works — Blast Furnace Division

The plant address is Wilcox Street, Hamilton.

PRODUCTION, THE STEEL COMPANY OF CANADA, 1968 AND 1969

Furnace	1968 Operation	1968 Pig Iron Produced	1969 Operation	1969 Pig Iron Produced
	days	tons	days	tons
A	141	56,010	none	—
B	364	529,682	213	269,585
C	291	558,803	267	522,436
D	312	758,308	281	699,884
E	341	1,244,214	278	1,015,517
Total		3,147,017		2,507,422

The blast furnace treated 3,622,423 net tons of ore, averaging 12,800 tons for 283 operating days, to produce 2,507,422 net tons of pig iron.

Employment and Management

The average number of employees at the Griffith mine was 443; 130 in the open pit and 311 on surface. Pickands Mather and Company were the managing agents; F. P. Morawski was manager.

The average number of employees in the blast furnace division of the company was 572; C. M. Birkett was works manager; J. A. Peart was superintendent of blast furnaces; J. G. Sibakin was manager, Research and Development department.

STEEP ROCK IRON MINES LIMITED

Steep Rock Iron Mines Limited was incorporated in February 1939. Early in 1955 the authorized capitalization was changed to 10,000 shares of preferred stock of $100 par value and 10,666,666 shares of common stock of $1 par value; of which no preferred and 8,063,652 common shares have been issued. The directors and officers were: John Peterson, chairman of the board and director; Neil Edmonstone, president and director; Jakob Isbrandtsen, A. L. Rising Jr., John D. Dale, F. H. Logan, G. E. Allen, Mark McKee, F. H. Black, Hon. W. M. Benidickson and R. L. Kaiser, directors; F. R. Jones, vice-president and general manager; C. J. Fitzgerald, secretary-treasurer and G. B. Sullivan, controller. The head office and mine offices are at Atikokan P.O., Steep Rock Lake.

The property consists of about 7,000 acres in Freeborn and Schwenger townships, Steep Rock Lake area, District of Rainy River, about 3½ miles north of Atikokan.

Operations continued throughout 1969. The amount of ore mined during the year is shown in the following table.

	1969	1968
	Net tons	Net tons
B orebody (Errington underground)	—	—
G orebody (Roberts open pit)	1,894,486	1,630,008

A (Hogarth) Orebody

The property comprises nine claims in Freeborn township.

The vertical, three compartment A1 shaft located in claim FF3183 has a depth of 845 feet below the collar. The vertical, eight compartment No. A2 shaft located in claim FF3660 has a depth of 1,479 feet below the collar.

Open pit mining was completed on 16 March 1962 and preparations for underground mining of the Hogarth orebody had continued to 31 August 1961. Development and diamond-drilling operations progressed from 1 September to 31 December 1969.

Development work in 1969 consisted of 453 feet of drifting and 46 feet of crosscutting. Total development footage to 31 December 1969 consisted of 1,930 feet of drifts, 5,215 feet of crosscutting and 1,040 feet of raises. Some eight diamond-drill holes totalling 2,282 feet were completed from underground in 1969.

B (Errington) Orebody

Underground development of the B (Errington) orebody continued throughout 1969.

SHAFTS, B (ERRINGTON) OREBODY

	Claim No.	Inclination	Number of Compartments	Depth from Surface
				feet
No. B1 Errington (Float Ore Island) shaft	G629	Vertical	3	1,263
Mosher Point (Drainage Tunnel) shaft	FF3664	Vertical	2	283

Development footage in 1969 consisted of 2,509 feet of drifting. Total development footage to 31 December 1969 was as follows: 52,161 feet of drifts; 14,090 feet of crosscuts; 10,872 feet of raises. Some 20 diamond-drillholes, totalling 8,519 feet were completed from underground.

Roberts Open Pit Mine

The dredging of the "G" ore zone was completed in 1961, and is now an open pit operation called the Roberts mine. The property comprises nine claims in Freeborn township.

Added equipment included the following:

1 rotary drill electric, model 45R
1 shovel electric, model 1900, 10 cu.yd.
3 front end loaders, caterpillar 5 cu.yd.
4 tractors (two — D-8; one — D9; one — 824B)
1 motor grader, model 14E

Mining operations continued throughout 1969, and milling proceeded from 22 April to 22 October, 1969.

A total of 1,894,486 net tons of ore was mined in the open pit, of which 941,190 net tons of ore were milled in 1969 at an average of 6,675 net tons daily during the period of operation.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Shipment of pellets at 1,403,900 tons exceeded the 1,350,000 ton planned capacity of the new pellet plant. In addition, 159,200 tons of red ore was shipped bringing the 1969 total shipments to 1,563,100 tons compared with 1,440,200 tons in 1968 (of which 1,065,800 were pellets and 374,400 tons were red ore).

Total cash generated was $7,274,176 compared with $7,868,503 (as restated) in 1968.

Capital expenditures on the pellet plant and for normal replacements totalled $1,628,700. Stripping and drilling expenditures chargeable to future operations were $2,420,100. Rental agreements covering mobile mining equipment required to accelerate the stripping and mining operation involved a $2,489,000 capital commitment over the lease period.

A long overdue increase in the market price of iron ore and pellets was announced by a leading merchant during the closing weeks of the year, and was confirmed by a second industry leader. The price increase now will be 5.5 percent on pellets and 25c per ton on red ore, and became effective January 1, 1970. It is expected to provide added gross revenue of $1,000,000 in the current year for the company.

Employment costs have increased over 30 percent during the past five years, with supply costs experiencing a similar trend. A new three-year wage contract that became effective last May brought a further substantial increase in direct cost.

Because actual mining experience in the Roberts open pit has not been as favourable as originally predicted, the geological ore reserve at Steep Rock has been under review, and the intensive drilling program in support thereof is expected to be completed late in 1970. Subject to confirmation, the calculated open pit assured and reasonably assured reserves based on drilling and operating experience in the South Roberts, North Roberts and Hogarth pits only, is now estimated to approach 20 million tons of ore. The comparable figure on the property under lease is estimated to be 16.5 million with additional tonnage there that may be recovered in the future, ranging from 8 million to 12 million tons.

Although the combination of present costs, prices and state of mining technology have narrowed the range of profitability, in the opinion of independent consultants "all calculations point to a moderately profitable underground operation under existing economics . . ." and ". . . all the technical studies and geological evidence point to an eventual underground operation." Of the underground measured geological reserves the consultants estimate that there are 74 million tons of inferred ore in selected areas between the 900 and 1,700-foot level in Errington, South Roberts and Hogarth mines.

Present reserves of assured and reasonably assured open pit ore may make it difficult to produce sufficient pellets to meet long range commitments for delivery of pellets from the Steep Rock pits. The company anticipates obtaining any additional reserves from mining areas adjoining the present open pits, from an underground mining operation or from Lake St.

Joseph where previously estimated reserves are capable of sustaining production of 3 million to 5 million tons of pellets annually.

Employment and Management

The average number of employees was 557: 193 in the open pit and underground and 364 on surface. Neil Edmonstone president, was in charge, F. R. Jones, vice-president was general-manager.

STRATEGIC-UDY METALLURGY LIMITED (Niagara Falls)

The pyrometallurgical, electrometallurgical and ore-dressing research and development facilities were virtually inoperative during the year. The company was forced into bankruptcy early in 1969.

The test work was completed involving a method of agglomerating flue dust and mill scale and the production of a metallized extruded pellet acceptable to a steel company.

Employment and Management

The average number of employees was 4; R. O. Denman was in charge during the period of operation.

SUPERIOR ACID AND IRON LIMITED

Superior Acid and Iron Limited was incorporated in July 1968, with an authorized capitalization of 5,000,000 shares of no par value, of which 1,550,000 shares have been issued. The directors and officers were: W. C. Ralston, president and manager; D. L. Roberts, J. P. Manley, W. E. Rogan, J. E. R. Wood and B. G. Cheney, directors; R. G. Caine, chief financial officer. The head office is at Suite 209, 185 Bay Street, Toronto 1; the mine address is Hawk Junction.

The property comprises 13 claims, in Township 28, Range 26, District of Algoma. It is located on the west side of the Algoma Central Railway at mileage 176½, about 1 mile south of Goudreau.

Operations progressed from 1 January to 30 September 1969.

During the first five months of the year an extensive diamond-drilling campaign comprising some 45 holes totalling 18,626 feet was completed from surface; surface trenching averaging two feet in depth over a length of 655 feet was also completed on the pyrite deposit. An adit, some 1,127 feet long on claim AC9, was driven into the hillside to develop the orebody outlined by surface drilling. A temporary camp was established and hydro power from the Great Lakes Power Company was connected to the property in July.

A 2,000 ton per day mining operation was proposed for the property. The pyrite was to be concentrated at the property before shipping to Ashtabula, Ohio, U.S.A. as a source material for a sulphuric acid and iron oxide plant. On 13 November the company reported that it had not been successful in arranging senior financing for plant construction and that operations were being suspended indefinitely.

Employment and Management

The work was completed under contract, an average of 6 men were employed; W. C. Ralston, president of the company was in charge during the period of operation.

LEAD AND ZINC

In 1969, the production of lead in Ontario decreased by 6.2 percent, from 25,800,813 pounds to 24,193,257 pounds. However, the value of lead production increased by 5.8 percent to $3,670,117 from $3,467,629 in 1968. The increase in the value of Ontario's lead output in 1969 was due to higher annual average prices for this metal — 15.17 cents per pound as compared with 13.44 cents per pound in 1968.

In the 1962-1966 period, Ontario's zinc output averaged 10 percent of Canada's total zinc production. In 1967, it increased to 24.2 percent, in 1968 to 29.9 percent and in 1969, it amounted to 29.8 percent of the Canadian total. The slight decline of the Ontario share in Canadian zinc output in 1969 as compared to 1968 production occurred despite the 3.9 percent increase in Ontario's zinc output to 720,571,567 pounds in 1969 from 693,575,176 pounds in 1968. Now, Ontario ranks first in zinc output followed by Northwest Territories and Quebec. In 1969, Canada's zinc production increased to 2,415 million pounds from 2,319 million pounds in 1968 — an increase of 4.1 percent. The value of zinc production in the 1968-1969 period increased by 12.2 percent.

The companies paid $14,806,708 in wages and salaries to 2,027 employees; $3,035,353 on fuel and electricity and $15,522,935 on processing supplies.

SHERBROOKE METALLURGICAL COMPANY LIMITED

Sherbrooke Metallurgical Company Limited was incorporated in May 1959, with an authorized capitalization of 200,000 common shares of no par value, and 3,000 preferred shares of $10 par value; all common shares have been issued. The officers were: H. D. Carus, president; C. R. MacBrayne, vice-president; R. K. Thoman, vice-president and secretary; and W. E. Greene, treasurer. The head office is at P.O. Box 463, La Salle, Illinois 61301, U.S.A.; the plant address is Port Maitland, P.O. Box 220, Dunnville.

Sherbrooke Metallurgical Company Limited produced during 1969, the highest tonnage of zinc oxide in the nine years history of the Port Maitland plant. This was accomplished by applying certain operating improvements to the fluid-bed roasters and by keeping the downtime of all equipment to a minimum, through planned maintenance. Coincidental with the tonnage record, the quality of the calcine was also improved. About 10 lbs. additional sulphide sulphur per ton of product was removed from the calcine, and converted into sulphuric acid.

Sulphuric Acid sales were surprisingly good considering the depressed state of the fertilizer industry. Sherbrooke broadened its sales base considerably during the year, serving a number of new industries not previously in its marketing plan.

Highlights of the year were (1) redesign and relocation of the main bag-house and ancillary equipment to enhance dust pickup through-out the plant, thereby improving the working environment of plant personnel, (2) closer checking of all process water to ensure an effluent acceptable to the Ontario Water Resources Commission, and (3) close co-operation with the Department of Energy and Resources to reduce Sulphur Oxide emissions to a minimum. Modifications of the plant stack were made, in accordance with the recommendations of the Air Management Branch, to keep ground level concentrations of SO_2 below the limits prescribed by statute.

No major plant changes took place in 1969. However, considerable research and development work was accomplished, with the ultimate objective of producing greater tonnages and a diversity of products.

A total of 103,868 tons of concentrate was treated at an average of 280 tons daily to produce 75,350 short tons of zinc oxide calcine.

Employment and Management

The average number of employees was 68; R. L. Pyne was works manager.

ZENMAC METAL MINES LIMITED

Zenmac Metal Mines Limited was incorporated in February 1952 with an authorized capitalization of 10,000,000 shares of $1 par value, of which 6,415,755 shares have been issued. The directors and officers were: R. A. Halet, president and managing director; K. A. Davis, vice-president, secretary-treasurer and director; E. R. Heald, Patrick Harrison and Wm. McKee, directors. The head office is at Suite 1010, 360 Bay Street, Toronto 1; the mine address is P.O. Box 189, Schreiber.

Zenmac's Zenith mine property comprises 37 claims located in the Pays Plat Lake area, Schreiber District, about 10 miles north of Lake Superior.

Mining and milling operations progressed from 1 January to 31 December 1969.

The vertical three-compartment main shaft, collared in claim TB42277, has a depth of 425 feet below the collar. Development footage in 1969 consisted of 56 feet of drifting, and 48 feet of raising. Total development footage to 31 December 1969 was as follows: 3,838 feet of drifts; 1,260 feet of crosscuts; 2,321 feet of raises. Some 65 diamond-drillholes, totalling 3,733 feet were completed from underground.

A total of 35,478 tons of ore was hoisted; 35,283 tons were milled at a daily average of 97 tons.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

The concentrator treated 35,283 tons of ore with a calculated head of 13.24 percent zinc.

There were 8,277 short dry tons of zinc concentrates shipped to National Zinc Corporation at Bartlesville, Okla. For the first time a copper concentrate was produced and 171 short dry tons were shipped to Hudson Bay Mining and Smelting Co. Limited at Flin Flon, Manitoba.

Metal sales included 8,628,000 lbs. of zinc, 60,767 lbs. of copper and 22,280 lbs. of cadmium.

In addition 21.5 ozs. of gold and 556.4 ozs. of silver were recovered from the copper concentrates.

The grade of zinc concentrates was 52.12 percent zinc and 0.135 cadmium. The grade of copper concentrate was 17.76 percent copper.

The mill operated 87.67 percent of possible time and the average tonnage processed was 69.19 tons per calendar day. Recovery of zinc was 92.81 percent.

Mining Reserves:

Underground operations were confined to a single shift basis throughout the year, a system which was advantageous both in efficiency and cost reduction.

A total of 29,567 tons was mined, all from stoping of known ore structures. There were 70 feet of drifting and 53 feet of raising completed in stope development. There were 3,793 feet of diamond-drilling completed as an aid in stope delineation.

A total of 174,746 tons have been mined and processed to the end of 1969. Reserves were extended because of two increases in the price of zinc during the year, from 13½ cents to 15½ cents a pound.

Lower grade tonnages above the first level were placed in an ore category and represented the bulk of production. Current reserves are estimated to permit continuing operations on a salvage basis to April 1970.

Employment and Management

The average number of employees was 37: 13 underground and 24 on surface. P. S. Broadhurst was general manager.

MAGNESIUM AND CALCIUM

Total Canadian output of magnesium and calcium is being mined and processed in Ontario at Haley in Renfrew County by Dominion Magnesium Limited. Ontario ranks fourth among the world's leading magnesium producers.

From 1962 to 1966, Ontario's production of magnesium averaged 17,561,862 pounds accounting for 5.29 percent of the world's output of this metal. In the 1965-1969 period, Ontario's output of magnesium rose from 20,216,369 lbs. to 21,274,841 lbs. or by 5.2 percent. At the same time, the value of magnesium, which in 1965 amounted to $6,067,057, increased to $7,263,849 in 1969 or by 19.7 percent.

The calcium produced by Dominion Magnesium has increased by 491.3 percent from 159,434 pounds in 1965 to 942,682 pounds in 1969 — an all time record.

The production value of calcium increased from $152,848 to $953,522 or by 523.8 percent.

In 1969, the company paid $474,742 to 70 salaried employees, up 2.3 percent from 1968; $2,275,861 to 381 wage-earners, an increase of 30 percent from 1968.

DOMINION MAGNESIUM LIMITED

Dominion Magnesium Limited was incorporated in February 1941, with an authorized capitalization of 500,000 shares of no par value, of which 476,270 shares have been issued. The directors and officers were: M. A. Cooper president and director; John Thomson, vice-president, general manager and director; C. P. Keeley, L. M. Pidgeon, F. H. Jowsey, G. T. N. Woodrooffe, J. R. Smith and W. G. Dahl, directors; H. B. Clearihue, secretary-treasurer. The head office is at 20th Floor, 7 King Street East, Toronto 1. The plant address is Haley.

Dominion Magnesium Limited holds exclusive patent rights to the Pidgeon magnesium production process. The company's quarry and plant about 3 miles from Haley, comprising 407 acres is in concessions V and VI, Ross township, Renfrew County.

Operations in the open pit and plant continued from 1 January to 31 December 1969.

A new record in annual production was established in 1969 for both magnesium and calcium. Approximately 370 tons of dolomite was processed daily for magnesium and calcium production; the ore is calcined in rotary kilns and pure magnesium is reduced by silicon in retort furnaces, heated by natural gas or electricity. Silicon in the form of ferrosilicon is obtained from the company owned smelter at Beauharnois, Quebec.

Another electrical heated furnace was converted to natural gas, which not only resulted in some improvement economically but also made extra electrical power available for other mechanical installations. The company is carrying on an extensive program in an effort to mechanize the charging and discharging of the reduction furnaces which would require increased electrical power.

Approximately 70 percent of the magnesium production was exported with the United Kingdom and the United States being the largest export customers.

Calcium metal was in increased demand in 1969; the metal was used for the production of calcium hydride in the United States, as a reducing agent for metals such as Zirconium, and as a refining agent in other metal production. Considerable calcium of special purity, particularly low in oxygen and nitrogen was produced for the production of high purity Zirconium for atomic energy purposes. A drying room with closely controlled temperature and humidity was required for the production of this metal.

The company's extrusion plant at Haley operated steadily throughout the year. Aerometals Limited, a wholly owned subsidiary, operates a magnesium fabricating plant at Toronto.

Production of metals for 1969 and 1968 was as follows:

Metal		1969	1968
Calcium crowns	lb	838,372	645,235
Magnesium crowns	lb	23,396,353	22,285,948
Thorium	lb	337	1,223
Titanium	lb	669	4,722
Barium	lb	1,867	10,219
Strontium	lb	1,027	783
Zirconium	lb	3,527	4,790

Employment and Management

The average number of employees was 449: 74 in the open pit and 375 in the plant. D. J. McPhail was plant manager.

NICKEL-COPPER

Canada's average nickel output in the 1962-1966 period represented 55.5 percent of total world nickel production. However, the Canadian share in world nickel output in 1969 declined to 39.8 percent, as a result of the labour unrest in the Sudbury area of Ontario and an expansion of nickel production in other areas of the world.

During the 1962-1966 period, Ontario's nickel output averaged 71.5 percent of Canada's total nickel production. In 1969, Ontario production of nickel decreased to 293,561,275 pounds from 407,493,447 pounds in 1968 or by 28 percent.

Since the commencement of nickel mining in Ontario to 31 December 1969, the value of nickel output in the Province totalled $6,192,805,670.

In the 1968-1969 period, the value of nickel per pound increased from 99c to 112c — more than 12 percent. This increase was due to changes in product mix and to substantial price increases in the price of nickel.

In 1969, the production of copper from the nickel-copper mines totalled 261,154,200 pounds valued at $132,972,263; from zinc-copper-lead mines 176,875,432 pounds valued at $90,967,035; and from other mines 39,590,139 pounds valued $20,361,203.

In addition to the significant production of nickel and copper, these mines also accounted for the Province's entire production of platinum metals, selenium, tellurium and for most of the cobalt output.

In 1969, the Ontario total production of copper from all sources (zinc-copper-lead, nickel-copper and copper-gold mines) declined to 47,619,761 pounds from 581,236,227 pounds in 1968 or by 17.8 percent, while the value declined only 12.2 percent, from $278,313,194 in 1968 to $244,300,501 in 1969.

Ontario's predominantly copper mines increased their production to 37,873,217 pounds valued $19,478,195 in 1969 from 34,275,755 pounds, valued at $16,486,638 in 1968 or by 10.5 percent in volume and 18.1 percent in value. However, the major sources of copper in Ontario were the nickel-copper mines and zinc-copper-lead mines.

In 1969, the nickel-copper mining, smelting and refining industry paid $51,672,574 to 4,856 salaried employees and $109,581,016 to 18,644 wage-earners.

BIG NAMA CREEK MINES LIMITED

Big Nama Creek Mines Limited was incorporated in January, 1954, with an authorized capitalization of 5,000,000 shares of $1.00 par value, of which 2,437,375 shares have been issued. The officers of the company were: M. J. Boylen, president; J. A. Boylen and D. W. Gordon, vice-presidents; G. L. Moore, secretary-treasurer. The head office is at Suite 908, 330 Bay Street, Toronto 1; the mine address is Manitouwadge.

The property comprises 13 claims in Mapledoram township, District of Thunder Bay. It adjoins the Willroy Mines Limited property on the north and has been leased to Willroy on a profit-sharing basis.

Mining operations progressed throughout 1969.

The mine is operated from an inclined roadway some 9 x 15 feet at —11 degrees which was driven a further 825 feet in 1969 for a total length of 1,509 feet. Development footage completed in 1969 consisted of 499 feet of drifting, 327 feet of crosscutting and 406 feet of raising. Total development footage to 31 December 1969 consisted of 1,390 feet of drifts, 385 feet of crosscuts and 467 feet of raises. Some 27 diamond-drill holes totalling 2,111 feet were completed from underground.

Added equipment in 1969 comprised a general purpose van, ¾ ton capacity, a five stage pump with 75 h.p. motor used in the incline, and a 50 h.p. electric slusher used in selective mining.

A total of 57,690 tons of ore was hoisted; 57,472 tons were treated in the Willroy mill, in a pre-production mill test at an average of 172 tons daily. (For further information on the Big Nama operation see Willroy Mines Limited in this report.)

Employment and Management

All mining and milling operations are carried out by Willroy Mines Limited; J. I. Jarvis was mine manager.

CANADIAN JAMIESON MINES LIMITED

Canadian Jamieson Mines Limited was incorporated in April 1964, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 2,579,006 shares have been issued. The directors and officers were: A. T. Griffis, president and director; G. J. Killeen, vice-president and director; R. C. Bragagnolo, secretary and director; R. H. Pope, treasurer and director; R. D. Lawrence, J. J. Parisi and D. H. Wigston, directors. The executive office is at Suite 911, 159 Bay Street, Toronto 1; the mine address is Box 1050, Timmins.

The property comprises 17 claims in Godfrey and Jamieson townships, District of Cochrane, readily accessible by road from Timmins.

Operations progressed throughout the year.

The vertical, three compartment No. 1 shaft located in lot 9, concession VI, Godfrey township, has a depth of 760 feet below collar. Development footage completed in 1969 consisted of 670 feet of drifting, 1,065 feet of crosscutting and 432 feet of raising. Total development footage to 31 December 1969 consisted of 8,023 feet of drifting, 4,450 feet of crosscutting and 3,781 feet of raising. Some 107 diamond-drillholes totalling 28,143 feet, were completed from underground.

A total of 196,140 tons of ore was hoisted; 174,108 tons were milled at an average of 537 tons daily.

Company Annual Report

The following is taken from the company annual report for the year ending 31 March 1969.

Production

During the third year of production the milling plant was maintained in operation for 96.7 percent of the total hours of the year and treated 174,108 tons of ore with an average grade of 2.75 percent copper and 4.42 percent zinc. The average milling rate per day was 477 tons, an increase from the previous year's average of 382 tons per day.

The production of copper concentrate amounted to 21,535 tons grading 19.66 percent copper all of which was sold to Boliden Aktiebolag on the basis of London Metal Exchange prices. Copper recovery was 8,470,648 pounds of copper representing 88.43 percent of the metal content of the ore. Normally this concentrate was shipped to Three Rivers, Quebec and stockpiled at the mine.

The production of zinc concentrate amounted to 10,402 tons grading 54.34 percent zinc. The zinc concentrate was sold to New Jersey Zinc Company at the East St. Louis average price. Zinc recovery was 73.3 percent of the metal content of the ore and amounted to 11,305,320 pounds of zinc.

Mining

Underground stoping continued ahead of mill consumption, producing 229,383 tons of broken ore and increasing the broken ore reserve in the mine to 95,277 tons which will allow time to mine out every corner of the irregular ore structure. The fourteen active areas yielded the following tonnages and grades by levels

1st level	53,647 tons at 2.3 percent copper and 4.1 percent zinc
2nd level	41,615 tons at 2.8 percent copper and 4.4 percent zinc
3rd level	35,668 tons at 2.4 percent copper and 4.4 percent zinc
4th level	43,000 tons at 3.5 percent copper and 4.8 percent zinc

Long-hole stoping provided 24.8 percent of the year's mill feed.

Milling

Continual experimental work in the concentrator has resulted in the ability to treat a larger daily tonnage of ore with very satisfactory recovery of both the copper and the zinc. A few hours shutdown each month for a maintenance check and repair has kept the mechanical equipment in top condition. During the year, the zinc dryer was overhauled, a new shell being fabricated at the mine.

Production

	Short Tons	Grade Copper percent	Grade Zinc percent
Ore milled	174,108	2.75	4.42
Concentrate produced			
Copper concentrate (dry)	21,535	19.66	
Zinc concentrate (dry)	10,402		54.34

Reserves
(as at 31 March, 1969)

Ore reserve (after 15 percent dilution)			
Broken ore underground	95,000	2.53	4.19
South zone (upper)	3,000	1.50	2.50
South zone (lower)	11,000	1.82	2.13
Upper centre zone (west)	5,000	2.44	3.40
Upper centre zone (east)	2,000	1.55	2.00
Lower centre zone	45,000	2.82	4.46
North zone	31,000	2.18	3.93
Total reserves	192,000	2.47	4.03

Employment and Management

The average number of employees was 135: 62 underground and 73 on surface. Ross MacPhail was manager.

CANNON MINES LIMITED

Cannon Mines Limited was incorporated in July 1965 with an authorized capitalization of 6,000,000 shares of $1 par value, of which 2,835,005 shares have been issued. The directors and officers were: E. B. Ashton, president and director; G. C. Snell, vice-president and director; E. B. Ashton Jr., secretary-treasurer and director; D. D. Martin, director. The head office is at Suite 204, Westlaw Building, 1920 Weston Road, Weston; the mine address is Box 208, Iron Bridge.

The property formerly operated by Crownbridge Copper Mines Limited comprises 101 claims in Townships 168 and 175, District of Algoma.

Operations progressed from 25 June to 21 November 1969.

All mining operations were carried out by a contractor. An adit 13 x 9 feet on claim 5383455M was driven at —14 degrees a distance of 831 feet to explore and develop the shear zone; four short crosscuts totalling 181 feet were driven into the zone at regular intervals to act as future drawpoints and also as drill stations for future diamond-drill exploration. A raise some 232 feet long was driven from the bottom of the decline to surface for exploration, ventilation and as an escapement raise. Some eight diamond-drillholes totalling 1,006 feet were completed from underground and four holes totalling 1,652 feet from surface were completed in 1969. The company is awaiting the results of a feasibility study, which will determine future work programs.

A 250 t.p.d. mill on the property had been installed by former operators.

Cominco Limited has been drilling deep seated flat laying beds of uraniferous conglomerates north of Blind River, and has made arrangements for a deep drilling test of the Cannon property.

Employment and Management

The work was completed by a contractor who employed an average of five men. W. Zuckerkandel, resident geologist, was in charge at the property.

CONSOLIDATED CANADIAN FARADAY LIMITED
(Werner Lake Division)

Eastern Mining and Smelting Corporation Limited was incorporated in December 1955 on amalgamation of Eastern Smelting and Refining Company Limited and Quebec Nickel Corporation Limited; the name was later changed to Nickel Mining and Smelting Corporation. In December 1963 the name was again changed to Metal Mines Limited to include Faraday Uranium Mines Limited and Nickel Mining and Smelting Corporation and in May 1967 to Consolidated Canadian Faraday Limited. The authorized capitalization was increased to 5,000,000 shares of no par value, of which 3,421,300 shares have been issued. The directors and officers were: A. W. Johnston, chairman of the board and director; W. C. Campbell, president and director, Jules Loeb, J. K. McCausland, J. J. Rankin, G. T. Smith and A. B. Whitelaw, directors; W. M. O'Shaughnessy, secretary-treasurer. The head office is at Suite 1600, 100 Adelaide Street West, Toronto 1. The mine address of the Bancroft Division (formerly Faraday Uranium Mines Limited, now operated by Can-Fed Resources Corporation Limited) is R.R. No. 3, Bancroft (see URANIUM section.) The mine address of the Werner Lake Division, (formerly Gordon Lake Division is Werner Lake, Ontario.)

The Werner Lake Division property comprises 182 claims in the Werner Lake area, District of Kenora.

Mining and milling continued throughout 1969.

SHAFTS, WERNER LAKE DIVISION MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
				feet	feet
No. 1	KRL19096	Vertical	3	Surface	360
No. 2	KRL31831	Vertical	3	Surface	1,817
No. 3	—	Vertical	2	1,130	1,613

Development footage in 1969 consisted of 820 feet of drifting. Total footage to 31 December 1969 was as follows: 29,832 feet of drifts; 10,353 feet of crosscuts; 19,331 feet of raises; diamond-drilling consisted of 265 holes, totalling 23,930 feet from underground.

A total of 177,276 tons of ore was hoisted and milled. The mill treated an average of 587 tons daily which included 66,395 tons custom milled for the Dumbarton mine located some 25 miles west of Werner Lake in Manitoba, and which is 50 percent owned by Canadian Faraday.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

The mine operated throughout the year at an average daily rate of 498 tons.

The production of concentrates totalled 12,659.2 dry tons with a recoverable metal content of 1,974,830 pounds of nickel, 1,051,462 pounds of copper, 638.465 ounces of platinum, and 3,782.566 ounces of palladium.

Decreases in the recoverable metal content for the year is basically attributed to the lower grade of ore milled.

The concentrates were sold to The International Nickel Company of Canada.

Milling

Performance figures are tabulated below with comparative data for 1968 and 1967:

	1969	1968	1967
Tons milled	177,726	207,417	214,536
Heads —			
Nickel percent	0.82	1.05	1.17
Copper percent	0.39	0.53	0.58
Tails —			
Nickel percent	0.20	0.22	0.21
Copper percent	0.055	0.05	0.06
Recoveries —			
Nickel percent	77.1	80.8	83.5
Copper percent	86.9	90.7	90.8
Concentrate —			
Nickel percent	8.84	9.47	10.25
Copper percent	4.81	5.33	5.55

The new mill circuit was completed in June. The addition of this circuit increases the milling capacity to 1,200 tons per day. Modifications of the old circuit were completed by August.

Difficulties were encountered in both circuits during the tune-up periods which followed. These are primarily due to the abrasiveness of the Dumbarton ores, sliming and erratic assay values. Analytical analyses are being checked and new material substituted to combat the abrasive qualities of the ore.

Mining

Blasthole mining is gradually replacing cut-and-fill and shrinkage stope methods, except in the "B" Zone.

Tonnage mined over the year decreased from the previous year. This is attributed to a cut-back in the Werner Lake production as Dumbarton Mines began providing an ore supply.

Production at Werner Lake has been reduced to 300 tons per day. The balance of the ore will come from the Dumbarton operation.

The underground mining force at Werner Lake has been reduced by 50 percent.

Ore Reserves

Reserves as at December 31, 1969 are tabulated below:

	Tons	% Nickel	% Copper
Proven ore	345,188	0.87	0.34

Costs

Reduction in manpower with comparative reduction in costs, reduced operational expenditures by $1.54 per ton and mining costs by $1.64. However, while these costs were achieved, the effects were neutralized by the lower grade of ore treated and the inflationary effects of high wages and materials.

Efforts to reduce these costs, in every aspect, are continuing. Comparative cost figures per ton, not including head office expenses, are as follows:

	1969	1968
Development	0.67	0.73
Mining	8.38	10.33
Milling	2.61	2.38
Marketing	1.40	1.67
	13.06	15.11

Employment and Management

The average number of employees at the Werner Lake Division was 148: 68 underground and 80 on surface. C. P. Moore was manager.

COPPERFIELDS MINING CORPORATION LIMITED

Temagami Mining Company Limited was incorporated in August 1954; it was an amalgamation of Temagami Mining Company and Derosier Nickel and Copper Mines. In December 1964 Temagami Mining Company Limited and Goldfields Mining Corporation Limited were consolidated into Copperfields Mining Corporation Limited; the authorized capitalization was 7,500,000 shares of $1 par value, of which 6,325,600 shares have been issued. The directors and officers were: N. B. Keevil, president and director; N. B. Keevil Jr., vice-president and director; R. A. Cranston, J. G. Godsoe, J. L. C. Jenner, M. J. McCabe and D. A. Perigoe, directors; R. J. Wright, secretary; J. H. Westell, treasurer. The head office is at Suite 4900, Toronto-Dominion Centre, Bay and King Streets, Toronto 1. The mine address is P.O. Box 39, Temagami.

The company's holdings comprising about 7,223 acres consist of a mineral lease on part of Timagami Island, leases on 11 other islands and 185 claims in Phyllis, Briggs, Joan, Yates and Scholes townships, Timagami area, District of Nipissing.

Mining and milling operations continued throughout 1969 except for lost time due to strike action from 14 February to 21 April.

The vertical, four-compartment No. 1 shaft located in Phyllis township on mining lease No. 11446 was sunk 451 feet to a depth of 2,535 feet below the collar. The 2,175 and 2,375-foot levels and the 2,425-foot loading pocket were established at those depths below the collar.

Development footage in 1969 consisted of 6,708 feet of drifting, 1,381 feet of crosscutting and 953 feet of raising. Total development footage to 31 December 1969 was as follows: 55,755 feet of drifts; 11,565 feet of crosscuts; 12,665 feet of raises. Diamond-drilling consisted of 478 holes, totalling 73,907 feet from underground, and 86 holes totalling 21,182 feet from surface.

Major construction in 1969 consisted of a large diamond-drill core rack.

A total of 41,136 tons of ore was hoisted; the mill treated 41,056 tons averaging 162 tons daily.

Company Annual Report

The following is taken from the company annual report for the year ending 30 June, 1969.

The Temagami mine operated normally throughout the fiscal year, except from 14 February to 21 April, 1969 when the operation was closed due to a strike by the United Steelworkers of America. As a result of the strike and of the lower grade of ore milled, production was considerably lower than in previous years. Development was carried out at an accelerated pace throughout the year.

Tons milled	39,371	
Ore grade	3.77	percent copper
Copper produced	2,847,565	pounds
Average price per pound	63.04	cents
Ore hoisted	39,571	tons
Waste hoisted	41,844	tons
Ore reserves (11,217 tons broken)	57,567	
Ore reserve grade	4.75	percent

A plan to recover high-grade ore from the No. 3 orebody beneath Lake Temagami is underway, with construction of a cofferdam over the ore zone nearing completion. If the dam can be sealed successfully, the water inside the cofferdam will be pumped out and the high-grade ore mined as close to the lake bed as possible. After mining, the area dammed will be donated to the Temagami Lakes Association as a fish-rearing pond.

Pyritic Zone Project

In view of the possibility of continued improved markets for nickel and copper, a program of re-evaluation of Copperfields "pyritic zone" was begun during the year.

The pyritic zone is a more or less continuous band of sulphides which follows the metadiorite-rhyolite contact throughout the entire length of the Temagami mine workings. The favourable horizon for the massive sulphide copper orebodies which have been mined up to the present occurs within the rhyolite sequence parallel to and approximately 100 feet south of the pyritic zone. While the massive sulphide orebodies contain chalcopyrite with subordinate amounts of pyrite, the pyritic zone is a complex assemblage of sulphides including, in order of abundance, pyrite, chalcopyrite, millerite, siegenite, gersdorffite and violarite. It contains abundant sulphides with 1 to 1½ percent combined copper and nickel over widths ranging in general from 10 to 40 feet.

The mine workings developing the high-grade massive sulphide orebodies now extend for a strike length of 7,800 feet and to a depth of 1,975 feet. The pyritic zone has been shown to be essentially continuous within the workings, with local sections above and others below average grade and width. Two zones have been outlined by drilling which contain probable reserves of 770,000 tons grading 1.04 percent copper and 0.47 percent nickel. The pyritic zone occurs wherever the metadiorite-rhyolite contact has been investigated over a length of nine miles, so that the overall tonnage potential of the deposit is considerable.

Metallurgical investigations of this material during the early development of the Temagami mine, at a time of low copper prices, showed that normal flotation techniques would not produce an acceptable concentrate with reasonable recoveries, and the project was shelved. Because of higher copper and nickel prices and general technological advancement, metallurgical investigations have been resumed.

Sulphide Point Project

Development to the present has stopped at a major post-ore fault at the east end of the mine workings. Although the favourable zone is known to occur on the other side of the fault, until now no attempt has been made to cross it underground. Exploration from the surface has been hampered because the zone re-occurs under the lake, but the results of 11,000 feet of drilling from the ice last winter proved continuity of the rhyolite-metadiorite sequence, and located copper mineralization in the expected stratigraphic position.

Preliminary mapping under the lake using scuba diving gear provided additional confirmation of geological projections, and it was decided to drive eastwards across the fault. Negotiations are underway with companies that have expressed an interest in assisting financing further development of this project.

Employment and Management

The average number of employees was 112: 58 underground and 54 on surface. M. F. Leavens was mine manager.

DONDOL MINES LIMITED

Dondol Mines Limited was incorporated in July 1968, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 922,000 shares have been issued. The directors and officers were: Peter Kamula, president and director; Arnold Dolan, treasurer and director; Cecil Armstrong, manager and director; Charles Guagliano, secretary. The head office is at 466 Burlington Street East, Hamilton 21; the mine address is Iron Bridge, R.R. No. 1.

The property, a copper prospect, comprises four claims in Grasett township and four in Parkinson township known as the Belle Falls property, in the District of Algoma.

Operations progressed from April to December 1969.

Grasett Township Property

The "O" adit located in the N½, lot 8, concession I, Grasett township was advanced a further 147 feet in 1969, for a total distance of 347 feet to develop copper showings exposed on surface. Some eight diamond-drillholes totalling 146 feet were completed from underground and trenching some 30 feet in length, averaging two feet in depth was completed on surface.

Major construction consisted of a frame mill and crusher building 130 x 30 feet, and a frame shop building 36 x 24 feet.

Milling equipment added consisted of a ball mill 5 x 12 feet, a rake classifier 23 x 5 feet, five 36-inch Denver flotation cells, a vacuum pump and 4-foot diameter single disc filter.

Belle Falls Property

A road some two miles in length was built into this property acquired by Dondol. An adit was being driven into the hillside with some 85 feet completed at year end.

Construction during the year comprised a combined lunchroom and storage shed 16 x 12 feet, and housing for a portable compressor 12 x 8 feet.

Employment and Management

The average number of employees was 7: 2 underground and 5 on surface. Cecil Armstrong was acting manager.

ECSTALL MINING LIMITED
(Kidd Creek Mine)

Texas Gulf Sulphur Company was incorporated in December 1909. In March 1965 a wholly owned subsidiary, Ecstall Mining Limited was formed to operate the Kidd Creek mine. The senior officer in Canada is Richard D. Mollison, executive vice-president, metals division. The head office is at 100 West Tenth Street, Wilmington, Delaware, 19899; the Toronto office is at P.O. Box 150, Toronto-Dominion Centre; the mine address is B-2002, Timmins.

The Ecstall Mining Limited property comprises about 640 acres in Kidd township, Porcupine area, District of Cochrane.

The open pit mining operation and ore milling progressed from 1 January to 31 December 1969.

Preparations to sink the vertical, four compartment, circular No. 1 shaft, on the west (footwall) side of the open pit commenced at mid-year. At year-end the shaft had been collared to a depth of 90 feet, a reinforced concrete headframe 340 feet high had been erected and work was in progress to install a sinking plant. Shaft sinking should commence in early 1970, to the proposed final depth of 3,000 feet. The 9 x 17 feet inclined service ramp was driven a total of 1,101 feet; a five foot diameter borehole some 205 feet long connects the underground ramp with the surface. For ventilation purposes some seven diamond-drillholes totalling 14,450 feet were completed from surface.

Major construction in 1969 included extensions to the mine site dry, 96 x 40 feet and office 72 x 16 feet, and load-out building 54 x 44 x 92 feet.

Added equipment consisted of a lead dryer, five hearth 900 tons/hr.; a conveyor gantry 24 in. belt 280 feet long to a 1,000 ton storage bin.

Production from the open pit amounted to 3,617,226 tons which was milled at an average of 9,910 tpd.

Company Annual Report

The following pertaining to Ecstall Mining Limited is taken from the Texas Gulf Sulphur Company annual report for the year ending 31 December 1969.

Production at the Kidd Creek mine and concentrator near Timmins, continued to be excellent and the market for zinc, copper, lead and silver is strong. Work has started on the headframe, shaft and ramp for underground mining to be co-ordinated when completed with open pit production. In 1969 the decision was made to proceed with construction of a zinc plant at an estimated cost of more than $50 million. It will process at least 50 percent of the zinc concentrates which are presently being sold to custom smelters and will produce about 120,000 short tons of slab zinc metal, 230,000 short tons of sulphuric acid, and 1,000,000 pounds of cadmium metal. Substantial silver and other metal values may also be recovered. It is scheduled to be completed early in 1972.

Ecstall Mining Limited, produced and processed more than 3,600,000 tons of ore at the Kidd Creek mine and concentrator near Timmins, Ontario, in 1969. While the total tonnage mined in 1969 was about the same as 1968, the 1969 millheads contained more zinc and less copper. As the open pit depth increased, the flexibility in blending of ore is reduced. This flexibility will again be increased when tonnage is mined from the underground in addition to the open pit.

The bottom of the open pit reached the seventh 40-foot bench late in 1969. Substantial progress was made on the headframe for an underground mine shaft and a decline ramp for underground mining. Sinking of the 24-foot diameter 3,000-foot deep shaft will start in the second quarter of 1970 and be completed by late 1971.

In designing the new zinc plant — as it did in planning the original Kidd Creek mine and concentrator — Texas Gulf is reviewing its plans with provincial authorities to insure that the construction and operation of the plant will meet the very high standards established for air and water control in Ontario.

Employment and Management

The average number of employees was 698; 118 in the open pit and 580 on surface. P. R. Clarke was vice-president in charge of production.

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, of which 4,946,243 shares have been issued. The directors and officers were: Marsh A. Cooper, president and managing director; R. Campbell, senior vice-president and director; E. L. Healy, executive vice-president (operations) and director; W. G. Dahl, vice-president (marketing) and director; C. F. H. Carson, O. D. Cowan, W. F. James, M. A. Cooper, F. H. Brand, H. B. Keck, F. P. Jones Jr., M. J. McKinnon, and R. B. West, directors; G. T. N. Woodrooffe, vice-president (corporate affairs) and secretary; D. R. DeLaporte, vice-president (western minerals division); G. P. Mitchell, vice-president (metallurgy and research); J. J. Mather, vice-president (industrial mineral division); R. H. Moore, vice-president (technical services); J. T. McWhirter, treasurer; Kenneth Dunn, controller; J. L. Matthews, assistant secretary; D. R. Lochhead, vice-president (nickel division); H. L. Hickey, director (public relations); L. C. Kilburn, asst. vice-president (exploration and development). The head office is at the 21st Floor, 7 King Street East, Toronto 1.

The company has numerous interests and holdings, principally in mining companies, through a merger with Ventures Limited in 1962. The nickel-copper mines, concentrating and smelting operations in the Sudbury area, research laboratories at Richvale and Lakefield, and refinery at Kristiansand, Norway, are the operations principally connected with nickel production. The total ore production from producing mines was 3,117,106 tons of which 3,102,245 tons were milled.

SHAFTS, FALCONBRIDGE NICKEL COMPANY'S MINES IN THE SUDBURY AREA

Mine	Claim No.	Inclination	Number of compartments	Depth	Sinking 1969	Vertical depth from Surface
				(feet)	(feet)	(feet)
East Mine						
No. 1	3036 SES	Vertical	3	Surface	—	3,942
No. 2	3036 SES	Vertical	3	3,872	—	5,964
Falconbridge						
No. 1	3035 SES	Vertical	3	Surface	—	2,848
No. 5	3040 SES	Vertical	6	Surface	—	4,347
No. 7	3040 SES	Vertical	(inactive)	2,631	—	4,323
No. 9	3040 SES	Vertical	6	4,023	—	6,562
Fecunis Lake						
No. 1	N.W.¼ N½, lot 5, con. II Levack twp.	Vertical	6	Surface	—	4,183
No. 2	" "	Vertical	4	Surface	—	3,243
Hardy-Boundary-Onaping						
Hardy	5822	Vertical	3	Surface	—	1,427
1125 Incline	5822	36½°	1 (inactive)	986	—	1,138
Boundary	5822	Vertical	3	S 996	—	1,951
Onaping	S.E.¼ S½, lot 8, con. I, Levack twp.	Vertical	5	Surface	370	4,400
Lockerby	N.½, lot 2, con. V, Denison twp.	Vertical	4	Surface	1,625	1,674
Longvack South	N.½, lot 3, con. IV, Levack twp.	Vertical	3	Surface	—	1,289
North Mine — Serviced through Fecunis Lake mine shafts					207	3,657
Strathcona						
No. 1	S½, lot 4, con. IV, Levack twp.	Vertical	4	Surface	—	3,205
No. 2	" "	Vertical	5	Surface	—	3,144

MINES

East Mine

The property comprises 12 claims in Falconbridge township. The mine address is Falconbridge.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November.

During the year 1,933 feet of drifting, 1,122 feet of crosscutting and 1,042 feet of raising was completed. Total development footage to 31 December 1969 was as follows: 42,406 feet of drifts; 13,020 feet of crosscuts; 18,833 feet of raises. Some 60 diamond-drillholes totalling 5,140 feet, were drilled from underground. The No. 2 shaft area was further developed between the 4,000 and 6,000-foot levels for future production. The ore was trammed over to Falconbridge mine ore pass; the East mine is about 2,000 feet east of the Falconbridge mine.

A total of 207,983 tons of ore was hoisted and milled.

Employment and Management

The average number of employees was 150, all underground, G. A. Dunthorne was mine superintendent.

Falconbridge Mine

The Falconbridge property comprises 24 claims in Falconbridge township. The mine address is Falconbridge.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November.

A total of 754 feet of drifting, 306 feet of crosscutting and 147 feet of raising was completed during the year. Total development footage to 31 December 1969 was as follows: 229,362 feet of drifts; 47,546 feet of crosscuts, 113,135 feet of raises. A total of 169 diamond-drillholes totalling 16,667 feet were completed in 1969 from underground and 14 non-geological holes totalling 507 feet.

Employment and Management

The average number of employees was 766; 716 underground and 50 on surface. W. W. Bolton was mine superintendent.

Fecunis Lake Mine

The property comprises two claims in Levack township. The mine address is Onaping.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November. There was no development work carried out during the year. Total development footage to 31 December 1969 was as follows: 18,846 feet of drifts; 13,776 feet of crosscuts; 14,346 feet of raises. Some 4 diamond-drillholes totalling 1,147 feet were drilled from underground.

Added equipment in 1969 consisted of a compressed air demister installed at the 2,650-foot level.

A total of 216,170 tons of ore was hoisted and milled.

The International Nickel Company of Canada Limited, mines the Fecunis ore and delivers it underground to the Fecunis shaft for hoisting and subsequent treatment. The ore in the same orebody mined by International Nickel is delivered to the Levack mine shaft.

Employment and Management

The average number of employees was 190; 74 underground and 116 on surface. E. N. Gilje was mine superintendent.

Hardy, Boundary and Onaping Mines

The Hardy property comprises two claims; the Boundary property one claim; the Onaping property 1.5 claims; a total of 4.5 claims all in Levack township. The mine address is Onaping.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November.

The vertical, five compartment Onaping shaft was sunk 370 feet in 1969 to a total depth of 4,400 feet below the collar. Development footage in 1969 comprised the following: 91 feet of drifting, 100 feet of crosscutting and 223 feet of raising at the Hardy property; 49 feet of raising at the Boundary property; 1,247 feet of drifting, 514 feet of cross-cutting and 1,861 feet of raising at the Onaping property. Total development footage at the three properties to 31 December 1969 was as follows: 15,035 feet of drifts, 19,086 feet of crosscuts, and 13,691 feet of raises on the Hardy property;

12,483 feet of drifts, 4,137 feet of crosscuts and 4,398 feet of raises on the Boundary property; 15,840 feet of drifts, 11,344 feet of crosscuts and 10,252 feet of raises on the Onaping property; Diamond-drilling in 1969 consisted of 64 holes, totalling 27,773 feet from underground, and five non-geological holes totalling 311 feet.

Employment and Management

The average number of employees at the Hardy, Boundary and Onaping properties was 440; 263 underground and 177 in the mill and on surface. P. W. MacMillan was mine superintendent.

Lockerby Mine

The property comprises eight claims in Denison township.

Operations progressed from 1 March to 31 December, 1969.

The four compartment, vertical No. 1 shaft located in the north half, lot 2, concession V, Denison township was sunk 1,625 feet to a depth of 1,674 feet below the collar. The 275,575,850, 1000, 1175, 1350, and 1525-foot levels were established at depths of 272,576,832,1008, 1184, 1360 and 1536 feet respectively below the collar.

Development footage completed during the year consisted of 408 feet of crosscutting which is also the total development footage to 31 December, 1969. Some five non-geological diamond-drillholes totalling 214 feet were completed from underground.

New construction in 1969 consisted of the following:

1 pump house, sewage disposal, 21.5 x 12.5 x 8.5 feet, concrete foundation, wood frame construction, insulated walls
1 dry and shop building, 80 x 60 x 16 feet, concrete slab foundation, metal siding and roofing
1 substation, 37.8 x 30.3 x 45.3 feet, concrete foundation, steel superstructure
1 water line, 685 feet long, 6 inch pipe with 2.5 inch return.
1 sewage disposal line, 4,300 feet long, 1.5 inch plastic insulated.

Management

The work was carried out by MacIsaac Explorations Limited; under the direction of J. B. Watts, Chief Mine Planning Engineer.

Longvack South Mine

The property comprises four claims in Levack township. The mine address is Onaping.

Operation progressed from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November. The vertical, three compartment Longvack South shaft collared in the N.½, lot 3, concession IV, Levack township has a total depth of 1,289 feet below the collar.

Development work in 1969 consisted of 1,665 feet of drifting, 506 feet of crosscutting and 1,206 feet of raising. Total development footage to 31 December 1969 was as follows: 4,979 feet of drifting, 2,725 feet of crosscutting and 3,052 feet of raising. Diamond-drilling in 1969 consisted of 696 holes totalling 18,035 feet from underground.

Management

The work was completed by MacIsaac Explorations Limited; J. B. Watts, Chief Mine Planning Engineer for Falconbridge (Onaping) was in charge.

North Mine

The mine, located in the N.¼, of lot 5, concession XI, of Levack township comprises two claims and lies east of the shaft and workings of Fecunis Lake mine which are used to service the operation. The mine address is Onaping.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November.

The vertical, three compartment, No. 1 internal shaft was collared at a depth of 3,450 feet and sunk 207 feet in 1969 to a depth of 3,657 feet below surface.

Development work consisted of 2,219 feet of drifting, 687 feet of crosscutting and 924 feet of raising. The total to 31 December 1969 was as follows: 13,647 feet of drifts, 3,281 feet of crosscuts; 2,517 feet of raises completed from the 2,550-foot to 3,775-foot levels of the Fecunis Lake mine. Some 93 diamond-drillholes totalling 28,499 feet were completed from underground, and 5 non-geological holes, totalling 296 feet.

A total of 95,113 tons of ore was hoisted for milling.

Employment and Management

E. N. Gilje was superintendent; employees were included in Fecunis Lake total.

Strathcona Mine

The Strathcona property comprises five claims located in Levack township. The mine address is Onaping.

Operations proceeded from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November.

Development work consisted of 3,131 feet of drifting, 4,438 feet of crosscutting and 10,338 feet of raising.

Total development footage to 31 December 1969 consisted of 55,147 feet of drifts, 49,188 feet of crosscuts, 68,764 feet of raises. Diamond-drilling consisted of 185 holes totalling 47,572 feet from underground and 80 non-geological holes totalling 4,941 feet.

New construction in 1969 consisted of a steel storage building on concrete slab 80 x 60 feet.

Added equipment included the following:

1 2-boom jumbo on four wheel drive, 78 h.p. diesel carrier
3 scooptrams (two model STHA, one model ST2A)
5 Hudson mine cars, 250 cu. ft.
1 diesel locomotive, 60 h.p.
1 ambulance, complete

A total of 1,299,493 tons of ore was hoisted and milled.

Strathcona Depth Mine

The property comprises six claims in Levack township. The property address is Onaping.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 21 August to 22 November.

Development work in 1969 was 2,559 feet of drifts and 3,528 feet of crosscuts. Some 15 geological diamond-drillholes totalling 19,120 feet were completed from underground.

Employment and Management

The average number of employees at the Strathcona and Strathcona Depth operations was 880; 526 underground and 354 on surface. K. A. Baillie was mine superintendent.

OUTSIDE EXPLORATION

Outside exploration completed in 1969 on Sudbury Basin properties required some 686 feet of drifting from International Nickel's Maclennan mine, in 1968, to complete exploratory diamond-drilling. Some 24 holes totalling 25,864 feet were drilled from underground and 33 holes totalling 35,113 feet from surface.

Management

The work was carried out under the direction of J. C. Cowan, chief geologist for Falconbridge.

CONCENTRATORS

Falconbridge Mill

The plant address is Falconbridge.

Operations progressed from 1 January to 31 December 1969, except for time lost due to strike action from 21 August to 22 November.

Added equipment comprised two pumps 8 x 6 SRL-C with 40 and 75 h.p. motors and appliances for on stream measurement of the circulating load to the flotation units consisting of a nuclear gauge, density meter, magnetic flowmeter; recorder, integrator and totalizer.

During the year a total of 857,954 tons of ore was milled, at an average of 3,178 tons daily.

Employment and Management

J. K. Wegle was superintendent of plants. The employees were included in the smelter total.

Fecunis Mill

The plant address is Onaping.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 22 August to 22 November.

Major added equipment consisted of an additional 600 cu. ft. flotation cell in rougher circuit to treat 40/50 tph.

During the year a total of 447,926 tons of ore was milled, at a daily average of 2,379 tons, producing 57,503 tons of nickel-copper concentrate.

Employment and Management

The number of employees is included in Fecunis mine total. K. C. Mott was mill superintendent.

Hardy-Boundary-Onaping Mill

The plant address is Onaping.

Operations proceeded from 1 January to 19 August, 1969.

During the year a total of 254,017 tons of ore was milled, at an average of 1,620 tons daily and 40,718 tons of nickel-copper concentrate was produced during the period of operation.

Employment and Management

The average number of employees is included in Hardy-Boundary-Onaping mine total. W. H. Van Raadshooven was mill superintendent.

Strathcona Mill

The plant address is Onaping.

Operations progressed from 1 January to 31 December 1969, except for lost time due to strike action from 17 August to 23 November 1969.

Major construction in 1969 included the completion of the loadout station extension, 69 x 61 x 98 ft. at the concentrator.

A total of 1,540,348 tons of ore was treated at an average of 7,000 tons daily to produce 149,271 tons of nickel-copper concentrate.

Employment and Management

F. G. Pickard was in charge; the employees were included in Strathcona mine total.

SMELTER, PYRRHOTITE PLANT and IRON ORE CONCENTRATOR

The pyrrhotite plant has become an integral part of the smelter process and serves as a pilot plant for the new nickel-iron refinery plant which is now under construction.

Major construction in 1969 at the plant included a six-inch wood stave waste water line from the pyrrhotite plant to No. 5 tailings fill plant some 1,592 feet and an eight inch wood stave, tailings line from No. 5 railings fill plant to the disposal area some 2,462 feet in length.

The smelter treated concentrates from the Falconbridge, Hardy, Fecunis and Strathcona mills and produced 76,832 tons of nickel-copper matte. The pyrrhotite plant treated pyrrhotite concentrate and produced 49,030 short tons of iron ore.

Employment and Management

The average number of employees in the smelter and pyrrhotite plant was 1,035; J. K. Weglo, superintendent of plants was in charge.

NICKEL-IRON REFINERY

Major construction and installation of equipment, commenced in 1968 at the new nickel-iron refinery, was continued in 1969. The work was delayed by labour problems in both the construction and production trades. Completion of construction and commencement of production are scheduled for late 1970. Annual capacity of the current stage of the refinery will be 300,000 tons of nickel-iron pellets produced from 500,000 tons of pyrrhotite concentrate.

Completion of the nickel-iron refinery and development of the Lockerby property are major items of the $30 million capital program for 1969-70.

Employment and Management

The work is primarily on contract, however Falconbridge employed an average of 15 men under the direction of G. B. Reed, project superintendent.

RESEARCH AND DEVELOPMENT

Falconbridge Research Laboratory

The central metallurgical research laboratories of Falconbridge Nickel Mines Limited are at Thornhill, in the Toronto area. Research carried out here deals with such widely varied subjects as mineralogical investigation of materials from exploration, development, mining and extractive metallurgy; development of chemical and instrumental analytical procedures for use in the company's research, production, and

quality control laboratories; development and testing of new production methods; and investigation of the physical nature of the metals produced.

Employment and Management

C. L. Lewis was the manager. There were 83 persons employed.

Lakefield Research of Canada Limited

This custom-testing and research centre, a subsidiary of Falconbridge Nickel Mines Limited, is located in Lakefield.

The plant is equipped with complete laboratory facilities and a pilot plant with wet and dry grinding, wet and dry magnetic separation, gravity concentration and flotation, electric roasting, as well as units for autogenous grinding and pebble milling. Additions to the laboratory equipment acquired during the year include an X-ray diffractometer, X-ray spectrometer, atomic absorption spectrophotometer, permaran surface area meter and a warman cyclosizer.

Employment and Management

A. G. Scobie was manager and there were 37 persons employed.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Metal Deliveries

	1969	1968
	(lb.)	(lb.)
Nickel	80,647,000	70,712,000
Copper	49,456,000	39,787,000

The demands for nickel, copper and cobalt were exceptionally firm throughout the year, and nickel demand continued to exceed supply. The Sudbury strikes severely aggravated the metal shortage and the company, in an effort to supply nickel to customers, depleted inventories which must be replenished in 1970. In spite of new production expected to come onstream during 1970-71, nickel will probably remain in tight supply at least until the latter part of 1971.

In 1969 world copper supplies again lagged behind demand. The production lost during the extended 1967-68 strike in the United States copper mining industry remains a significant factor affecting the supply-demand balance. Strikes, including those in Sudbury, as well as various production difficulties in other copper mining centres, increased the pressure on available supplies.

The Company's cobalt deliveries rose substantially in 1969, reflecting unusually high demand for the metal.

The Company's marketing organization was further strengthened during the past year to provide the most efficient coverage of growing markets. Special attention was directed to broadening the Company's product line to include NICKEL 98, introduced during 1969, iron-nickel pellets slated for commercial production in 1970 and ferronickel from the Dominican Republic project scheduled for 1972.

To help offset substantially higher production costs in the industry and finance new exploration and development activities producers increased nickel prices late in 1969. The base price of Falconbridge electrolytic nickel was increased 25 U.S.c (27 Can.c) per pound to U.S. $1.28 (Can $1.38) per pound F.O.B. Thorold, Ontario on 25 November 1969. Corresponding price adjustments were made for other basing points.

During 1969, world copper prices rose significantly, exhibiting a broad general upward trend from January through December. The London Metal Exchange (L.M.E.) average monthly spot cash price increased from a low, equivalent to 56.6 U.S.c (61 Can.c) per pound for January, to a peak of 77.0 U.S.c (73 Can.c) per pound for December.

The major producers raised the price of cobalt in October and again in November. Falconbridge increased the base price of its electrolytic cobalt by 15 U.S.c (16 Can.c) to U.S. $2.00 (Can. $2.15) per pound on October 21 and to U.S. $2.20 (Can $2.36) per pound on 24 November.

Mines

Ores delivered to treatment plants from company mines amounted to 3,118,000 short tons, a slight reduction from 3,208,000 short tons in 1968. Except for the three-month strike, ore production for the year would have greatly exceeded that of 1968. During the second quarter, when Strathcona had reached full production, total mine production was running 40 percent above the 1968 average rate. At year-end, the mines and plants were again operating at pre-strike levels.

Sinking of the production shaft at the Lockerby property commenced in March with an objective of 4,300 feet and at year-end had reached a depth of 1,674 feet below the collar. Seven levels have been established.

Deepening of the main shaft at the Onaping mine from the original depth of 3,050 feet was completed at 4,400 feet below the collar on July 25th, and level development is now underway.

At the Fraser area which is between Strathcona and Fecunis Lake mines, plans are underway to sink a 5,100-foot shaft from surface to explore this area at a faster pace than is possible from the Fecunis or Strathcona underground workings. The site has considerable ore potential.

Treatment Plants

Strathcona mill operated satisfactorily although occasionally hampered by some equipment weaknesses.

To provide additional smelting capacity plans are in progress to reactivate a blast furnace and converter in the old smelter aisle.

Nickel-Iron Refinery

Strikes by construction tradesmen and Falconbridge production employees caused six months' delay in construction, the direct and indirect results of which will considerably increase the cost of the project. It is expected this plant will be ready for initial operation during the third quarter of 1970.

Ore Reserves — Sudbury Area

The year-end review of the company's ore reserves in the Sudbury District showed an increase of 1,169,700 tons of ore and 723 tons of contained metals after mining 3,118,000 tons of ore during the year. Small amounts of additional ore were developed at existing mines. Additional tonnages were outlined by exploration drilling in other areas. These two factors more than offset the tons of ore mined.

Proved and probable ore at the end of 1969 amounted to 92,808,300 tons with a contained nickel-copper metal content of 1,810,491 tons.

Research and Development

Research and development activities in 1969, as in the previous year, continued towards further progress in three principal directions: lateritic ore processing, refining of nickel-copper matte, and production and use of iron-nickel pellets.

New programs of research and development have been undertaken in the search for more economic processes, particularly for remote northern locations, for application of newer techniques in instrumentation, automation and process control in all plants, and for new approaches to metallurgical processes which will help meet the growing demands for improved environmental conditions.

Intensified research in recent years and increasing attention to patent protection for the developments-in-process and apparatus have resulted in the filing of a number of patent applications and the issuance of a number of patents during 1969.

Employment and Management

The company employed in Ontario in 1969, excluding employees of contractors (totalling 204 reported) doing work for the company, a total of 4,023 employees; 2,246 at the mines, 1,729 underground and 828 on surface, including the concentrators; 1,035 in the smelter and iron ore recovery plants; 15 in the nickel-iron refinery, 120 in two

research plants. G. A. Allen was manager of the Sudbury operations; R. R. Holmes was general superintendent, Falconbridge area; W. W. Westaway was general superintendent, Onaping area.

GOULD COPPER MINES LIMITED

Gould Copper Mines Limited was incorporated in August 1968 with an authorized capitalization of 200,000 shares of no par value of which 142,622 shares have been issued. The officers and directors were: Alfred Lebel, president; Raymond Poirier, vice-president; Jim Wylis, director; G. D. Cameron, secretary-treasurer. The head office and mine office is at Box 1329 Blind River.

The property comprises 51 claims in Gould township, District of Algoma, located approximately 31 miles north of Thessalon on Highway 29 and about a mile west of the highway on a mine access road.

Operations progressed from 15 May to 31 December 1969.

A large amount of surface trenching and test pits were completed on the property. An adit some 15 feet wide and 12 feet high was driven a distance of 95 feet into the hillside to develop a chalcocite copper vein first encountered in surface showings.

Construction in 1969 comprised a wood frame dry 32 x 16 feet and a wood frame office 30 x 26 feet. Added equipment included an air compressor, 600 cfm., a diamond-drill and a front-end loader.

Water supplies are available from Huston Lake near the adit, and a hydro line is about half a mile distant.

Employment and Management

The property is controlled by six partners, two of which were steady at the property, the other four on weekends only. Raoul Beaudin was general manager.

GREAT LAKES NICKEL LIMITED

Great Lakes Nickel Corporation Limited was incorporated in December 1965; in 1969 it was amalgamated with Thunder Bay Mining Corporation Limited as Great Lakes Nickel Limited. The authorized capitalization remained at 5,000,000 shares of $1 par value, of which 2,574,956 shares have been issued. The directors and officers were: J. A. McCuaig, president and director; I. C. Christopher, H. R. Hogan, W. H. Hood, C. N. Simpson, J. H. McDougall and B. Brown, directors; J. A. Murphy, secretary. The head office is at Suite 203, 8 King St. East, Toronto 1. The mine address is Box 367, Thunder Bay.

The property comprises approximately 3,000 acres located in Pardee township, District of Thunder Bay about 50 miles south of the City of Thunder Bay. Some work had been previously completed on the property including a tunnel some 80 feet long on claim TB109399.

Mining operations proceeded from 1 January to 31 December 1969.

The company continued the diamond-drilling program; some 22 diamond-drillholes totalling 40,725 feet were completed from surface.

Employment and Management

The average number of employees on surface was 25. J. O. Wall was general manager, A. W. Grant was superintendent.

HARRISON DRILLING AND EXPLORATION COMPANY LIMITED
(Potter Mine)

Harrison Drilling and Exploration Company Limited was incorporated in December 1949, with an authorized capitalization of 800 shares of $50 par value of which 135 shares have been issued. The directors and officers were: Patrick Harrison, president and director; Gerald Ernest, Edward H. Harrison, vice-presidents and directors; S. J. Gabon, secretary-treasurer and director. The head office is at 146-14th Street, Noranda, Quebec; the Potter mine address is P.O. Box 604, Matheson.

The property, formerly known as Munro Copper Mines Limited and Centre Hill Mines Limited (see 1968 report) comprises 24 claims, about 1,120 acres, located in Munro township, District of Cochrane, some 22 miles northeast of Matheson. Since December 1968, the ownership and supervision of the mine has been under Harrison Drilling and Exploration Company Limited who purchased the mining property, mill and other assets from Munro Copper Mines Limited.

Mining operations progressed from 1 January to 31 December, milling from 1 June to 31 December 1969.

The mine is serviced by the vertical, three compartment No. 1 shaft located in the northeast quarter of the south half, concession V (claim P.53954) which has a depth of 970 feet below the collar.

Development work in 1969 consisted of 2,162 feet of drifting, 300 feet of crosscutting and 1,119 feet of raising. Total development footage on the property to 31 December 1969 was as follows: 10,840 feet of drifts, 1,441 feet of crosscuts, and 6,529 feet of raises. Some 11 diamond-drillholes totalling 2,369 feet were completed from underground.

A total of 101,802 tons of ore was hoisted; 101,225 tons were milled at a daily average of 592 tons during the period of operation.

Employment and Management

The average number of employees was 52: 29 underground and 23 on surface. D. Sykes was manager.

HERMINA COPPER LIMITED

Hermina Copper Limited was incorporated in August 1968 with an authorized capitalization of 40,000 shares of $1 par value, of which 20,003 shares have been issued. The directors and officers were: G. H. Babcock, president and manager; C. Babcock, secretary. The head office and mine address is P.O. Box 97, Massey.

The property is a copper prospect northwest of Massey, comprising two blocks of claims in Salter township, District of Sudbury. One block of ten claims includes the old Hermina mine on which geophysical work has been done. The second block of 24 claims known as the Gutcher-Raycraft had an adit driven by previous operators on which some work was carried out in 1969.

Work commenced at the No. 4 ore zone in February, where a timber headframe was erected over a two compartment shaft, some 68 feet deep. A hoist was installed and the shaft sunk a further 12 feet on the 80 degree incline, with some 240 feet of drifting

to the east and 75 feet to the west and 120 feet of raising completed during the year. Some 70 feet of surface trenching averaging three feet in depth was completed.

Added equipment included a diesel powered truck of two ton capacity.

A total of 6,167 tons of ore was hoisted; 6,199 tons was trucked to the Pronto mill of Rio Algom Mines Limited and processed under contract.

Employment and Management

There were 6 employees; 5 underground and 1 on surface during the period of operation with George Babcock in charge.

THE INTERNATIONAL NICKEL COMPANY OF CANADA LIMITED

The International Nickel Company of Canada Limited was incorporated in July 1916 under Dominion of Canada charter; in 1957 all issued preferred shares of stock were redeemed for cash, and all authorized but unissued preferred shares were cancelled; in April 1960 the authorized capitalization was increased to 36,000,000 shares; in July 1968 to 90,000,000 of no par value, of which 74,415,688 shares have been issued.

The officers of the company in 1969 were: H. S. Wingate, chairman and chief officer; A. F. Gagnebin, president; J. C. Parlee, senior executive vice-president; F. F. Todd, executive vice-president; L. S. Renzoni and H. F. Zurbrigg, vice-presidents; N. H. Wadge, assistant vice-president; W. A. McCadden, comptroller; W. F. Kennedy, secretary; F. M. A. Noblet, treasurer; J. A. Pigott, assistant vice-president and division general manager (Ontario); G. O. Machum, assistant general manager (processing); D. A. Fraser, assistant general manager, (administration); G. R. Green, assistant general manager (mining); Alex Godfrey and R. R. Saddington, assistants to division general manager (Ontario); M. E. Young, manager of mines; J. B. McConnell, manager of reduction plants; G. A. Dick, manager (copper refining division, Sudbury); W. V. Barker, manager (nickel refining division, Port Colborne); E. G. Stoneman, manager (iron ore recovery plant, Copper Cliff).

The executive office is at 67 Wall Street, New York 10005, N.Y., U.S.A., and the general offices are at Copper Cliff. The Toronto office is at Toronto-Dominion Centre, Toronto 1.

The company and its subsidiary companies operate hydro-electric plants; nickel-copper mines in the Sudbury District, smelters, copper refinery and iron ore recovery plant at Copper Cliff; a nickel refinery at Port Colborne. The new J. Roy Gordon Research Laboratory located in Sheridan Park commenced operations in 1967. Operations outside the province include refineries at Acton, England and Clydach, Wales; rolling mills at Birmingham, England; Huntington, West Virginia, U.S.A. and Glasgow, Scotland and a foundry at Bayonne, New Jersey, U.S.A. In 1961 the company's new nickel mining, smelting and refining project at Thompson, Manitoba was completed and brought into full operation.

The company operated in 1969, 18 mines, 13 of which, including two open pit operations, produced 15,450,655 tons of ore; 14,011,124 tons were milled in four concentrators, with the concentrate treated in two smelters and an iron ore recovery plant prior to metal refining in a number of refineries. The byproduct, sulphur dioxide gas, was processed in plants operated by Canadian Industries Limited to produce liquid sulphur dioxide and sulphuric acid.

SHAFTS, INTERNATIONAL NICKEL COMPANY'S MINES, SUDBURY AREA

	Inclination	Number of Compartments	Collar Depth	Sinking in 1969	Vertical Depth from Surface
			feet	feet	feet
Coleman					
No. 1	Vertical	5	Surface	—	2,278
Copper Cliff North					
No. 1	Vertical	5	Surface	—	4,134
No. 2	Vertical	3	Surface	—	1,166
Copper Cliff South					
No. 1	Vertical	5	Surface	365	436
No. 2	Vertical	3	Surface	944	2,301
Crean Hill					
No. 1	(57° to 305 ft.) (71° to bottom)	3 (inactive)	Surface	—	797
No. 2	Vertical	5	Surface	625	2,749
Creighton					
No. 2	65°	2 (inactive)	Surface	—	314
No. 3	55°	5	Surface	—	1,946
No. 4	50°	5 (inactive)	1,477	—	2,702
No. 5	Vertical	6	Surface	—	4,074
No. 6	Vertical	5	3,822	—	5,562
No. 7	Vertical	3	Surface	—	2,056
No. 65	65°	3 (inactive)	3,819	—	4,320
No. 8	Vertical	3	5,017	—	6,746
No. 9	Vertical	6	Surface	492	7,137
Frood Stobie					
No. 1	(77° to 1,300 ft.) (61° to bottom)	2 (inactive)	Surface	—	3,097
No. 3	Vertical	6	Surface	—	3,042
No. 4	Vertical	3 (inactive)	2,783	—	3,928
No. 6	Vertical	4 (inactive)	2,782	—	3,391
No. 7	Vertical	5	Surface	—	3,105
No. 8	Vertical	3	Surface	—	2,624
No. 9	Vertical	3 to 2,358 ft. 4 to bottom	Surface	—	2,774
Garson					
No. 1	Vertical	3 (inactive)	Surface	—	1,457
No. 2	Vertical	5	Surface	—	4,242
No. 3	Vertical	2	4,000	—	5,126
Kirkwood					
No. 1	Vertical	3	Surface	—	2,134
Levack					
No. 1	65°	3 (inactive)	Surface	—	983
No. 2	Vertical	(6 to 2,910 ft.) (5 to 2,973 ft.) (4 to bottom)	Surface	—	3,915
No. 3	Vertical	3	1,594	—	3,716
Little Stobie					
No. 1	Vertical	3	Surface	—	2,650
No. 2	Vertical	3	Surface	—	1,994
MacLennan					
No. 1	Vertical	3	Surface	—	1,346
Murray					
No. 1	36°	3 (inactive)	Surface	—	593
No. 1 winze	36°	1 (inactive)	470	—	775
No. 2	Vertical	5	Surface	—	3,298
No. 3	Vertical	2	2,994	—	4,163
North Range					
No. 1	Vertical	3	Surface	—	3,175

	Inclination	Number of Compartments	Collar Depth	Sinking in 1969	Vertical Depth from Surface
			feet	feet	feet
Shebandowan					
No. 1	Vertical	3	Surface	15	1,136
No. 2	Vertical	5	Surface	1,525	1,596
Totten					
No. 1	Vertical	3	Surface	—	1,057
No. 2	Vertical	3	Surface	347	2,334

MINES

Coleman Mine

Lateral development from the vertical, five compartment No. 1 shaft having a depth of 2,278 feet below collar, was suspended in May 1968 to permit construction of the permanent headframe; it was resumed late in the year using temporary hoisting facilities. Dravo of Canada was the prime contractor. Construction of the permanent headframe was completed and the friction hoists, which will be operative in mid 1970 were installed. Construction of surface plant buildings continued throughout the year.

Development work in 1969 consisted of 5,001 feet of drifts and crosscuts and 1,982 feet of raises. Total development footage to 31 December 1969 consisted of 15,260 feet of drifts and crosscuts and 3,097 feet of raises. A total of 82 diamond-drillholes, totalling 32,938 feet were completed from underground.

Added equipment in 1969 included the following:

1 boiler, combination unit for oil or natural gas, 15 pound pressure
2 locomotives, batteries and charger, 2 ton
1 motor, electric 200 h.p. 3/60/550/1200
10 transformers, 15 KVA
3 fans, Axivane (1 — 125, 1 — 75, 1 — 50 h.p. motor)

Employment and Management

The work completed was done under contract; D. Lennie, area superintendent for International Nickel was in charge.

Copper Cliff North Mine

Clarabelle is an open pit operation, Copper Cliff North is an underground operation, both on the same orebody. They are located between Copper Cliff and the Murray mine. The mine address is Copper Cliff.

Operations progressed from 1 January to 31 December except for time lost due to strike action from 10 July to 14 November.

Development footage in 1969 consisted of 18,555 feet of drifting and crosscutting and 2,081 feet of raising. Total development footage to 31 December 1969 was as follows: 94,324 feet of drifts and crosscuts; 18,897 feet of raises. Some 96 diamond-drillholes, totalling 56,200 feet were completed from underground.

Added equipment was as follows:

3 scooptrams, diesel powered, 4 wheel drive
1 teletram, diesel powered, 4 wheel drive
4 drill carriers
5 gesters, mobile two seaters, 36 inch gauge
1 air heater, multipass model
7 locomotives, diesel, 8 ton
2 loaders, model LM-56H
49 rock drills (42 stoper model RB83; 7 deep hole, model DH123)

13 fans, Axivane, various sizes
1 unit, self contained battery and charger
10 utility hoists, model DGU
50 mine cars; (40 Granby type 140 cubic feet — 10 utility, 36 inch gauge)
1 rotary drill complete with derrick and control tower
2 motors, electric 250 h.p.
1 transformer, 300 KVP, 3 phase, 60 cycle
1 lift truck, model 12TEC15

A total of 985,155 tons of ore was hoisted; and shipped at a daily average of 4,877 tons during the period of operations.

Employment and Management

The work was completed on contract by Dravo of Canada Limited; N. A. Creet was area superintendent and J. G. Stresser was superintendent in charge for International Nickel.

Copper Cliff South Mine

The vertical, five compartment No. 1 production shaft was sunk 365 feet in 1969 to a depth of 436 feet below the collar. The 250 and 500-foot levels were established at depths of 190 and 430 feet respectively below the collar. Sinking in the vertical, three compartment No. 2 development shaft for a further 944 feet was completed to a depth of 2,301 feet below the collar. The 1,500, 1,750, 2,000, 2,250-foot levels, and 2,250 loading pocket were established at vertical depths of 1,418, 1,670, 1,922, 2,174 and 2,247 feet respectively below the collar. A ramp from surface to the 500-foot level, to mine an isolated section of the ore is being driven. Mining will be carried out from the ramp with the ore trucked to surface for crushing and shipping. A total of 1,783 feet of drifting and crosscutting and 91 feet of raising was completed. Total development footage to 31 December 1969 was as follows: 2,115 feet of drifts and crosscuts and 91 feet of raises. Some 28 diamond-drillholes totalling 11,156 feet were completed from underground.

Major construction included a warehouse, one storey 160 x 60 x 18 feet; a collarhouse 116 x 66.5 x 41.5 feet and a headframe 31.3 x 35.9 x 150 feet with a penthouse on top of headframe 42 x 45.9 x 41 feet and a bin on side of headframe 19.6 x 27 x 90 feet.

Equipment installed included the following:

8 fans, Axivane (6 — 30 h.p. motors; 2 — 60 h.p. motors)
1 air compressor, 2 stage with 100 h.p. electric motor
4 scooptrams, diesel powered, four wheel drive
1 boiler, automatic heating
1 crusher, Jaw 48 x 66 inches
5 pumps, various models and sizes
20 mine cars, rocker dump 55 cubic feet, 36 inch gauge
1 gunite spray machine, 19 cubic foot capacity
1 cooling tower, capacity 1500
10 utility hoists, model DGU
1 lift truck, electric aisle model
6 electric motors (5 — 100 h.p.; 1 — 600 h.p.)
1 personnel and service carrier, 38 h.p. diesel
4 transformers (2 — 300 KVA; 2 — 75 KVA)
1 loading station 2 compartment with 280 cubic foot measuring boxes.

Employment and Management

The development work completed on the property was on contract; N. A. Creet, area superintendent for International Nickel was in charge.

Crean Hill Mine

Normal operations continued from 1 January to 31 December 1969, except for lost time due to strike action from 10 July to 14 November.

The vertical five compartment No. 2 shaft was sunk 625 feet to a depth of 2,749 feet below the collar. The 2,250 and 2,500-foot levels were established at depths of 2,247 and 2,499 feet below the collar. The No. 1 inclined shaft has been abandoned for hoisting purposes.

Development footage in 1969 consisted of 4,638 feet of drifting and crosscutting and 2,555 feet of raising. Total development footage to 31 December 1969 was as follows: 73,540 feet of drifts and crosscuts; 21,895 feet of raises. Some 123 diamond-drillholes totalling 40,163 feet, were completed from underground.

Added equipment consisted of the following:

20 mine cars, Granby type 140 cubic feet; 36 inch gauge
2 locomotives, diesel 8 ton, 36 inch gauge
1 drill carrier, model 7300C
1 battery, type ZU9B
1 electric motor, 200 h.p. 3/60/550/900
2 fans, Axivane (1-30 h.p. motor; 1-7½ h.p. motor)

A total of 604,302 tons of ore was hoisted and shipped at an average of 3,640 tons per working day during the period of operations.

Employment and Management

The average number of employees was 373; 265 underground and 108 on surface. R. M. Brown area superintendent was in charge.

Crean Hill Pit

The work in the Crean Hill open pit is being done by Carman Construction Limited on contract.

Operations progressed from 1 January to 31 December 1969 except for lost time due to strike action from 10 July to 14 November.

A total of 211,005 tons of ore was mined and trucked at a daily average of 1,111 tons during the period of operation.

Employment and Management

The contractor supplied the working crew which averaged 13 men. R. M. Brown area superintendent for International Nickel was in charge.

Creighton Mine

Normal operations continued during 1969 except for lost time due to strike action from 10 July to 14 November.

The vertical, six compartment No. 9 shaft was sunk some 492 feet and the excavation and concrete lining was completed to a final depth of 7,137 feet below the collar, and preparations for equipping the shaft were commenced. The 6,800 and 7,000-foot levels were established at depths of 6,790 and 7,000 feet below the collar.

Development work in 1969 consisted of 23,061 feet of drifting and crosscutting; 2,438 feet of raising. Total development footage to 31 December 1969 was as follows: 562,075 feet of drifts and crosscuts; 237,336 feet of raises. A total of 254 diamond-drillholes totalling 57,664 feet were completed from underground.

Development was continued on a service ramp to permit the free movement of diesel equipment from level to level between surface and the 1,700-foot level.

Considerable new and replacement equipment was added, which included the following:

2 batteries, 66D8 cells, 11 trays
2 loaders, ore, with 145 h.p. air cooled diesel engines
3 gesters, mobile two seater
2 ore car dumpers for 24 inch gauge cars
1 welder, electric model SAE 300
1 threading machine with 2½ inch spindle
1 press, model Y-150-3, 150 ton
2 weighing systems complete to weigh load, haul, dump vehicles
6 scrooptrams, diesel powered, four wheel drive
2 teletrams, 20 ton, 4 wheel drive, 195 h.p.
6 carriers, personnel and service
8 drill carriers, various models
5 locomotives, 8 ton diesel (3 — 36 inch gauge; 2 — 24 inch gauge)
2 controllers, 125 h.p.
11 transformers of various KVA ratings
6 pumps, model M-15
3 fans, Axivane with 30 h.p. motors

A total of 3,244,261 tons of ore was mined; 3,191,420 tons were shipped at an average of 18,997 tons daily during the period of operations.

Employment and Management

The average number of employees was 2,237; 1,657 underground and 580 on surface. B. T. King was area superintendent.

Frood Stobie Mine

Normal operations continued during 1969 except for lost time due to strike action from 10 July to 14 November.

The No. 9 shaft will be used to service future operations at the Little Stobie mine as well as additional tonnage to be produced from the Stobie section of the Frood Stobie mine.

Development work consisted of 40,608 feet of drifting and crosscutting; 6,973 feet of raising. Total development footage to 31 December 1969 was as follows: 734,971 feet of drifts and crosscuts, 256,231 feet of raises. Some 17 diamond-drillholes, totalling 6,434 feet were completed from surface.

Major added and replacement equipment included the following:

5 batteries, various capacities
7 carriers, personnel and service, diesel
2 diesel locomotives, 8 ton, 36 inch gauge
20 mine cars, 260 cubic foot capacity
3 gesters, mobile two seater, 36 inch gauge
12 drill carriers, various types and models
1 Ross 7B feeder with hydraulic drive
1 hoist, electric, 11,000 pound capacity
7 fans, Axivane (2 — 150 h.p. motors; 5 — 30 h.p. motors)
10 scooptrams, model ST-4A, diesel powered with four wheel drive
5 rock drills, various models and types
1 drilling machine with elevating table
1 pipe threading and cutting machine with 1 h.p. motor
1 band saw, model C9
1 car weighing system, underground
2 transformers, oil filled, 300 KVA and 11,200 KVA capacity
2 separators, horizontal
1 stator for 5,500 hp motor
1 switchgear unit with standby battery
4 skips, bottom dump, 400 cubic foot, 20 ton capacity for Stobie No. 9
4 skip arrestors, 2 in headframe, 2 shaft bottom for Stobie No. 9
2 motors, 50 h.p. 3/60/550/1800 type K, for Stobie No. 9
1 sampler, model HVC — 600 for Stobie No. 9
1 electro dryer, 100 psig working pressure for Stobie No. 9

A total of 4,947,765 tons of ore, at a daily average of 29,451 tons was hoisted and shipped for further treatment during the period of operations.

Employment and Management

The average number of employees was 3,559; 2,586 underground and 973 on surface. S. J. Sheehan was area superintendent.

Garson Mine

Normal operations continued during 1969 except for lost time due to strike action from 10 July to 14 November.

Development work consisted of 6,290 feet of drifting and crosscutting, 5,145 feet of raising. Total development footage to 31 December 1969 was as follows: 273,649 feet of drifts and crosscuts; 130,694 feet of raises. Some 44 diamond-drillholes, totalling 29,627 feet, were drilled from underground.

Added and replacement equipment in 1969 included the following:

4 batteries, (one N/1 66D8; three ZU9B)
6 scooptrams, (two air powered, four diesel powered)
3 drill carriers various types and models
1 locomotive, diesel, 8 ton
1 Bradford breaker, size 10½ x 19 feet
1 flat rail car, for mounting breaker and equipment
3 transformers, (two 1500 KVA, one 225 KVA)
1 rectifier, output 50 KW, 250 V, 200 Amps.
1 motor, synchronous, 2,500 h.p.
13 fans, Axivane (11 with 5 h.p. motors; 2 with 10 h.p. motors)
6 pumps, various models and capacities
2 controllers, 60 h.p.
10 drills, model AL-60
1 substation unit for outdoor use mounted on railroad car

A total of 775,137 tons of ore, at a daily average of 4,587 tons was hoisted and shipped for further treatment during the period of operations.

Employment and Management

The average number of employees was 1,170; 931 underground and 239 on surface. M. E. Jowsey was area superintendent.

Kirkwood Mine

Operations continued on contract at the Kirkwood property located in Garson township, except for lost time due to strike action from 10 July to 14 November.

The vertical, three compartment No. 1 shaft has a depth of 2,134 feet below the collar. Development footage in 1969 consisted of 10,178 feet of drifting and crosscutting and 2,657 feet of raising. Total development footage to 31 December 1969 was as follows: 25,380 feet of drifts and crosscuts, 5,761 feet of raises. Some 128 diamond-drillholes totalling 63,798 feet were completed from underground.

Major equipment installed in 1969 consisted of the following:

1 treatment plant, model S-50-33-2, 500 U.S. gpd.
1 controller, 150 h.p.
1 car dumper, 10 inch diameter, cylinders; 36 inch gauge
1 utility hoist
7 fans, Axivane (three 5 h.p. motors; four 15 h.p. motors)
2 transformers, 45 KVA, 3 phase, 60 cycle
1 load centre, portable 34C 4.16 KV

A total of 43,443 tons of ore was hoisted; 40,117 tons were shipped for further treatment during the period of operations.

Employment and Management

The work completed in 1969 was on contract to Dravo of Canada Limited who employed an average of 95; 56 underground and 39 on surface. M. E. Jowsey was area superintendent for International Nickel.

Levack Mine

Normal operations continued during 1969 except for lost time due to strike action from 10 July to 14 November.

Development work in 1969 consisted of 3,457 feet of drifting and crosscutting; 3,225 feet of raising. Total development footage to 31 December 1969 was as follows: 272,994 feet of drifts and crosscuts; 95,956 feet of raises. Some 47 diamond-drillholes, totalling 27,953 feet were drilled from underground.

New and replacement equipment added in 1969 was as follows:

11 batteries, locomotive 40-60x23
1 Cary lift unit, diesel powered 4 wheel drive
1 drill carrier with two deephole drills model DH123
1 carrier, personnel and service with 38 h.p. diesel engine
3 scooptrams, diesel powered, 4 wheel drive
5 motors, electric (four — 100 h.p.; one — 60 h.p.)
1 pump, 8 x 6 SRL-C-S
2 transformers (one — 500 KVA, one — 112½ KVA)
1 electric welder, shield arc stationary type
15 fans, Axivane, various types and sizes
4 car dumpers, 10 inch diameter cylinders, 24-inch gauge

A total of 1,449,106 tons of ore was hoisted and shipped at an average of 8,677 tons per working day during the period of operations.

Employment and Management

The average number of employees was 2,025; 1,467 underground and 558 on surface. D. Lennie was area superintendent.

Little Stobie Mine

Level development from No. 1 and No. 2 shafts continued throughout the year except for lost time due to strike action from 10 July to 14 November. The No. 1 shaft temporary headframe and hoist were dismantled in May and construction of the permanent headframe was commenced. Work at No. 1 shaft was continued with the use of a temporary hoist and cage installed on the 400-foot level.

A service ramp, which is to extend from surface to the 600-foot level, has reached the 500-foot level. It will be used in developing the upper portion of the mine for initial production and will also provide access for diesel mining equipment.

Development footage in 1969 consisted of 18,037 feet of drifting and crosscutting and 2,755 feet of raising. Total development footage to 31 December 1969 was as follows: 57,995 feet of drifts and crosscuts and 9,114 feet of raises. Some 51 diamond-drillholes totalling 18,921 feet were completed from underground and six holes totalling 5,694 feet from surface.

Major construction in 1969 included a reinforced concrete tunnel below grade 7 x 8 feet, 198 feet long; a concrete block cap and fuse house 35 x 25.5 x 10 feet and a compressor house 90 x 54 x 25 feet.

Equipment installed was as follows:

1 jaw crusher, 48 x 66 inches, type H
60 mine cars, 260 cubic foot capacity
1 battery NY, 66D8 cells, 11 trays

1 boiler, automatic
1 dust collector, area 1848 sq.ft. to filter 12,000 cfm.
1 magnet, Dings model 5
2 drill carriers with 2 model DH-123 drills
1 teletram, 20 ton
1 scooptram, diesel powered 4 wheel drive
2 locomotives, 23 ton with 120 h.p. motors
2 skips, bottom dump 240 cubic feet, 12 ton
1 electric hoist, 25 ton, double girder, span 175 feet
6 fans (four — 30 h.p. motors; two — 100 h.p. motors)
1 motor, 250 h.p. 3/60/550/1200
1 heater, warm air multipass, model 2500
19 transformers, various types and capacities

A total of 140,083 tons of ore was hoisted; 115,020 tons were shipped for further treatment during the period of operations.

Employment and Management

The work was completed under contract. S. J. Sheehan was area superintendent and V. Ritzel was superintendent in charge.

MacLennan Mine

The mine address is Garson.

Underground operations continued throughout 1969 except for lost time due to strike action from 10 July to 14 November.

The vertical, three compartment No. 1 shaft has a depth of 1,346 feet below the collar. A total of 1,826 feet of drifting and crosscutting and 1,635 feet of raising was completed. Total development footage to 31 December 1969 was as follows: 13,473 feet of drifts and crosscuts, 7,202 feet of raises. Some 22 diamond-drillholes, totalling 6,927 feet were completed from underground.

A total of 164,669 tons of ore was hoisted and shipped at a daily rate of 832 tons during the period of operations.

Employment and Management

The work completed was done under contract. M. E. Jowsey was area superintendent for International Nickel.

Murray Mine

Normal operations continued during 1969 except for lost time due to strike action from 10 July to 14 November.

Development work consisted of 23,728 feet of drifting and crosscutting; 2,618 feet of raising. Total development footage to 31 December 1969 was as follows: 252,454 feet of drifts and crosscuts, 50,430 feet of raises. Some 8 diamond-drillholes, totalling 9,280 feet were completed from underground.

Major equipment added in 1969 was as follows:

6 drill carriers, various models and sizes
3 carriers, personnel and service, 38 h.p. diesel engine
2 scooptrams, diesel powered 4 wheel drive
2 transformers, 225 KVA, 3 phase, 60 cycle
3 rock drills, model D123
7 fans, Axivane, with 30 h.p. motors
1 car transfer powered for 140 cubic foot cars
1 transformer, 75 KVA

A total of 1,250,733 tons of ore was hoisted; 1,244,266 tons were shipped at a daily average of 7,406 tons per day during the period of operation.

Employment and Management

The average number of employees was 673: 473 underground and 200 on surface. N. A. Creet was area superintendent.

North Range Mine

The North Range vertical, three compartment No. 1 shaft has a depth of 3,175 feet below the collar. Development footages in 1969 consisted of 3,209 feet of drifting and crosscutting; 192 feet of raising. Total development footage to 31 December 1969 was as follows: 4,394 feet of drifts and crosscuts and 312 feet of raises.

Major added equipment in 1969 was as follows:

4 fans, Axivane with 100 h.p. motors
1 switchgear unit 4.16 KV
2 load centres, S & C
4 pump control cabinets
2 transformer cars, 36 inch gauge

Employment and Management

The work completed during the year was under contract. G. R. Green, assistant general manager of mines for International Nickel, was in charge.

Shebandowan Mine

The property is located in Hagey township, some 50 miles west of the City of Thunder Bay.

The No. 2 vertical five compartment shaft was sunk 1,525 feet to a depth of 1,596 feet below the collar. The 400, 600, 800, 1,000, 1,200 and 1,400-foot levels were established at depths of 400, 610, 799, 999, 1,188 and 1,398 feet respectively below the collar. Some 10,936 feet of drifting and crosscutting and 4,108 feet of raising was completed. Total development footage to 31 December 1969 was as follows: 28,439 feet of drifts and crosscuts; 5,378 feet of raises. A total of 185 diamond-drillholes totalling 83,571 feet was completed from underground. P. Harrison and Company Limited, mining contractors, continued development work from the No. 1 shaft throughout 1969. The 1,000-foot level was connected to the No. 2 shaft and drifting is continuing east of No. 2 shaft. Cementation Company (Canada) Limited are the contractors for sinking No. 2 shaft which should be bottomed at 2,600 feet in 1970.

Major construction in 1969 included a hoistroom 53 x 44.2 x 41 feet, with reinforced concrete foundation, floors and structural steel framing.

Added equipment consisted of the following:

1 raise borer machine, model G1-R, air powered crawler
1 pump, 8 stage, 500 gpm. with 250 h.p. motor 3/60/550/1,800
1 controller, 250 h.p. — size 6
2 transformers (one — 225 KVA; one — 300 KVA)
4 air hoists, model 186
1 motor grader, diesel powered

Employment and Management

The work was completed on contract under the direction of A. Olive, project engineer for International Nickel.

Totten Mine

The vertical three compartment No. 1 shaft has a depth of 1,057 feet below the collar. The vertical three compartment No. 2 shaft was sunk 347 feet to a depth of 2,334 feet below the collar. The 2,100-foot level was established at 2,101 feet below the collar.

A total of 1,629 feet of drifts and crosscuts, and 312 feet of raises were completed in 1969. Total development footage to 31 December 1969 consisted of 25,314 feet of drifts and crosscuts and 10,006 feet of raises. Some nine diamond-drillholes, totalling 10,382 feet were completed from underground, and five holes totalling 902 feet were completed from surface.

Added equipment in 1969 comprised the following:

2 conveyor belts, 30 inches wide, various lengths
1 vibrating feeder, electric 36 x 72 inches
1 transformer, 112½ KVA

A total of 143,208 tons of ore was hoisted; 144,484 tons were shipped at a daily average of 737 tons.

Employment and Management

The work was completed by MacIsaac Mining and Tunnelling Company Limited on contract under the direction of R. M. Brown, area superintendent for International Nickel.

Victoria Mine

Dewatering of the underground workings was carried on throughout the year. The vertical, three compartment No. 2 shaft, having a depth of 3,012 feet, was reconditioned to the 14th level under contract by MacIsaac Explorations Limited.

Management

R. M. Brown was area superintendent.

Clarabelle Open Pits, Nos. 1 and 2

Operations continued throughout 1969 at the Clarabelle open pits, except for time lost due to strike action mentioned before.

A total of 3,833 rotary-drillholes totalling 159,269 feet were completed for production in 1969

Major equipment added in 1969 was as follows:

1 diesel tractor dozer, model D7E
4 railroad flat cars
1 blasthole drill, model 4SR, diesel powered
1 diesel engine 320 h.p., 200 rpm.
1 body for 35 ton truck
1 motor, 350 h.p. for 5 unit MG set
1 dipper for 6 yard shovel

A total of 1,578,209 tons of ore was mined and shipped for treatment at a daily average of 9,508 tons during the period of operations.

Employment and Management

The average number of employees was 401: 175 in the open pit and 226 on surface. N. A. Creet was area superintendent and J. G. Strasser was superintendent.

CONCENTRATORS

Clarabelle Mill

The site preparation for the new Clarabelle concentrator was commenced under the direction of R. Regimbal, manager.

Copper Cliff Mill

Normal operations continued throughout 1969 except for time lost due to strike action from 10 July to 14 November.

Major equipment added included the following:

2 air heaters, direct gas fired to deliver 25,000 cfm.
1 chlorinator, advance gas model 201
7 motors, electric (four 75 h.p.; two 30 h.p.; one 25 h.p.)
4 controllers, 75 h.p.
1 pump, vertical SPV-180
1 weightometer, 36 inches
1 uni loader, diesel powered
1 electric hoist, capacity 11,000 pounds
1 speed reducer, ratio 55.68 to 1.

The Copper Cliff concentrator treated a total of 5,973,392 tons of ore averaging 25,204 tons daily during the period of operations.

Employment and Management

The employees are included in Copper Cliff smelter totals. R. N. Browne was superintendent.

Creighton Mill

Normal operations continued throughout 1969 except for lost time due to strike action from 10 July to 14 November.

The mill treated a total of 2,559,612 tons of ore averaging 10,800 tons daily during the period of operations and produced concentrates which were pumped to the Copper Cliff Smelter.

Employment and Management

The average number of employees in the mill was included in the mine total; E. McMullen was superintendent.

Frood Stobie Mill

Normal operations continued throughout 1969 except for lost time due to strike action from 10 July to 14 November.

Major added equipment in 1969 was as follows:

6 motors, electric (one — 500 h.p.; two — 300 h.p.; two — 250 h.p.; one 125 h.p.)
2 controllers, 250 h.p. size 6
1 heater, counterflo model No. 7565
2 hoists, model L 3/60/550 and one utility with locked clutch
4 pumps 8 x 8 LSA-25
2 samplers (one — 8 foot stroke, speed 60 ft/min.; one — 4½ foot stroke, speed 30 ft./min.)

Milling rate at the new 22,500 tons per day Frood Stobie mill was increased to design capacity during 1969. A plant size autogenous grinding mill was placed in service, and the use of an on stream X-ray fluorescence analyser and computer was instituted to assist in the guidance of mill operations.

The mill treated a total of 5,055,620 tons of ore at an average of 21,332 tons per day during the period of operations.

Employment and Management

The average number of employees was included in the mine total; H. Fowler was superintendent.

Levack Mill

Normal operations continued throughout 1969 except for lost time due to strike action from 10 July to 14 November.

Major added equipment included a tractor, model M190, uniloader.

The mill treated a total of 1,322,500 tons of ore averaging 5,580 tons daily.

Employment and Management

The average number of employees is included in the mine total; G. Morrison was superintendent.

SMELTERS

Coniston Smelter

Normal operations continued throughout 1969 except for lost time due to strike action from 10 July to 14 November.

The construction program commenced in 1967 was essentially completed. High grade nickel concentrates are being sintered and smelted with resultant increased plant capacity and efficiency.

Added equipment in 1969 included the following:

1 locomotive crane with D-326 diesel engine
1 dust collector, 4 compartment each with 5,376 sq.ft. cloth area
4 motors, electric (three — 1000 h.p.; one — 300 h.p.)
1 controller, 1000 h.p. 3 phase, 60 cycle, 7,300 V
1 screw conveyor, 9 inch diameter, 30 feet long
3 transformers, 45 KVA

The Coniston smelter treated 219,251 tons of concentrate averaging 925 tons per working day and produced 39,832 tons of bessemer matte, shipped to Copper Cliff for further processing.

Employment and Management

The average number of employees was 661: R. L. Snitch was superintendent.

Copper Cliff Smelter

Normal operations continued throughout 1969 except for lost time due to strike action from 10 July to 14 November.

During 1969 construction continued at the smelter on the installation of fluid bed driers to increase the capacity of the copper flash smelting furnace, and on the installation of a fourth fluid bed roaster which will be used on the final production of nickel oxide sinter. In addition, plans to increase slag dumping capacity by the utilization of a double-bowl 70 ton capacity cars were instituted, and work began on an expansion to the Bessemer matte casting facilities to match the increased capacity of smelting units. A 1,250 foot chimney will be erected by 1971 to replace the three existing stacks. It is also planned to install two new electrostatic precipitators and enlarge existing units. Total cost of this program will be in excess of $13 million.

Major equipment installed in 1969 included the following:

7 loaders, various makes and models
10 air heaters, various capacities
4 dust collectors, various makes and capacities
2 dryers
23 electric motors, various h.p. ratings
8 pumps, various models
4 motor controllers 100 and 200 h.p.
1 belt feeder, gravimetric

1 transformer, 800 KVA indoor type
2 disc filters 8.9 x 6 feet
26 speed reducers, various ratios
1 hoist, utility H 30
12 systems, weight, control and alarm
2 slag pots, 340 cubic foot capacity
1 balling disc, 14 foot diameter
1 scale, motor truck model 75 ton
1 bucket elevator
1 switchgear and two circuit breakers
3 air switches, 3 phase 600 amps.
1 heavy duty screen, 5 x 12 feet
1 rotating assembly for air
2 fans, Vaneaxial

The smelter treated 345,001 tons of concentrate averaging 1,456 tons per working day and 116,016 tons of nickel matte was shipped; 35,978 tons of nickel oxide sinter, and 112,619 tons of converter copper was produced during the period of operations.

Employment and Management

The average number of employees at the Copper Cliff concentrator and smelter was 6,015. J. R. Feick was superintendent of smelters.

Copper Cliff Iron Ore Recovery Plant

Normal operations continued throughout the year at the plant located in Waters township, except for lost time due to strike action from 10 July to 14 November.

Major construction in 1969 consisted of a powerhouse cooling tower, 3 cells 30 x 108 by 36.5 feet, and a pumphouse addition to the thickener station 47 x 35 x 16 feet.

Added equipment in 1969 included the following:

61 motors, electric from 15 to 900 h.p.
14 transformers 45 to 2,240 KVA
58 pumps, various models and sizes
3 ball mills with liners
1 rectangular lifting magnet 36 x 34 x 11 inches
26 electric fans, various models
2 pump distributors, motorized 60 foot diameter
2 agitator mechanisms for tanks 32 foot diameter 30 feet high
4 electric hoists 3 and 4 ton capacity
2 scrubbers with motor and drive
1 crane, 10 ton span 14 ft.

The iron ore recovery plant produced 473,732 gross tons of iron ore and 5,205 net tons of nickel oxide.

Employment and Management

The average number of employees was 696. E. Stoneman was manager.

REFINERIES

Copper Cliff Refinery

Normal operations continued throughout the year except for lost time due to strike action from 10 July to 14 November.

The Copper Cliff refinery produces copper cathodes and shapes, nickel sulphate, gold, silver, tellurium, selenium, and semi-refined platinum metals.

The construction of a refinery at Copper Cliff, using International Nickel's pressure carbonyl (IPC) process was announced in August 1968; site preparation for the process carbonyl plant (IPC plant) was commenced.

Major construction in 1969 consisted of a rectifier and switchroom building at the powerhouse 80 x 34 x 38 feet and a switch room at the acid plant 42 x 32 x 18.5 feet.

Added equipment included the following:

1 diesel generator, 1000 KVA
3 switchgear and rectifier sets, 18,000 Amp. Cap.
1 roll filter, stainless steel
1 centrifuge, model 5-1600A
2 transformers, 69KV Delta
3 gas fired heaters, cap. 5,200,000 BTU/hr.

A total of 112,619 tons of converter copper, 4,567 tons of scrap secondary copper was refined at an average of 494 tons per working day during the period of operations; 105,056 tons of refined copper was produced from the primary converter copper and 4,686 tons from the secondary scrap copper. No. 1 furnace was in operation for 202 days, No. 2 furnace for 222 days.

Employment and Management

The average number of employees was 965; G. A. Dick was manager.

Port Colborne Refinery

Operations continued throughout the year except for time lost due to strike action from 10 July to 14 November.

The Port Colborne refinery produces nickel metal, cobalt metal, elemental sulphur and precious metal concentrates. The new Inco pressure carbonyl refinery which is now under construction at Copper Cliff will not curtail nickel refining operations at the largest nickel refinery in the world at Port Colborne. An increase of several million in the expenditure at the refinery is scheduled during the next two or three years.

Three process research stations operating at this site provide versatile pilot plant facilities for testing pyrometallurgical, hydrometallurgical and vapometallurgical processes on the company's sulphide and laterite ores brought in from many parts of the world.

Major construction in 1969 consisted of a building for mastic preparation 40 x 16 x 14.5 feet and a gatehouse at the south entrance 8 x 5.5 x 8 feet.

Added equipment included eight ventilation fans on the roof of the south tankhouse, 54 inch diameter, 42,500 cfm. capacity.

Production at the nickel refinery included 46,458 short tons of electrolytic nickel, 482 short tons of cobalt oxide, and 364,000 troy ounces of precious metals in concentrates and 1,475 long tons of elemental sulphur.

Employment and Management

The average number of employees was 2,061. W. V. Barker was manager.

J. ROY GORDON RESEARCH LABORATORY

The J. Roy Gordon Research Laboratory at Sheridan Park has completed three years of successful operation. Its activities, combined with those of the three research stations at Port Colborne, greatly speed transition of new concepts in extractive metallurgy from laboratory investigation to commercial realization. The continuing efforts of laboratory personnel are directed toward better methods for the treatment of both sulfide ores and concentrates, and the lateritic ores of nickel.

Employment and Management

The average number of scientists, technicians and administrative personnel employed was 75. Dr. J. S. Warner was director.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

		1969	1968	1967	1966
Nickel					
Primary nickel*	lb.	309,940,000	415,520,000	399,450,000	431,560,000
Nickel in rolling mill products	lb.	72,230,000	65,320,000	64,000,000	68,640,000
Total nickel	lb.	382,170,000	480,840,000	463,450,000	500,200,000
Copper	lb.	280,220,000	314,160,000	310,930,000	293,000,000
Cobalt	lb.	1,870,000	1,790,000	2,210,000	2,000,000
Platinum-Group Metals (*) and Gold	oz.	421,500	440,900	475,600	500,900
Silver	oz.	1,111,000	1,607,000	1,592,000	1,513,000
Iron Ore	long ton	758,000	654,000	708,000	673,000

* Including salts and chemicals, and rolled bars for electroplating.
(*) Platinum, palladium, rhodium, ruthenium, iridium, osmium.

The strike at the company's Ontario facilities severely affected deliveries in 1969. It resulted in a production loss of 140,000,000 pounds of nickel and 125,000,000 pounds of copper. Because production was resumed more rapidly than anticipated, these losses are less than originally estimated. Full pre-strike levels of deliveries will be reached in the second quarter of 1970.

Prices

On 24 November the company's price for electrolytic nickel in the United States rose from $1.03 a pound to $1.28, and in Canada from $1.11¼ (Can.) to $1.38. In the United Kingdom, the price for electrolytic nickel, and for refined nickel pellets produced at the company's refinery at Clydach, Wales, rose from £986 to £1,200 a long ton, or £1,200.10.0 a metric ton. There were corresponding increases in the prices for the company's other primary nickel products.

The pricing action was necessary to help produce the earnings required to support the company's very large Canadian expansion program and to cover the sharply increased costs of production. The increase brought the company's prices closer to the value placed on nickel in the merchant market prior to the aggravated shortage caused by the strike.

During the year, the Canadian price of copper was increased from 45 cents (Can.) a pound to 57 cents. In late December, further increases to 66 cents a pound were announced. On 13 January, 1970 the company and other producers suspended this increase for the months of January and February in response to a request by the Canadian Government. As a result, for that period the price in Canada was held at 57 cents (Can.) which was lower than in any other industrial country.

International Nickel traditionally markets the major portion of its copper in Canada and the remainder in the United Kingdom and Europe. The company's European price for copper is based on the London Metal Exchange settlement price for copper wirebars. During 1969, this price ranged from a low of £510 a long ton to a high of £746. This is equivalent to a range of 59 cents(Can.) a pound to 86.5 cents.

Industrial demand for platinum remained strong during 1969, but receded for the other platinum-group metals. The average published price of platinum increased from $122.50 a troy ounce to $132.50 on 1 November. The average published prices of the other platinum-group metals decreased during 1969. Palladium went from $46 a troy ounce to $38; rhodium from $247.50 to $222.50; iridium from $187.50 to $162.50; and ruthenium from $57.50 to $52.50.

The market price for gold in the United States was $42.05 a troy ounce at the beginning of 1969, reached a high of $44.05 on 10 March, and was $35.40 on 31 December.

The New York price for refined silver was $1.90 a troy ounce at the beginning of 1969, rose to a high of $2.025 on 15 January, fell to a low of $1.54 on 27 June and was $1.80 at year end.

Cobalt rose in price during 1969 from $1.85 to $2.20 a pound, with somewhat higher increases for cobalt compounds, the form in which all of the company's cobalt is now sold.

Production Facilities

To meet customers' demands for nickel, the company made stremuous efforts to increase its rate of production in 1969. During the first six months of 1969, prior to the strike in the Ontario division, the company's production was increasing progressively and reached record levels averaging some 40,000,000 pounds of nickel a month.

This increasing production rate was achieved despite a shortage of labour, particularly at the Manitoba division, and despite the decreasing grade of ore being mined. At the same time, work went forward in both divisions to open up new sources of ore to replace those being mined and to develop additional sources to allow for increased production rates. These efforts, coupled with the large construction program underground and on the surface, placed heavy demands on operating personnel. The high and steadily increasing production rate prior to the strike reflects the company's advances in mining methods and process technology, and increased mechanization.

Capital Expenditures

The company's program to modernize and expand its Canadian facilities to increase its annual nickel production capability to 600,000,000 pounds by late 1971 was delayed by the strike. It is now expected that the increase will be achieved in 1972.

Because of the halt in most construction work in the Ontario division during the strike, capital expenditures, which were expected to be $200,000,000 in 1969, were $175,182,000. Capital expenditures for 1969 and 1968 were:

	1969	1968
Mines		
Ontario	$ 37,340,000	$ 47,524,000
Manitoba	28,657,000	24,749,000
Plants		
Ontario	51,899,000	27,538,000
Manitoba	21,050,000	39,303,000
United Kingdom	2,223,000	2,097,000
Rolling Mills		
United States	17,909,000	20,586,000
United Kingdom	1,413,000	688,000
Other Facilities		
Canada	1,937,000	3,256,000
United States	365,000	1,334,000
Other countries	12,389,000	8,309,000
Total	$175,182,000	$175,384,000

Capital expenditures for 1970 are expected to reach $250,000,000 of which $185,000,000 will be spent in Canada.

Producing Mines

The nine mines in the Ontario Division are currently scheduled to produce ore at the rate of about 88,000 tons a day and the two in the Thompson division, 12,000 tons a day, for a total daily production schedule of about 100,000 wet short tons.

The 11 producing mines, and their approximate production rates per mine day, are:

Ontario Division	Wet Short Tons
Frood-Stobie	30,000
Creighton	20,000
Clarabelle	11,000
Levack	8,000
Murray	7,500
Crean Hill	5,000
Garson	5,000
Maclennan	1,000
Totten	500
Manitoba Division	
Thompson	8,000
Birchtree	4,000

Development of New Mines in Canada

As part of the company's expansion program, work continued in 1969 on International Nickel's eight new mines, three of which are scheduled to start, or reach full production in 1970. Those three are Copper Cliff North and Kirkwood in Ontario, and Soab in Manitoba. All eight new mines are expected to be in production in 1972.

When all currently planned expansion projects are completed, International Nickel's approximate daily capacity will increase from 100,000 to 150,000 tons of ore, of which 118,000 will be produced in Ontario and 32,000 in Manitoba.

The eight mines under development, and their projected approximate daily capacities, are:

Ontario Division	Wet Short Tons
Copper Cliff North	8,000
Little Stobie	8,000
Copper Cliff South	6,000
Coleman	4,000
Shebandowan	3,000
Kirkwood	1,500
Manitoba Division	
Pipe	16,000
Soab	4,000

Expansion and Modernization of Surface Facilities

During 1969, the company continued to expand and modernize its surface facilities so that it can process the increased tonnages of ore resulting from the company's mine development program.

Construction was begun on the large Clarabelle mill in Copper Cliff that will be able to process 35,000 tons of ore a day. This will make increased milling capacity available for upgrading concentrates, and thus increase the smelter's efficiency. It is scheduled for completion late in 1971 and will be the company's fifth mill in the Sudbury district.

Construction work was continued on the new and novel Inco Pressure Carbonyl refinery in Copper Cliff, which will have an annual capacity of 100,000,000 pounds of nickel pellets and 25,000,000 pounds of nickel powders. Work was delayed by the strike and is now scheduled for completion in 1972.

Further work on the Copper Cliff iron ore recovery plant expansion program has been deferred so that construction efforts can be concentrated on those facilities that contribute the most rapidly to the company's nickel-producing capacity. The expansion of the iron ore plant, which is now scheduled for completion in late 1972, will increase the plant's production capacity from 900,000 to 1,100,000 long tons of iron ore a year as well as contributing to the company's nickel-producing capacity.

Work is going forward currently on the construction of the 1,250-foot chimney — the highest in the world — which by highly effective dispersion will reduce sulphur dioxide in the Sudbury area to levels well below standards set by government authorities. The installation of a fourth fluid bed roaster in the nickel oxide plant and enlargement of the copper refinery are also progressing.

The planned expansion of International Nickel's electric power distribution capacity in Copper Cliff was completed during 1969. The capacity of the main substation was doubled and three subsidiary substations were built.

Ore Reserves

The company's exploration and mines development programs in the Sudbury and Thompson areas during 1969 outlined sufficient new ore reserves to more than compensate for the ores mined during the year.

On 31 December the company had proven ore reserves in Canada of 379,580,000 dry short tons, containing 12,370,000,000 pounds of nickel and 7,890,000,000 pounds of copper. At the end of 1968, the company had 370,970.000 dry short tons of proven ore reserves, containing 12,240,000,000 pounds of nickel and 7,780,000,000 pounds of copper.

The company's reports as proven ore reserves only blocks of ore that have been defined by drilling and sampling, in accordance with its standard practice, in sufficient detail to permit calculation of the number of short tons of ore and its nickel and copper content.

Employment

The International Nickel Company of Canada Limited employed for its Ontario operations, excluding some 1,425 employees of contractors doing work for the

company, a total average of 20,927 employes. There were 10,438 employed in the mines; 7,564 underground and 2,874 on surface and in the mills; 7,372 were employed in the smelters and iron ore recovery plant; 3,026 were employed in two refineries; 16 were employed in one quarry and 75 in the J. Roy Gordon research laboratory.

KAM-KOTIA MINES LIMITED

Kam-Kotia Porcupine Mines Limited was incorporated in August 1932; in March 1966 the Cobalt Refinery and Kam-Kotia mine became operating divisions of Kam-Kotia Mines Limited. The authorized capitalization was 5,000,000 shares of $1 par value, of which 4,260,000 shares have been issued. The directors and officers were: A. W. White, president and director; D. F. Burt, vice-president and director; G. W. Walkey, general manager and director; J. Geddes, assistant secretary and director; A. W. McDonald, J. D. Barrington and J. J. White, directors; H. R. Heard, secretary-treasurer. The head office is at Suite 416, 25 Adelaide Street West, Toronto 1. The mine address is P.O. Box 290, Timmins.

The property comprises 26 claims located in Robb and Jamieson townships, Porcupine area, District of Cochrane, about 12 miles northwest of Timmins.

Mining and milling continued throughout 1969.

The vertical, four compartment No. 1 shaft collared on claim P12341, has a vertical depth of 1,974 feet below surface.

Development footage completed in 1969 consisted of 9,126 feet of drifting, 1,293 feet of crosscutting and 1,915 feet of raising. Total development footage to 31 December 1969 was as follows: 60,386 feet of drifts; 5,959 feet of crosscuts; 22,900 feet of raises.

Major construction in 1969 consisted of a zinc concentrator dryer house 49 x 23 x 20 feet and a zinc concentrate storage bin 24 x 24 x 20 feet both of steel and concrete block construction and a Butler zinc concentrate storage building at the railroad siding 72 x 40 x 25 feet.

Major added equipment in the mill, included the following:

2 banks of 4 cell; 2 banks of 6 cell, flotation units
1 bank of 6 cell, flotation unit No. 24 Sub A
1 lime mixing tank, 10 x 10 feet with 3HP motor
1 lime storage tank, 120 ton with 25 ft. 9 in. diameter screw conveyor
1 dryer, capacity 7 tons/hr. with 2,600,000 BTU oil burner.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Production and Milling

Milling was carried out continuously through the year at maximum capacity, except for down time required to make changes and install new processing equipment in the milling plant. Operating time was 96.15 percent of total hours for the year. Daily treatment rate averaged 2,241 tons per day. Mill feed was supplied mainly from underground operations with balance coming from mine ore stockpile and 26,931 from Jameland Mines.

Production Data

COPPER		1969	1961 to 1969
Milled	ton	818,171	4,890,598
Average per day	ton	2,241	1,578
Mill heads copper	percent	1.205	1.495
Copper concentrate	ton	49,307.49	319,724.69
Copper concentrate grade	percent	17.353	19.213
Returnable copper	pound	16,070,797	117,938,337
Copper recovery	percent	86.80	85.28
Smelter settlements outstanding at December 31, 1969			
Copper	pound	4,750,714	
Zinc	pound	8,201,619	

ZINC		1969	1964 to 1969 only
Dry milled	ton	818,171	3,304,994
Zinc mill heads	percent	3.27	2.379
Zinc concentrate	ton	37,906.3	105,397.2
Zinc concentrate grade	percent	49.71	49.287
Zinc recovery	percent	70.37	65.126
Gold paid for	ounce	1,014.6	4,224.7
Silver paid for	ounce	116,721.0	514,381.01

Milling Data

Grinding Steel Consumption		
Balls	lb./ton	2.47
Rods	lb./ton	0.90
Total	lb./ton	3.37
Re-agent Consumption		lb./ton milled
Lime		4.459
Zanthates		0.294
Sodium Cyanide		0.0196
Frothers		0.2171
Zinc Sulphate		0.209
Copper Sulphate		0.804
Total cost per ton		36.328 cents

Mining Operations

Underground mining operations supplied 763,399 tons, 8,400 tons came from low grade stockpile and 46,372 tons from the surface mine ore stock pile.

Ore Reserves

Positive and Broken ore

1,200,000 tons grading 1.03 percent copper and 3.0 percent zinc, in the mine.
180,000 tons grading 0.87 percent copper and 2.29 percent zinc, in surface stockpile.
200,000 tons grading 0.4 percent copper and 4.6 percent zinc, in place.

Probable ore

100,000 tons grading 1.25 percent copper.

Possible ore

150,000 tons grading 0.75 percent copper.

Jamesland Mines Limited

All work performed was under the direction of Kam-Kotia staff. Shaft sinking was completed to a depth of 1,240.0 feet below collar and skips and cages were installed June 3, 1969. Five stations were established with the 5th station established for future requirements. Provision was made for future shaft deepening (i.e.) permanent sinking bulk head, station access for sinking hoist on the 4th level, etc.

Loading station, below 4th level was installed and ore and waste passes completed to 1st level.

The 1st and 2nd levels were equipped with 2 yard load haul dump units, one on each level which allows more flexibility for comparable capital cost.

Two 650 U.S.G.P.M. Mather Platte pumps were installed below the 4th level and all services completed down the shaft.

An escape and ventilation raise was collared through 46.0 ft. of overburden and raise broken into it. A 30,000 C.F.M. fan and a direct fired propane heater with capacity of 2,800,000 B.T.U. per hour were installed in November for mine air heating.

Production

The mine was readied for production and production milling at Kam-Kotia's mill commencing on 1 November 1969.

26,931 tons grading 1.381 percent copper and 0.25 percent zinc were broken and milled. This ore was broken in the development of the A-1, A-2, A-3, and A-5 blocks which were being prepared for blasthole stoping methods. Most of the broken ore came from the fringes of the blocks that were being prepared for production.

Employment and Management

The average number of employees at the Kam-Kotia and Jamesland properties was 317: 125 underground and 192 on surface. G. W. Walkey was general manager.

KIDD COPPER MINES LIMITED

Kidd Copper Mines Limited was incorporated in 1964; in 1966 the authorized capitalization was increased to 10,000,000 shares of $1 par value, of which 2,922,909 shares have been issued. The director and officers were: B. M. Young, secretary and director; A. T. Kana, treasurer and director; M. Juby, P. Roby and J. Quaisser, directors. The head office is at 15th floor, 4 King Street West, Toronto 1. The mine address is Worthington.

The property comprises 538 acres located in Denison township, District of Sudbury, formerly operated by Denison Nickel Mines Limited. In 1955 Pascolund Mines Limited was reorganized, the name changed to Aer Nickel Corporation Limited and the Denison Nickel property was purchased. Aer Nickel Corporation ceased operations on 9 November 1957 and was fully reported on, in Ontario Department of Mines Annual Report, Volume LXVII, 1958, Part 2, Page 111. The property was leased to Kidd Copper Mines Limited in 1966, and operated by Sheridan Geophysics.

SHAFTS, KIDD COPPER MINE

	Location	Inclination	Number of Compartments	Vertical Depth below Surface
				feet
No. 1	S.W.¼ of S.½ lot 12, con. III, Denison twp.	Vertical	3	985
No. 2	S.W.¼ of S.½ lot 12, con. III, Denison twp.	Vertical	3	1,078

Mining operations at the Kidd Copper mine were terminated on 21 December 1968, and no ore was produced in 1969. The mine is being kept pumped out and mine

exploration will be continued by diamond-drilling. The hoistroom for No. 1 shaft burned down and the conveyance permits for No. 2 shaft were cancelled since maintenance work had not been carried out.

The crushing plant and mill operated from 4 June to 31 December 1969, processing ore from Spanish River Mines Limited. Some 89,594 tons were treated at a daily average of 425 tons during the period of operation.

Employment and Management

For further details see Spanish River Mines Limited.

The average number of employees at both operations was 90: 40 underground and 50 on surface. J. Willan was manager.

NORANDA MINES LIMITED
(Geco Division)

Geco Mines Limited was incorporated in October 1953, in December 1964, Geco Mines Limited and Noranda Mines Limited were amalgamated under the name of Noranda Mines Limited and Geco became the Geco Division of the company; the authorized capitalization was 15,000,000 shares of no par value, increased to 40,000,000 in December 1968 of which 23,888,090 shares have been issued. The directors and officers were: J. R. Bradfield, chairman and director; R. V. Porritt, vice-chairman and director; A. Powis, president and director; W. S. Roe, executive vice-president and director; Hon. G. B. Foster and L. G. Lumbers, vice-presidents and directors; Louis Herbert, Hon. Jean Raymond, J. D. Simpson, Andre Monast, W. P. Wilder and William James directors; R. C. Ashenhurst, secretary; E. R. Cork, vice-president and treasurer. The head office is at Suite 1700, 44 King Street West, Toronto 1. The Geco mine address is Manitouwadge.

The property comprises 145 claims, 66 of which are unpatented, in the Manitouwadge Lake area, District of Thunder Bay.

Mining and milling progressed from 1 January to 21 November 1969, after which all operations were suspended due to strike action, which had not been resolved by year end.

SHAFTS, GECO MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth from Surface
				feet	feet
No. 1	TB46849	Vertical	5	Surface	2,459
No. 2	TB46849	Vertical	3 (inactive)	Surface	455
No. 3	.....	Vertical	3	1,250	2,765
No. 4	TB46847	Vertical	7	Surface	4,334

The following development work was done during the year; drifting and crosscutting 10,334 feet; raising 4,998 feet. The total development footage to 31 December 1969 was as follows: 283,194 feet of drifts and crosscuts; 100,082 feet of raises. Diamond-drilling consists of 218 holes, totalling 57,834 feet from underground and two holes totalling 8,255 feet from surface.

Added equipment was as follows:

1 rod mill, 12 x 13.7 feet
2 motors, 1100 H.P.

3 pumps, 1 x 8 c.s
1 switch gear assembly
2 flotation machines (one —8 cell, one Agitair)
1 trackmobile, 5 TM
1 drill, Airtrac
2 shovels — Model 600
5 trucks — 325

Company Annual Report

The following pertaining to the Geco Division is taken from the company annual report for the year ending 31 December, 1969.

Geco Mine

Ore mined and treated to 22 November, when operations were suspended by a strike which was settled since the year end, was 1,320,000 tons for an average of 4,040 tons per day. It contained 2.48 percent copper, 4.90 percent zinc and 2.34 ounces silver per ton. Copper, zinc and lead concentrates produced were 114,100 tons, 95,000 tons and 1,700 tons respectively, containing 31,030 tons of copper, 51,440 tons of zinc and 2,351,000 ounces of silver. Concentrator capacity will be expanded in 1970.

Estimated ore reserves at the end of the year showed a net increase of 1 million tons to 28.8 million tons and averaged 2.06 percent copper, 4.82 percent zinc and 1.98 ounces of silver per ton.

The No. 4 shaft complex handled more than half of the production of ore and waste from the mine.

Employment and Management

The average number of employees was 589; 215 underground and 374 on surface. J. A. Graham was mine manager.

NORTH CANADIAN ENTERPRISES LIMITED
(Coppercorp Property)

Sheridan Geophysics Limited was incorporated in October 1962, with an authorized capitalization of 10,000 preferred shares of $10 par value each and 2,000,000 common shares of no par value; 1,000 preferred and all common shares have been issued. The company officers were: J. P. Sheridan, president; J. A. L. Brown, secretary. The head office is at Suite 1606, 4 King Street West, Toronto 1. The mine address is Batchawana Bay.

The former Coppercorp Limited property comprises about 688 acres in Ryan township, Mamainse Point area, District of Algoma, about sixty miles north of Sault Ste. Marie, and readily accessible from Highway 17. The property is being operated under lease on a profit sharing basis by North Canadian Enterprises Limited, which is controlled by Sheridan Geophysics Limited.

Mining and milling operations progressed from 1 January to 31 December 1969.

The vertical, three compartment No. 1 Ryan township shaft has a depth of 624 feet below collar. Development work in 1969 consisted of 6,872 feet of drifting, 272 feet of crosscutting and 3,323 feet of raising. Total development footage completed to 31 December 1969 was as follows: 29,861 feet of drifts; 3,444 feet of crosscuts; and 12,216 feet of raises. Some 113 diamond-drillholes totalling 20,950 feet from underground and 93 holes totalling 30,020 feet from surface were completed in 1969.

Major added equipment included a 7¾ x 6 x 6 in. air compressor with 150 hp motor.

The concentrate produced is trucked to Sault Ste. Marie where it is stockpiled for shipment to an overseas smelter. The method of mining used is shrinkage stoping. Underground development is being concentrated in the "SB" and Silver Creek zones.

An escapeway from the 350-foot level was completed by linking up with an adit driven from the west side of the property. During the year a shortage of experienced labour continued to hinder operations.

A total of 161,488 tons of ore was hoisted and milled at a daily average of 460 tons.

Employment and Management

The average number of employees was 90; 67 underground and 23 on surface. Dr. George Disler was managing director; George Elbre was manager.

RIO ALGOM MINES LIMITED
(Pronto Mine)

In June 1960, Pronto Uranium Mines Limited, which comprised the Pronto mine, was amalgamated under the name of Rio Algom Mines Limited. Further details are given in the URANIUM section of this report under Rio Algom Mines Limited.

The property consists of approximately 800 acres in Spragge township, District of Algoma; it is located on the north shore of Lake Huron just south of the C.P.R. railway and Highway No. 17 at Spragge. The mine address is Algoma Mills.

The No. 1 vertical shaft located on the southeast quarter of section 29, Spragge township, is 3,005 feet below the collar; there are three compartments from the collar to a depth of 1,024 feet, and four compartments from this point to the bottom. The vertical No. 2 shaft collared on the 15th level, at a depth of 2,705 feet, has a depth of 3,954 feet below surface. The one compartment No. 21 incline, collared at 3,888 feet, was sunk 300 feet at –30 degrees to a depth of 4,052 feet below surface.

Normal cut-and-hydraulic fill stoping operations continued in four stopes on the bottom levels of No. 2 shaft. During the year all development work was terminated. The mine is expected to suspend all operation in late spring or early summer of 1970.

Development work in 1969 consisted of 1,176 feet of drifting, 265 feet of crosscutting, and 351 feet of raising. Total development footage to 31 December 1969 was as follows: 30,456 feet of drifts; 8,561 feet of crosscuts; 37,826 feet of raises. Diamond-drilling consis'ed of 18 holes, totalling 682 feet from underground.

A total of 233,955 tons of ore was hoisted, the mill treated 235,456 averaging 727 tons daily.

Company Annual Report

The following, pertaining to the Pronto mine operation, was taken from the Rio Algom annual report for the year ending 31 December, 1969.

Rio Algom Mines — Copper

The mill treated 242,000 tons of ore and 8,245,000 payable pounds of copper in concentrate were produced compared to 259,000 tons and 9,286,000 payable pounds of copper in concentrate in the previous year. Average mill head grade was 1.9 percent, the same as in 1968, and average mill recovery was 96.6 percent compared to 96.4 percent in the previous year.

In October, the milling time was reduced from seven to five days as the last of the orebody is being extracted from the fewer underground working places available. The remaining ore will be mined out and, after saleable equipment and materials are brought to the surface, the underground workings will be permanently closed. On completion of milling operations early April, the plant will be placed on a care and maintenance basis.

Employment and Management

The average number of employees was 175; 109 underground and 66 on surface. J. Engstrom was acting manager.

SPANISH RIVER MINES LIMITED

Spanish River Mines Limited was incorporated in September 1967 with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,763,506 shares have been issued. The directors and officers were: G. Disler, president and director; E. G. Reade, executive vice-president and director; R. J. Armstrong and G. W. Fancy, directors; A. T. Kana, vice-president; H. Shlesinger, secretary-treasurer. The executive office is at Suite 203, 350 Bay Street, Toronto 1. The mine address is Worthington.

The property comprises 32 claims in Baldwin and Porter townships, District of Sudbury, about 42 miles west of Sudbury. It was acquired from Globe Exploration and Mining Company, and Sheridan Geophysics Limited and is being operated by Kidd Copper Mines Limited. Mining operations at the property, located on the north shore of Agnew Lake, a part of the Spanish River system, some 24 miles from the Kidd Copper Mines property, continued throughout 1969.

A road was constructed into the property in 1968 and a large barge has been erected to cross the lake. The barge is powered by a double-drum gasoline winch, with a cable hook-up across the river. A double layer of plastic pipe with pinholes at four-foot intervals has been laid in the channel, which has been successful in keeping the channel open through the winter by bubbling air through this system.

A 9 x 13-foot decline had been driven in 1968 into the hillside at a —15 percent grade, using Eimco 915 L.H.D. machines. This decline intersected the ore zone at a length of some 512 feet. The 10 x 14-foot east drift in lot 7, claim S-89505 was advanced 156 feet at —13 degrees for a total length of 546 feet. The 10 x 14 west drift was advanced in lot 7, claim S-89406, 144 feet at —8 degrees for a total length of 607 feet. The drift will ramp down the ore zone and boxholes will be driven from it. The ore will be mined by shrinkage stoping. Two raises, one 432 feet from the east drift and one 297 feet long from the west drift were driven through to surface for ventilation and escapeway. Some surface trenching 290 feet long, averaging 13.5 feet in depth was completed.

Major construction consisted of a steel frame metal bit shop.

Added equipment consisted of an air compressor, 1030 cfm.

A total of 91,124 tons of ore was hoisted and trucked to the Kidd Copper mill; 89,594 tons were milled between 4 June and 31 December at a daily average of 425 tons during the period of mill operation.

Employment and Management

The average number of employees was included in Kidd Copper Mines totals. G. Dimitrief was mine manager.

TRIBAG MINING COMPANY LIMITED

Tribag Mining Company Limited was incorporated in December 1926, the authorized capitalization has been increased to 7,500,000 shares of $1 par value of which 3,827,000 shares have been issued. In 1966 Tribag came under the management of Teck Corporation Limited. The directors and officers were: N. B. Keevil, president and director; N. B. Keevil, Jr., vice-president and director; J. H. Westell, treasurer and director; C. H. Franklin and E. R. Heald, directors; R. J. Wright, secretary. The head office is at Suite 4900, Toronto-Dominion Centre, Toronto 1. The mine address is Batchawana Bay.

Annual Report for 1969

The property comprises 135 claims in Townships 27 and 28, Range 13, District of Algoma, in the Batchawana Bay area, about 38 miles north of Sault Ste. Marie, and 18 miles east of Highway 17.

Mining and milling operations continued throughout the year.

The three-compartment, vertical No. 1 shaft, located on claim SSM35137 has a depth of 1,251 feet below collar.

Development footage completed in 1969 consisted of 295 feet of drifting, 423 feet of crosscutting and 533 feet of raising. Total development footage to 31 December 1969 consisted of 12,625 feet of drifts; 3,078 feet of crosscuts; 4,269 feet of raises. Some 222 diamond-drillholes, totalling 32,013 feet were completed from underground and 100 holes totalling 49,703 feet were completed from surface.

Major construction in 1969 included an addition to the mine dry 40 x 14 feet a coarse ore bin for west breccia ore and a core rack of wood construction with iron rods.

Added equipment was as follows:

1 diesel truck, 130 hp—10 ton capacity for ore haulage
1 electric slusher, 30 hp
conveying equipment and vibrator for west breccia ore bin.

A total of 177,714 tons of ore was hoisted; 177,339 tons were milled at a daily average of 486 tons.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

The mill operated at an average daily rate of 486 tons, treating 177,339 tons grading 1.94 percent cu. recovery was 98.1 percent and the grade of concentrate 31.23 percent. Copper production increased 19 percent to 6,646,885 pounds as a result of higher grade of ore as well as increased mill throughput.

	1969	1968
Copper production (pounds)	6,646,885	5,562,840
Milled tons	177,339	157,787
Milled per day tons	486	432
Grade of ore milled (percent cu.)	1.94	1.82
Recovery (percent)	98.1	97.9
Concentrate grade (percent cu.)	31.23	31.64

The proportion of mill feed from blasthole stoping increased from 25.8 percent in 1968 to 47.2 percent of the total mine production in 1969. The balance was from shrinkage stoping and development. Trial stoping is underway in the South Zone above the 750-foot level to determine the feasibility of mining the low-grade zone by blasthole methods.

Operations costs were reduced to $9.43 from $9.57 per ton milled in 1968, despite an increase in broken ore reserves of 139,000 tons.

Comparative Mine Operating Costs

	1969		1968	
	Total	Per Ton	Total	Per Ton
Exploration and development	$ 180,477	$1.02	$ 145,018	$0.92
Mining	855,483	4.82	778,329	4.93
Milling	235,186	1.33	212,676	1.35
General property expense	401,396	2.26	373,348	2.37
	$1,672,542	$9.43	$1,509,371	$9.57

Ore Reserves

Proven ore reserves at 31 December 1969 were 613,932 tons grading 1.60 percent copper. This does not include any provision for ore from the lower west breccia zone which has not yet been developed. A drift from the 625-foot level is being driven to further explore and develop this area.

Employment and Management

The average number of employees was 148; 76 underground and 72 on surface. A. Mitchell was mine manager.

WILLECHO MINES LIMITED

Willecho Mines Limited was incorporated in February 1964 with an authorized capitalization of 3,000,000 shares of $1 par value, all shares have been issued. The company was formed as a jointly-owned operating company of Lun-Echo Gold Mines Limited and Willroy Mines Limited to operate the former Lun-Echo base metal property. In June 1967 both Willroy Mines Limited and Willecho Mines Limited became associate companies of the Little Long Lac Gold Mines Limited. In May 1969 Willroy purchased the remaining 50 percent interest from Lun-Echo Gold Mines Limited for 500,000 Willecho shares, making Willecho a wholly owned subsidiary of Willroy Mines Limited. The directors and officers of Willroy and Willecho are essentially the same and are recorded under Willroy Mines Limited in this report. The head office is at Suite 400, 112 King Street West, Toronto 1; the mine address is Manitouwadge.

The property comprises 50 claims in Mapledoram township, Manitouwadge area, District of Thunder Bay.

Mining and milling operations continued throughout 1969.

The vertical, three compartment No. 1 shaft, in claim TB47378 has a depth of 1,361 feet below the collar.

Development work in 1969 consisted of 3,059 feet of drifting, including 1,162 feet of inclined haulageways and 6,082 feet of raising. Total development footage to 31 December 1969 was as follows: 18,115 feet of drifts which includes 3,164 feet of inclined haulageways; 2,511 feet of crosscuts; and 35,776 feet of raises. Some 282 diamond-drillholes totalling 36,666 feet were completed from underground.

Major added equipment in 1969 consisted of one pump, 8 stage with 75 h.p. motor on 1,350-foot level sump.

A total of 319,447 tons of ore was hoisted; 318,149 tons were treated at the Willroy concentrator at an average of 953 tons daily.

For further information on the Willecho operation see Willroy Mines Limited in this report.

Employment and Management

The operation continued under Willroy management and labour. J. I. Jarvis was mine manager.

WILLROY MINES LIMITED

Willroy Mines Limited was incorporated in January 1954; in June 1966 the Norlartic division was added and the authorized capitalization became 6,000,000 shares of no par value of which 4,786,244 shares have been issued. The directors and officers

were: J. C. L. Allen, president and director; R. C. Stanley Jr., vice-president and director; J. D. Bryce, P. A. Allen and P. K. Hanley, directors; A. G. Wilson, secretary. The executive head office is at Suite 400, 112 King Street West, Toronto 1. The mine address is Manitouwadge.

The property consists of 30 claims in Gemmell and Mapledoram townships, Manitouwadge Lake area, District of Thunder Bay, adjoining the west boundary of the Geco property.

Operations continued throughout 1969.

SHAFTS, WILLROY MINE

Shaft	Claim No.	Inclination	Number of Compartments	Vertical Depth below Surface
				feet
No. 1	TB46933	Vertical	4	2,855
No. 2	TB46938	Vertical	2	530

The following development work was completed during the year: drifting, including 259 feet in Slimlake property was 565 feet; crosscutting, 100 feet; raising, 1,471 feet. The total development footage to 31 December 1969 was as follows: 43,713 feet of drifts, 15,181 feet of crosscuts, 35,454 feet of raises. Diamond-drilling consisted of 167 holes totalling 23,574 feet from underground.

Added equipment included the following:

2 scooptrams, model 5A, used at Willecho and Big Nama mines
1 trackmobile, used at mill
1 atomic absorption spectrophotometer in assay laboratory

A total of 128,034 tons of ore was hoisted; 127,300 tons was milled at 381 tons daily average.

Company Annual Report

The following is taken from the Willroy annual report for the year ending 31 December 1969; it also contains information pertaining to Willecho, Slimlake and Big Nama mines.

Production

The tonnage treated declined slightly from the previous year, the total tons milled being 502,921 tons for an average milling rate of 1,378 tons per calendar day. Of this amount, 318,149 tons or 63 percent were milled for the Willecho operation, while 57,472 tons, equivalent to just over 11 percent, were obtained from the pre-production development at Big Nama Creek. Once again the main No. 3 zone at Willroy produced the bulk of Willroy tonnage. The percentage of mill feed from all zones and other sources are shown in the following table:

Ore Zone	Tons of Mill Feed	Percentage of Mill Feed
Willroy No. 1 zone	1,300	0.3
No. 3 zone	112,829	22.4
No. 6 zone	12,417	2.5
No. 7 zone	754	0.1
Total Willroy	127,300	25.3
Willecho Mines Limited	318,149	63.3
*Big Nama Creek Mines Limited	57,472	11.4
	502,921	100.0

Pre-production and development

The grade of Willroy tonnage milled ran 0.91 percent copper, 2.38 percent zinc, 0.06 percent lead and 0.61 ounces of silver. Concentrate production totalled 141 cars made up of 68 cars of copper, 71 cars of zinc and 2 cars of lead. This yielded a gross value of $2,109,463 and a net smelter return of $1,550,951 or $12.18 per ton milled.

Contained metals, along with the returned values, are shown:

	Metal Production	Net Smelter Return
Zinc	5,209,884 pounds	$ 328,226
Copper	2,132,613 pounds	1,119,887
Lead	94,904 pounds	6,833
Silver	51,077 ounces	86,320
Gold	245 ounces	9,685
		$1,550,951

Costs

Because of the nature and dispersement of the combined operations, comparison of separate unit costs for the Willroy Mine is misleading. Manpower and tonnage from Willroy, Willecho and Big Nama Creek are being scheduled to obtain the most efficient and advantageous long range objectives.

A comparison of operating costs for the years 1968 and 1969 are as follows:

	Cost per ton Milled	
	1969	1968
Exploration and Development	$ .45	$ .18
Mining	4.93	3.61
Milling	1.41	1.25
Administration and General	1.36	.81
	$8.15	$5.85

Exploration and Development

The 16-1 West Slimlake heading (2600-foot level) was continued 289 feet in the quartz-sericite schist horizon. After reaching the initial objective located 3,973 feet to the northwest of the Willroy shaft, the drive was suspended to carry out an extensive drill program. Diamond-drilling from this heading encountered areas of weak sphalerite and chalcopyrite mineralization but nothing of economic significance was intersected. Sixty-one feet of drift advance was carried out in the No. 7 zone to obtain additional information on the structure. Continuation of this zone was subsequently established up-plunge to the west but true widths were generally less than 4 feet and grade was marginal.

Thirty-six claims adjacent to the east extremity of the Noranda (Geco Division) property were staked during the latter part of December.

Pre-Production Development — Big Nama Creek Property

This operation is being prepared to carry out mining operations with rubber tired, trackless equipment. During the year the —11° incline haulageway was turned 180° to the east to parallel the ore section down-slope. An advance of 825 feet was obtained on the incline and a sump installed at the bottom or approximately 275 vertical feet below surface. Two new sub-levels were established at the 110-foot and 250-foot horizons and a ventilation raise was driven from the lower incline to connect with the surface ventilation system. Ore recovery from development and benching provided tonnage for obtaining additional information on milling and metallurgical procedures and compatability with Willroy and Willecho ores.

There was no exploration diamond-drilling carried out during the year and therefore no increase to the ore reserves. As of 31 December the broken, proven and indicated reserves to the 300-foot depth were calculated at 395,567 tons grading 0.93 percent copper, 2.51 percent zinc, and 0.73 ounces of silver.

Mill tests were continued with the 57,472 tons of pre-production and development muck. Revenue, amounting to $13.07 per ton milled, was applied against advances from Willroy. The grade of ore treated averaged 0.88 percent copper, 3.92 percent zinc, 0.09 percent lead and 1.08 ounces of silver.

Ore Reserves

At 31 December the total broken, proven and indicated reserves at the Willroy mine above the 2600-foot horizon stood at 266,578 tons. This figure is slightly higher than the 1968 tonnage and is attributable to tonnage developed in the No. 3 north zone. The No. 1 and No. 6 copper zones reserve remains substantially unchanged pending a complete re-appraisal of the mining method to be used in this area.

There was no increase on the Big Nama Creek reserve which included all tonnage to a depth of 300 feet.

The distribution of all reserve tons from the Willroy mine, Willecho mine, and from the Big Nama Creek option which includes a dilution factor of 15 percent is tabulated below:

Zone	Tonnage	Percent Copper	Percent Zinc	Ounces Silver
1	77,611	1.65	0.16	0.38
3	104,143	1.30	3.66	0.56
6	48,029	2.36	1.26	0.84
7	36,795	0.40	4.95	1.39
Total and Average	266,578	1.47	2.39	0.67
Nama Creek Option	395,567	0.93	2.51	0.73
Willecho Mines Ltd.	1,047,362	0.51	3.85	1.44
Grand Total	1,709,507	0.76	3.31	1.16

Employment and Management

The average number of employees was 249: 121 underground and 128 on surface. J. I. Jarvis was mine manager.

PLATINUM METALS — see NICKEL-COPPER

SELENIUM — see NICKEL-COPPER

SILVER-COBALT

In the 1965-1969 period, Ontario's silver production rose from 10,822,213 ounces to 22,260,439 ounces or by 105.7 percent. In 1967, Ontario's silver output represented 39.4 percent of the total amount of silver produced in Canada; in 1968 this share increased to 48.5 percent and in 1969 to 51.1 percent — nearly 8 percent of world silver output.

In 1969, the mines in the Cobalt-Gowganda area milled 285,405 tons of ore and re-treated an additional 212,158 tons of tailings, from which 6,150 tons of concentrates were shipped to Noranda, 1,486 tons to Cobalt Refinery Division of Kam-Kotia Mines Limited, and 213 tons to American Smelting and Refining Company in the United States. A total of 4,187,679 ounces of silver, valued $8,082,220 were recovered from the total of 7,852 tons of concentrates. In addition to the Cobalt-Gowganda silver output, the base metal mines produced 16,543,956 ounces, the nickel-copper mines, 1,093,852 ounces and the gold-copper mines 434,952 ounces.

In 1969, cobalt output in Ontario decreased to 2,553,583 pounds valued $5,421,046 from 3,221,025 pounds valued $6,957,851 in 1968 or by 20.7 percent in volume and 22 percent in value.

Cobalt was produced in only two areas in Ontario: more than 98 percent of the entire Ontario cobalt output was derived as a by-product of nickel-copper operations in the Sudbury area, and the remainder was mined in conjunction with silver in the Cobalt-Gowganda area. In 1969, Ontario's cobalt output accounted for 78.4 percent of the total Canadian production of this metal.

The mines in the Cobalt-Gowganda area reported the recovery of 49,398 pounds of cobalt from ores and concentrates shipped to Cobalt Refinery; the refining of nickel-copper ores produced 2,504,185 pounds of cobalt.

The silver-cobalt mines of the Cobalt-Gowganda areas paid $751,318 to 108 salaried employees and $2,975,152 to 487 wage earners.

AGNICO MINES LIMITED

Cobalt Consolidated Mining Corporation Limited was incorporated in January 1953; in October 1957 the name was changed to Agnico Mines Limited with an authorized capitalization of 5,000,000 shares of $1 par value, of which 3,434,327 shares have been issued. The directors and officers were: N. B. Sheriff, president and director; P. Penna, vice-president and managing director; S. Geller, W. Hogarth Jr., J. L. Vorbach, and Archie Basen, directors; Jean Geller, secretary-treasurer. The head office is at Suite 1101, 365 Bay Street, Toronto 1; the mine address is Box 140, Cobalt.

The company acquired properties formerly held by Silanco Mining and Refining Company Limited; Cobalt Lode Silver Mines Limited; Penn-Cobalt Silver Mines Limited; Gilgreer Mines Limited; Keylode Cobalt Silver Mines Limited; Hellens Mining and Reduction Company Limited and others in the Cobalt, South Lorrain and Gowganda areas, District of Timiskaming. A group of mines in Coleman township, including the Beaver and Temiskaming mines, was acquired in 1955, and the O'Brien mine in 1958.

Agnico properties worked during 1969, in the Cobalt area, included Nipissing 407 shaft, Nipissing 96 shaft, Penn-Canadian, Trout Lake No. 2 shaft and the Cobalt Lake Tailings Reclamation project. The Penn mill (fall and winter) and the Cobalt tailings mill (spring and summer) were operated intermittently.

Nipissing 407 Property

The property comprises claims RL407, RL408, RL 92 and RL110 located in Coleman township, where the vertical, two compartment No. 407 shaft has a depth of 460 feet below the collar. The shaft, located in high ground, is north of the Silverfields property and about 500 feet from the highway passing the Glen Lake silver property. There is also the vertical, two compartment No. 150 shaft some 325 feet deep located on claim RL407.

Operations progressed from 1 January to 31 July, 1969.

Development footage in 1969 consisted of 625 feet of drifting, 243 feet of sub-drifting, and 270 feet of raising. Total development footage to 31 December 1969 was as follows: 8,097 feet of drifts; 2,969 feet of sub-drifts; 7,233 feet of crosscuts; 3,847 feet of raises. Some 74 diamond-drillholes, totalling 14,286 feet were completed from underground.

A total of 13,343 tons of ore was hoisted and treated at the Penn mill, during the period of operation.

Nipissing 96 Shaft

The property consists of claims No. 404 and No. 406 located in Coleman township, District of Timiskaming.

Operations progressed from January to 31 December 1969.

SHAFTS, NIPISSING 96 PROPERTY

	Location	Inclination	Number of Compartments	Vertical Depth below collar
				feet
No. 63 shaft	RL 404	Vertical	2	219
No. 86 shaft	RL 406	Vertical	2	178
No. 96 shaft	RL 406	Vertical	2	466
Little Silver	RL 404	Vertical	2	203

Development work carried out on the new levels established in 1968 consisted of 1,130 feet of drifts, 709 feet of crosscuts and 688 feet of raises. Total development footage to 31 December 1969 comprised 1,200 feet of drifts, 764 feet of crosscuts and 688 feet of raises. Some 52 diamond-drillholes totalling 9,868 feet were completed from underground.

Major construction in 1969 consisted of a new dry building type 5-2, 40 x 20 x 14 feet, and the moving of a hoist building 24 x 16 feet from 150 to 96 shaft.

A total of 17,068 tons of ore was hoisted and treated in the Penn mill.

Trout Lake No. 2 Shaft

The leased property formerly known as Ramardo Mines Limited comprises six claims, approximately 230 acres, in North Hale and South Lorrain townships, District of Timiskaming.

The vertical, two compartment No. 2 shaft, located in claim T23294 has a vertical depth of 360 feet below the collar; No. 1 winze collared on the 350-foot level extends to a vertical depth of 510 feet below surface.

Work at the property in 1969 included the rehabilitation of the shaft and winze, the installation of a headframe, with surface and winze hoisting plants. Development footage completed by former operators comprised some 6,390 feet of drifts and 500 feet of crosscuts. Some 15 diamond-drillholes totalling 2,674 feet from underground and three holes, totalling 4,140 feet from surface were completed in 1969.

Major construction in 1969 consisted of a hoist and compressor building 47 x 41 feet and a diamond-drill core building 24 x 16 feet.

Added equipment included an air compressor, 1000 cfm; a hoist from O'Brien installed with 200 hp motor; a substation 700 kva and an air operated hoist 10 x 12 inches at No. 1 winze.

Penn Canadian Property

The property comprises some 79 acres in Coleman township, District of Timiskaming.

A diamond-drilling program has been carried out on this property located south of Nipissing 407 through leasing and utilizing Glen Lake Silver Mines Bailey shaft. Development work in 1969 comprised 667 feet of drifting; 129 feet of crosscutting and

118 feet of raising. Total development footage to 31 December 1969 consisted of 16,167 feet of drifts, 129 feet of crosscuts and 118 feet of raises. Some 144 diamond-drillholes totalling 21,769 feet were completed from underground. A total of 4,896 tons of ore was hoisted and delivered to the Penn mill for treatment.

Penn Mill

The Penn mill located on the 40-acre Foster property operated from 2 January to 24 May and from 17 November to 30 December. The same mill crew operated the tailings mill from 12 June to 5 November. The Penn mill treated a total of 36,740 tons of ore; 35,525 tons of Agnico ore and 1,215 tons custom milled for Silverfields Silver Summit and averaged 240 tons per working day.

Tailings Mill

The tailings mill located on claim RL404 in Coleman township was equipped in 1966.

The mill operated from 27 May to 14 November treating 151,323 tons of tailings averaging 906 tons daily.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

Production

Production during the year was provided by 407 Shaft, 96 Shaft, Penn-Canadian property and tailings reclamation. The combined production totalled 844,987 ounces of silver which is up considerably from 1968. The main source of production is from 96 Shaft while Penn-Canadian production is exceeding earlier expectations.

The following is a comparative summary of the main production items:

		1969	1968
Silver produced	oz.	844,987	583,126
Cobalt produced	lb.	78,660	52,800
Gross value of metals sold	$	1,576,829	1,259,104
Gross value per ounce of contained silver	$	1.87	2.16
Penn Mill			
Total milled from company properties	ton	35,525	33,384
Custom ore milled	ton	1,215	12,181
Total milled	ton	36,740	45,565
Total hoisted	ton	35,307	36,408
Calculated head silver	oz./ton	17.14	14.36
Recovery silver	oz./ton	16.12	13.12
Extraction efficiency	percent	94.05	91.36
Tailings Mill			
Total tailings milled	ton	151,323	81,530
Calculated head silver	oz./ton	2.70	2.81
Recovery silver	oz./ton	1.79	1.78
Extraction efficiency	percent	66.30	63.35

Ore Reserves

As of the end of December 1969, there is stockpiled on surface 11,536 tons of ore averaging 23.0 oz/ton and a further 13,958 tons of broken reserves underground averaging 25.0 oz/ton.

Employment and Management

The average number of employees was 103: 44 underground and 59 on surface. G. W. Kirk was manager.

CHITARONI MINERALS LIMITED

Chitaroni Minerals Limited, a private company, was incorporated in September 1962 with Albert Chitaroni, president and director; Elio Chitaroni, vice-president and director; Carlo Chitaroni, director. No shares have been issued. The head office and mine address is Box 271, 19 Prospect Avenue, Cobalt.

The four Chitaroni brothers leased the Old Nipissing property comprising approximately 42 acres in Coleman township in 1964 from Agnico Mines Limited, to mine out some old pillars.

Operations continued throughout 1969.

Drifting and stoping was continued in the No. 1 shaft area. Any ore recovered is stockpiled on surface for custom milling at the O'Brien mill of Deer Horn Mines Limited.

Development work in 1969 consisted of 670 feet of drifting and 75 feet of raising. Total development footage completed to 31 December 1969 consisted of 1,775 feet of drifting and 350 feet of raising.

Approximately 2,560 tons of ore was hoisted and 3,713 tons were custom milled between 20 October to 27 November 1969 at the O'Brien mill.

Employment and Management

The average number of employees was 6: 4 underground and 2 on surface. A. Chitaroni was in charge.

CRESWEL MINES LIMITED

Creswel Mines Limited was incorporated in 1964 with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,350,005 shares have been issued. The directors and officers were: G. C. Silverman, president and director; D. E. Silverman, vice-president and director; T. W. Haddon and S. J. Silverman, directors; M. H. Stekel, secretary-treasurer. The head office is at Suite 826, 159 Bay Street, Toronto 1. The mine address is Kakabeka Falls.

The property comprises approximately 176 acres in Gillies and O'Connor townships, District of Thunder Bay, some 30 miles west of Thunder Bay. Previous work carried out on the property was reported on under Animikie Mines Limited, who terminated operations in July 1930 (Ontario Department of Mines Annual Report, Volume XL, 1931, page 109) who reported the following development work had been completed at that time. Mining operations progressed from 1 April to 10 November, milling from 1 to 22 October 1969.

CRESWEL MINES LIMITED

Mine	Shafts	Drifts	Raises and Winzes
	feet	feet	feet
Badger	280	2,000	190
Porcupine	250	1,690	—
Keystone	330 70 62 40	325	—

The company continued development work in the old Porcupine mine (lot 961 in Gillies township, District of Thunder Bay). A new level was opened up at a depth of

170 feet below the collar of the Porcupine shaft. Some 650 feet of drifting and 450 feet of raising was completed. Added equipment included a mine hoist, assay equipment and a small mill rated at 50 t.p.d. consisting of a 10 x 16 inch crusher, a 5 x 3-foot ballmill jigs and cells.

A total of 360 tons of ore was hoisted; 280 tons were milled at an average of 30 tons daily during the period of operation.

Employment and Management

The average number of employees was 7: 2 underground and 5 on surface. The work was carried out with A. C. A. Howe & Associates as consultants and Lucien Cloutier as manager.

DEER HORN MINES LIMITED

Deer Horn Mines Limited was incorporated in December 1950, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 4,935,005 shares have been issued. The directors and officers were: Frank Cadesky, president and director; Norman Lamport, vice-president and director; A. J. Fortens, secretary-treasurer and director. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is Box 739, Cobalt.

Deer Horn Mines Limited leased, then purchased in 1963, the Cross Lake O'Brien property from Agnico Mines Limited. The property consists of 14 claims in Coleman township, District of Timiskaming, about 1½ miles east of Cobalt.

The mine operated from 1 January to 14 October, and the mill from 1 January to 31 December 1969.

SHAFTS, DEER HORN MINE

	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
			feet	feet
Main	Vertical	2	Surface	923
No. 1 winze	Vertical	2	584	656
No. 2 winze	Vertical	3	584	800
No. 1201 incline	Inclined	2	900	1,020

A total of 557 feet of drifting, 41 feet of crosscutting and 622 feet of raising was completed in 1969. Total development footage to December 1969 was as follows: 51,441 feet of drifts, 16,691 feet of crosscuts; 20,896 feet of raises. Some 42 diamond-drillholes, totalling 4,305 feet were drilled from underground.

A total of 6,984 tons of ore was hoisted; 13,447 tons were milled at an average of 117 tons per working day.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

All efforts were concentrated on the development and preliminary mining of No. 40 and No. 52 vein systems at the bottom or 1,000-foot level. Although some highgrade sectors were encountered, the overall grade proved disappointing and work at the mine was suspended in September due to lack of further development funds.

The mill operated intermittently when sufficient mine feed or custom ore was available. A total of 24,082 tons was milled of which 10,655 tons was custom ore.

Summary of Development

		1969	1968
Ore hoisted	(tons)	6,984.0	8,460.0
Ore milled	(tons)	13,447.0	21,881.0
Silver recovery	(ozs./ton)	10.3	8.4
Total silver recovery	(ozs.)	138,090.0	183,216.8

The mining properties and equipment are being maintained in good standing in the event that conditions should permit the resumption of development operations.

Employment and Management

The average number of employees was 43: 23 underground and 20 on surface. G. A. Smith was mine manager.

GLEN LAKE SILVER MINES LIMITED

Glen Lake Silver Mines Limited was incorporated in June 1960 with an authorized capitalization of 5,000,000 shares of $1 par value, of which 4,589,173 shares have been issued. The directors and officers were: J. P. Arnott, president and director; B. N. Apple, vice-president and director; R. W. Miller, H. R. Bartle and F. McCluney, directors; F. Cadesky, Secretary; A. J. Fortens, treasurer. Following a merger agreement between Glen Lake Silver Mines Limited and Silver Town Mines Limited effective 31 October 1968, all assets and operations of the two companies were under Glen Lake Silver for 1969. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is Cobalt.

The property, comprising 2 claims in Coleman township, District of Timiskaming, was formerly known as the Bailey mine. It is located on the west side of Glen Lake, opposite the Foster mill, about three miles southeast of Cobalt.

Mining and milling operations progressed from 2 January to 31 July 1969.

SHAFTS, GLEN LAKE SILVER MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth from Surface
				feet	feet
1	lot 4, S.W.½ N.½, con. IV, Coleman	Vertical	2	Surface	283
1W	lot 4, S.W.½ N.½, con. IV, Coleman	Vertical	2	283	455

The following table gives the development completed in 1969, and the total at the time of termination of operations on 31 July 1969.

Level	Drifts 1969	Drifts Accumulated total	Crosscuts 1969	Crosscuts Accumulated total	Raises 1969	Raises Accumulated total
	feet	feet	feet	feet	feet	feet
1-2-3 Levels see 1952 report	—	2,130	—	2,340	—	—
4	42	1,907	—	2,500	100	1,457
5	—	1,343	—	1,223	99	691
6	—	479	—	38	—	210
7	—	128	—	327	—	140
Total	42	5,987	—	6,428	199	2,498

Some 16 diamond-drillholes totalling 1,826 feet were completed from underground.

Production from the Bailey mine was terminated on 31 July. The hoisting plant, shaft and changehouse have been rented to Agnico Mines Limited. The Silver Town Peterson Lake property was closed on 11 July after producing 5,000 tons of ore. The King Edward shaft was rehabilitated down to 840 feet and a hoisting plant was installed but this project was suspended on 11 July.

Tailings from Peterson Lake were processed in the United Cobalt mill from June until late November and will be resumed in the spring 1970. The Glen Lake Bailey mill operated throughout the year at 150 tons per day with Hiho Silver Mines supplying the ore.

A total of 2,716 tons of ore was hoisted; 6,192 tons were milled. Some 30,400 tons of tailings were re-treated in the United Cobalt mill.

Hiho Silver Mines Limited

Hiho Silver Mines Limited was incorporated in February 1963; it is a wholly owned subsidiary of Glen Lake Silver Mines Limited.

The property comprises 1,574 acres in Coleman and Gillies townships, District of Timiskaming.

Operations proceeded from 2 January to 31 December 1969.

SHAFTS, HIHO SILVER MINE

	Inclination	Number of Compartments	Collar Depth	Vertical Depth from Surface
			feet	feet
University No. 1	Vertical	2	Surface	100
University No. 3	Vertical	2	Surface	298
Giroux winze No. 291	Vertical	2	291	405
Lawson No. 8	Vertical	2	Surface	410
Cleopatra Main	Vertical	2	Surface	243
Crown Reserve	Vertical	2	Surface	200
Kerr Lake No. 13	Vertical	2	Surface	90
Conisil	Vertical	2	Surface	610

The following table gives the development footage completed in 1969 and the accumulated footage to 31 December 1969 on the various Hiho operations.

	Drifts		Crosscuts		Raises	
Shaft Levels	1969	Accumulated total	1969	Accumulated total	1969	Accumulated total
	feet	feet	feet	feet	feet	feet
Cleopatra						
1st	85	2,940	—	5,125	185	315
2nd	227	2,653	528	1,830	491	757
3rd	—	569	16	663	130	164
University No. 3 (Giroux)						
2nd	—	230	—	500	—	—
3rd	437	1,265	40	1,673	474	1,132
4th	47	1,164	—	153	115	258
5th	500	500	95	95	94	94
Conisil (S. Giroux)						
610	70	70	247	3,021	686	686
Total	1,366	9,391	926	13,060	2,175	3,406

Some 22,534 feet of diamond-drillholes were completed in 1969 from underground.

New construction in 1969 consisted of a hoistroom addition at Conisil 32 x 18 frame construction. Added equipment included an electric hoist at Conisil mine, 42 x 30 in., 450 rpm.

Operations at Hiho's properties and leases were curtailed during the year. At the Cleopatra mine, operations continued throughout the year with pillar recovery and development. This was the only Hiho property working at year end.

Underground operations at the Giroux Lake and Conisil properties continued until the end of November, then were temporarily suspended. Both mines are being kept pumped out with resumption of operations in the future planned.

Milling of the old surface rock dumps from Kerr Lake and Crown Reserve continued throughout the year at the LaRose mill.

A total of 43,331 tons of ore was hoisted; 47,276 tons were milled in the Giroux mill at a daily average of 130 tons. The LaRose mill treated 59,744 tons from the Kerr Lake surface dump averaging 200 tons daily.

Company Annual Report

The following is taken from the Glen Lake Silver Mines Limited annual report for the period from 1 August 1968 to 31 July 1969.

Production for the various properties is as follows:

Glen Lake — Bailey Mine
Tons milled — 7,624 (1969)
Average mill heads — 8.72 oz. Ag
Recovery — 94.9 percent
Production:
Aug. 1/68-July 31/69—63,182.53 oz. Ag
Aug. 1/62-July 31/69—3,224,148.31 oz. Ag

Hiho — Glen Lake Subsidiary
Tons milled — 43,195 (1969)
Average mill heads — 19.51 oz. Ag
Recovery — 96.63 percent
Production:
Aug. 1/68-July 31/69—814,490.50 oz. Ag
Aug. 1/64-July 31/69—4,408,110.97 oz. Ag

Hiho Kerr Lake
Tons milled — 6,311 (1969)
Average mill heads — 7.27 oz. Ag
Recovery — 86.2 percent
Production:
Aug. 1/68-July 31/69—25,002.43 oz. Ag
July 1/67-July 31/69—191,129.30 oz. Ag

Production All Mines:
Aug. 1/68-July 31/69—1,181,178.70 oz. Ag

Hiho — Crown Reserve
Tons milled — 40,726 (1969)
Average mill heads — 3.38 oz. Ag per ton
Recovery — 88.87 percent
Production:
Aug. 13/68-July 31/69—122,548.54 oz. Ag

Glen Lake — Peterson Lake Mine
Tons milled — 5,031 (1969)
Average mill heads — 18.28 oz. Ag
Recovery — 96.69 percent
Production:
Nov. 1/68-April 30/69—88,972.84 oz. Ag

Glen Lake — Peterson Lake Tailings
Tons milled — 30, 431 (1969)
Average mill heads — 3.04 oz. Ag per ton
Recovery — 72.3 percent
Production:
May 15/69-July 31/69—66,981.86 oz. Ag

Production All Mines:
Aug. 1/62-July 31/69—8,117,162.92 oz. Ag

DEVELOPMENT AND MINING

Glen Lake — Bailey Mine

All development and mining has ceased at the Glen Lake Bailey mine. There remains low grade silver ore in the mine but it is not profitable to mine this at the present price for silver.

Hiho — Cleopatra Mine

During the year a number of cross veins were found and developed. They accounted for a large part of our silver production this past year. Mining on a number of these is still providing the largest part of our ore supply but the overall tonnage in sight is small.

Hiho — Giroux Lake mine

The upper levels of this mine are for the most part mined out. The 5th level is now being developed. It shows ore similar to that mined in the upper levels of 25 to 30 oz. Ag per ton.

Hiho — South Giroux Lake mine

This is the new area now being developed. It was reached by driving a 2,500 foot crosscut from the 600-foot level of the Conisil shaft. Diamond-drill holes cut commercial silver values in several holes above the 600-foot level. The veins were located on the 600-foot level and development has started. It appears that Hiho is at the bottom of the ore at the 600-foot level as the veins show low silver values. Raises are now in progress to ascertain at which level the commercial grade silver ore will come in.

Kerr Lake mine

This mine has been kept dewatered to keep the water level below that of ore dumps on the Kerr Lake and Crown Reserve Properties. The dumps rest on the bottom of Kerr Lake where a possible two years' ore supply still remains.

Glen Lake — Peterson Lake tailings

To date, 45,000 tons of the estimated 318,000 tons of tailings estimated to grade 3.6 oz. silver per ton have been milled. The grade average 3.5 oz. Ag per ton and recovery — 72 percent. The low price for silver this year has cut the profit on this operation considerably.

Employment and Management

The average number of employees at the Glen Lake Silver Mines operation was 44: 19 underground and 25 on surface.

The average number of employees at Hiho Silver Mines operation was 117: 56 underground and 61 on surface. M. C. Halstead was general manager at both operations.

KAM-KOTIA MINES LIMITED
(Cobalt Refinery Division)

Cobalt Refinery Limited was incorporated in June 1962; in 1963 it became a wholly owned subsidiary of Violamac Mines Limited; in 1966 it became the Cobalt Refinery Division of Kam-Kotia Mines Limited. The officers, directors and head office address of Kam-Kotia Mines are given in the NICKEL-COPPER section. The Cobalt Refinery Division address is R.R. No. 1 Cobalt. The treatment plant located six miles south of Cobalt and one half mile east of Highway 11, operated from 1 January to 31 December 1969.

Major construction in 1969 included an electrolytic building, a storage building and storage vault and five houses.

Added equipment comprised: two dust collectors, a new furnace and a conversion furnace, a pouring table and a fork-lift truck.

Company Annual Report

The following pertaining to the Cobalt Refinery Division is taken from the Kam-Kotia annual report for the year ending 31 December 1969.

Silver Receipts:

The majority (2/3) of silver received during 1969 was silver owned by others sent here for upgrading at a charge. There was at year end still some 2 million ounces of owned silver in inventory due to the delay in attaining expected production rates.

The electolytic silver circuit was operated on a limited basis only as it results in added costs for non-gold-bearing materials.

Production Data

		1969	1968
Concentrates terated	tons	1,583	2,154
Smelter ran	days	324	332
Roaster ran	days	162	234
Silver Refinery ran	days	364	363
Electrolytic Silver Refinery ran	days	143	232
Speiss Production	tons	290	551
Arsenic Refinery ran	days	Nil	49
Silver Production			
Owned	ozs.	6,194,294	5,362,473
Custom Toll	ozs.	13,776,582	7,432,048
Total		19,970,876	12,785,521
Arsenic trioxide:	lbs.	339,875	673,839
Arsenic purchased for resale:	lbs.	735,732	Nil
Net gain on production cost from Arsenic	$	26,000	11,726
Dore bullion			
Gold	ozs.	21,597	8,206
Silver	ozs.	56,975	16,415

Shipments from the local area mines decreased during 1969, although as of the end of the year all producing mines of the area were shipping to the Cobalt Refinery.

Further improvements in dust collection and waste water disposal, aimed at lowering pollution and silver losses, were effected during the year.

Employment and Management

The average number of employees was 87; J. N. Cram was general manager.

PATRICIA SILVER MINES LIMITED

Patricia Silver Mines Limited was incorporated in December 1961 with an authorized capitalization of 7,500,000 shares of $1 par value, of which 5,990,005 shares have been issued. The directors and officers were: G. E. Buchanan, president and director; A. J. Fortens, vice-president and director; Frank Cadesky, secretary-treasurer and director. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is Box 739, Cobalt.

The property leased from Silver Regent Mines Limited, comprises nine claims, approximately 400 acres, in Bucke and Coleman townships, District of Timiskaming and includes the former Nipissing-North and Genesee properties located in the Town of Cobalt.

Operations progressed from 2 January to 31 December 1969.

SHAFTS, GENESEE AND NIPISSING NORTH PROPERTIES

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Total Depth from surface
				feet	feet
Genesee					
No. 1	No. 247 Bucke	Vertical	2	Surface	572
No. 2	No. 247 Bucke	Vertical	2	350	390
Nipissing-North					
No. 64	RL400 Coleman	Vertical	2	Surface	900
No. 64 winze	RL400 Coleman	58°	2	900	970
No. 73	RL400 Coleman	Vertical	2	Surface	328
No. 73-4014	RL400 Coleman	Vertical	2	328	480
No. 98	RL400 Coleman	Vertical	2	Surface	273

At the Genesee property work was deferred, after preliminary mining and boxholing on the 450-foot level produced 300 tons of ore in 1968.

Development work completed on the Nipissing-North property consisted of 616 feet of drifts, 234 feet of crosscuts and 152 feet of raises. Total development footage to 31 December 1969 was as follows: 11,840 feet of drifts, 17,179 feet of crosscuts, 391 feet of raises. The total completed by former and present operators on the Genesee property comprised 1,251 feet of drifts, 5,275 feet of crosscuts, and 455 feet of raises. Some 54 diamond-drillholes totalling 12,441 feet were completed on the Nipissing-North property from underground.

Major construction in 1969 consisted of a mine dry 30 x 16 feet.

A total of 4,761 tons of ore was hoisted; 4,281 tons were custom milled at the Deer Horn mill.

Employment and Management

There were 22 men employed under contract to Deer Horn Mines. J. E. Armstrong, consulting engineer, was in charge.

RAGGED CHUTES SILVER MINES LIMITED

Ragged Chutes Silver Mines Limited was incorporated in May 1967, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,150,005 shares have been issued. The directors and officers were: N. B. Keevil, Jr., president and director; Stephen Kay, vice-president and director; J. L. Tindale, J. H. Westell and Norwood Carter, directors; J. A. S. Gibson, treasurer, W. S. Vaughan, secretary. The head office is at Suite 4900, Toronto-Dominion Centre, Toronto 1. The mine address is Cobalt.

The company acquired three separate groups of claims in the Cobalt area, consisting of 9 claims in Lorrain township, 15 claims in Gillies Limit, and 20 claims in Coleman township, leased from the Reinhardt estate. An exploration program continued in 1969 on the Coleman township claims, which comprise some 398 acres, at the south end of Crosswise Lake. Three shafts had been sunk on the property by former operators as follows: the vertical, two compartment Marks shaft (Cross Lake Silver) located on claim 15449 some 225 feet deep with levels at 70 and 210 feet below the collar, on which 380 feet of drifting, 685 feet of crosscutting and 37 feet of raising had been completed; the inclined two compartment Old Chap shaft, located on claim 76 some 225 feet deep with levels at 130 and 200 feet below the collar, on which 50 feet of drifting and 220 feet of

crosscutting had been completed; the vertical, two compartment Valentine shaft, located on claim 823 some 197 feet deep with a 100-foot level on which 40 feet of drifting had been completed.

During 1969 some five diamond-drillholes totalling 3,813 feet were completed from surface. A surface geophysical survey was also carried out.

Employment and Management

W. C. Summers, manager at Silverfields Mining Corporation was in charge. H. Moore, geologist, supervised the exploration program and two men were employed during the period of operation.

SILVERFIELDS MINING CORPORATION LIMITED

Silverfields Mining Corporation Limited was incorporated in September 1962 with an authorized capitalization of 3,000,000 shares of no par value and 25,000 class "A" shares of $4 par value of which 1,502,134 common and 6,082 class "A" shares have been issued. The directors and officers were: N. B. Keevil, president and director; Stephen Kay, vice-president and director; R. J. Wright, secretary and director; D. A. Perigoe and J. H. Hirshhorn, directors; J. H. Westell, treasurer. The head office is at Suite 4900, Toronto-Dominion Centre, Toronto 1. The mine address is Cobalt.

The property consists of four claims comprising 73 acres in Coleman township, District of Timiskaming. This was formerly known as the Alexandra property; it is located between Glen Lake Silver Mines and Silver Summit Mines on Diabase Mountain.

Mining and milling operations continued throughout 1969.

The vertical, two compartment Alexandra shaft has a depth of 502 feet below the collar. The vertical two compartment Meteor shaft has a depth of approximately 131 feet. Development footage in 1969 consisted of 1,761 feet of drifting, 81 feet of crosscutting and 48 feet of raising. Total development footage to 31 December 1969 was as follows: 22,264 feet of drifts, 6,842 feet of crosscuts, 1,628 feet of raises. Some 220 diamond-drillholes totalling 26,532 feet were completed from underground.

The joint program with Silver Summit Mines Limited continued throughout the year with two stopes being mined out and some 5,000 tons of ore being custom milled at Deer Horn's O'Brien mill, and Agnico's Penn mill.

A total of 86,740 tons of ore was hoisted; 79,556 tons were milled at a daily average of 221 tons.

Company Annual Report

The following is taken from the company report for thirteen months ending 30 September 1969.

Some 1,172,623 ounces of silver, 43,517 pounds of cobalt and 90,588 pounds of copper were produced during the period for gross bullion production of $2,129,033.

The mill operated at an average of 221 tons per day with a grade of 13.7 ounces of silver per ton. Broken ore reserves were increased by 22,352 tons and total reserves were maintained at previous levels. A considerable improvement was made in mine ventilation after a breakthrough into the adjoining Meteor mine late in the previous year. A two year contract was negotiated with the labour union, effective 3 June, 1969.

Exploration and development at the property continued in a routine manner. On the Silver Summit joint program, 2,744 tons were custom milled with an average recovery of 18.5 ounces of silver per ton. At year end stoping was continuing on the unexpectedly persistent ore structure in the 1 NN stope. Broken ore reserves totalled 2,042 tons.

On the Ragged Chutes Silver Mines Limited property, in which Silverfields has a major interest, four holes with an aggregate footage of 1,399 feet were drilled, but no significant silver mineralization was encountered.

Production from the Silverfields mine is expected to remain at present levels throughout 1970, with earnings dependent principally on the price received for silver.

Employment and Management

The average number of employees was 80: 47 underground and 33 on surface. W. C. Summers was mine manager.

SISCOE METALS OF ONTARIO LIMITED

Siscoe Metals of Ontario Limited is a wholly owned subsidiary of Siscoe Mines Limited, incorporated in September 1950. The directors and officers were: G. T. Smith, president and director; R. E. Fasken, vice-president and director; R. J. Adams, J. G. Ahern, H. Reimer, A. S. Fraser, and H. Dahl-Jensen, directors; C. M. Masterman, secretary; K. E. Elrick, treasurer. The executive office is at Suite 1700, 11 King Street West, Toronto 1. The mine address is O'Brien.

The company operates the Siscoe Metals property, formerly the Miller Lake O'Brien mine, comprising 14 claims in Nicol and Haultain townships, Gowganda area, District of Timiskaming. In 1967 the company leased the Castle Division mine of McIntyre Porcupine Mines Limited and also leases the property of Manridge Mines in Milner township.

Mining and milling continued from 3 January to 30 December 1969.

SHAFTS, SISCOE MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
				feet	feet
No. 6 shaft	RSC91	Vertical	3 and 2	Surface	1,542
No. 2 shaft	RSC91	75½°	2 (inactive)	Surface	438
No. 20 shaft	RSC94	76°	2 (inactive)	Surface	158
No. 1 winze	—	75°	2 (inactive)	350	458
No. 2 winze	—	82°	2 (inactive)	350	460
No. 3 winze	—	76°	2 (inactive)	350	402
No. 4 winze	—	82°	2 (inactive)	350	530
No. 5 winze	—	Vertical	2 (inactive)	525	640
No. 7 winze	—	75°	2 (inactive)	730	902
No. 8 winze	—	68°	2 (inactive)	730	788
No. 9 winze	—	Vertical	3 (inactive)	730	898
No. 10 winze	—	69°	2 (inactive)	900	970
No. 11 winze	—	Vertical	2	850	1,369
		Shafts and winzes not connected to present workings			
Upper Bonsal					
No. 1 shaft	RSC95	Vertical	2 (inactive)	Surface	85
No. 2 shaft	RSC84	80°	2 (inactive)	Surface	115
No. 3 shaft	RSC84	Vertical	2 (inactive)	Surface	68
Lower Bonsal					
No. 1 shaft	RSC83	76°	2 (inactive)	Surface	132
No. 2 shaft	RSC83	Vertical	3	Surface	511
Millerett					
No. 1 shaft	RSC95	Vertical	2 (inactive)	Surface	85
No. 7 shaft	RSC95	Vertical	2 (inactive)	Surface	210
No. 9 shaft	RSC95	Vertical	1 (inactive)	Surface	35
No. 10 shaft	RSC95	77°	2 (inactive)	Surface	127
No. 1 winze	—	65°	2 (inactive)	70	136
No. 2 winze	—	79°	2 (inactive)	200	303

Development work in 1969 consisted of 291 feet of drifting, 28 feet of crosscutting and 118 feet of raising. Total development footage by present operators to 31 December 1969 was as follows: 81,095 feet of drifts; 24,423 feet of crosscuts; 12,097 feet of raises. Diamond-drilling in 1969 consisted of 34 holes totalling 7,157 feet from underground, and 2 holes, totalling 1,502 feet from surface.

Mining and milling operations at about 200 tons per day continued throughout the year with ore coming from the Lower Bonsal No. 6 Shaft and Castle properties.

During the year work was suspended at the Lower Bonsal and exploration work concentrated on the Tonopah mine, formerly the Walsh mine, now leased by Siscoe from the Castle holdings of McIntyre Porcupine Mines Limited. At the Tonopah the two compartment shaft was rehabilitated, and a crosscut on the 650-foot level was driven south from the Siscoe main workings and a raise connection made through to the Tonopah 480-foot (bottom) level.

A total of 6,414 tons of ore was hoisted and milled at a daily average of 26 tons.

Castle Division Lease

The Castle Division property of McIntyre Porcupine Mines Limited consisting of 42 claims located in Haultain and Nicol townships, Gowganda area, District of Timiskaming, was leased by Siscoe Metals of Ontario in 1967.

Mining and milling operations progressed from 3 January to 30 December, 1969.

SHAFTS, CASTLE AND CAPITOL MINES

	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
				feet	feet
CAPITOL MINE					
Capitol Shaft	HS351	Vertical	2	Surface	819
Capitol winze	HS351	Vertical	2	778	1,131
Inclined haulageway	HS351	27°	2	1,125	1,425
Capitol Cobalt shaft	HS351	Vertical	1 (inactive)	Surface	38
CASTLE MINE					
No. 1 shaft	RSC106	Vertical	1 (inactive)	Surface	460
No. 2 shaft	RSC101	Vertical	(inactive	Surface	160
No. 3 shaft	RSC101	Vertical	2	Surface	850

Development work in 1969 included 1,127 feet of drifting, 552 feet of crosscutting and 479 feet of raising. Total development footage to 31 December 1969 was as follows: 43,814 feet of drifts; 17,444 feet of crosscuts; 10,339 feet of raises. Diamond-drilling consisted of 158 holes totalling 26,553 feet from underground and 19 holes, totalling 13,412 feet from surface.

Manridge Mine

In 1968 Siscoe Metals entered into an agreement with Manridge Mines Limited to lease the latter's extensive property holdings comprising some 73 claims in Milner township and about 12 miles distant from the Siscoe property.

Mining operations progressed from 1 May to 31 December.

SHAFTS, MANRIDGE MINE

Shaft	Claim No.	Inclination	Number of Compartments	Collar Depth	Vertical Depth below Surface
					feet
No. 1	26488	Vertical	2	Surface	unknown
No. 2	26488	Vertical	2	Surface	unknown
No. 3	26488	Vertical	2	Surface	200
No. 4	26488	Vertical	1	Surface	75
No. 5	26488	Vertical	2	Surface	unknown
Boyd Gordon	26491	Vertical	2	Surface	unknown

Development work in 1969 included 683 feet of drifting 1,061 feet of crosscutting and 95 feet of raising. Total development to 31 December consisted of 2,315 feet of drifts, 1,445 feet of crosscuts and 95 feet of raises.

Major construction comprised a mine dry 40 X 20 feet, a hoist housing 24 X 16 feet, a machine shop 24 X 16 feet, a compressor shed 24 X 22 feet and a headframe; all buildings frame construction with sheet aluminum siding.

Equipment added included two air compressors 600 cfm.

Company Annual Report

The following pertaining to all properties is taken from the company annual report for the year ending 31 December 1969.

Production

Silver concentrates produced

Table concentrates, dry tons	185 at 3,510 ozs. per ton
Flotation concentrates, dry tons	664 at 227 ozs. per ton
Total fine ounces recovered — 799,988	

Production over period 1946-1969

Year	Tons Ore Milled	Gross Production Silver Ounces
1946-1964	778,288	18,050,677
1965	58,049	1,103,785
1966	53,050	1,206,149
1967	50,917	917,333
1968	47,544	978,711
1969	41,808	799,798
	1,029,656	23,056,453

The following is a résumé of the main areas where exploration, development and/or mining operations were carried on during the year:

Areas Served by No. 6 Shaft

Flynn System

Three small pockets of ore were developed and mined in the area north of the Flynn System, in proximity to the upper contact of the Nippissing Diabase Sill. An intensive diamond-drilling program failed to encounter any new ore and work was suspended in this sector of the mine in May.

Castle No. 1 Shaft Area

Development and mining operations in this area accounted for 35 percent of the total production but at year end the known ore was nearly exhausted. Geological mapping and examination of the old upper levels revealed a number of promising veins. Subsequently a program of diamond-drilling designed to test these veins at a lower horizon, more favourable to ore deposition in this area, was carried out. The drilling was moderately successful insofar as intersecting the veins but silver values contained were below ore grade. Possibilities for new ore remain to the south of Castle No. 1 shaft and exploration activities will be extended to encompass this area.

Tonopah Area

The crosscut from Siscoe 650-foot level to beneath the Tonopah underground workings reached its objective in March and a diamond-drill hole was drilled through to the Tonopah 480-foot level. Following the completion of dewatering an inclined access raise connecting the two levels was driven.

Examination of the old levels revealed sporadic sections with silver mineralization in and about the area mined by previous operators, but not in sufficient quantity to warrant starting mining operations at this time.

Diamond-drilling from the 480-foot level aimed at testing the areas lying to the north and east of the formerly productive ore zone was started in September and is continuing. A surface diamond-drilling program designed to search for possible new ore shoots along the axis of a roll in the top contact of the Nipissing Diabase Sill eastwards from the Tonopah shaft began late in June. The first hole cut a vein containing visible silver at a point 1,300 feet east of the shaft and about 600 feet below surface. Six more holes were completed by year end and of these all but two encountered silver and cobalt mineralization in varying amounts. Follow-up drilling is continuing.

Capitol Shaft Area

Exploration, development and mining operations continued on all levels throughout the year. Although no new vein systems were discovered a number of ore shoots and extensions of previously mined ore shoots were found on the several levels, resulting in 55 percent of the year's production being won from this area.

In the area served by the south incline winze, geological mapping indicates the possibility of additional ore in or about the 45 and 47 vein systems.

Areas Not Served By No. 6 Shaft

Lower Bonsall

The ore shoots developed and mined at the Lower Bonsall thus far, occur beneath the Nipissing Diabase Sill along an axis trending from northwest to southeast and plunging at a low angle towards the southeast. The 1969 exploration and development was directed to the search for new ore shoots along this axis, and to testing a fault structure known as the Everett Lake Fault. Drifting northeastward along this fault on the 350-foot level encountered significant cobalt-arsenide mineralization but the associated silver values were below ore grade. Diamond-drilling failed to produce any further encouragement and all underground operations were suspended in May.

A surface drilling program to test a geochemical anomaly was conducted in an area approximately 1,900 feet northeast of the Bonsall Shaft. Two zones with silver values less than ore grade were found. The drilling indicated an irregularity in the bottom contact of the Nipissing Diabase Sill of the order of 250 feet in amplitude, and the presence of a north striking dyke of Matachewan Diabase in the Keewatin below the Sill. This is considered a favourable structural environment. Also it lies along the strike of an east-west zone of silver mineralization which includes the ore zones previously extracted from the Castle Nos. 2 and 3 shafts.

Manridge Mine

Construction of a small mining plant consisting of a 65 foot headframe with shafthouse and four other buildings plus installation of the necessary machinery commenced early in the year and was nearly finished at the end of April. Following the completion of dewatering and rehabilitation of the No. 3 shaft, development work began on the second (120-foot level) around the middle of May. At year end five out of the seven diamond-drill-indicated ore zones had been fully or partially developed and some mining done.

The ore accumulated from development operations was hoisted to and stockpiled on surface for future treatment in the Siscoe mill at O'Brien. A mill run is contemplated in the early part of 1970.

Mining

Sources of Ore Milled

From	1969 Tons	1969 Ozs. per Ton	1969 Total Ozs.	1968 Tons	1968 Ozs. Per Ton	1968 Total Ozs.
Development	2,954	10.97	32,403	4,811	17.00	81,804
Mining	38,854	19.76	767,585	40,536	21.23	860,697
Surface rock dump	—	—	—	2,197	2.06	4,526

Milling

		1969	1968
Ore treated	dry tons	41,808	47,544
Calculated heads	oz/ton	19.70	20.56
Mill residues	oz/ton	0.56	0.65
Recovery	percent	97.16	96.81
Recovered — mill	ozs.	799,988	947,027
Crude mine ore	ozs.	nil	31,684
Overall silver production	ozs.	799,988	978,711

Operating Costs

	1969 Per Ton	1969 Per Oz.	1968 Per Ton	1968 Per Oz.
Smelting and marketing	$ 2.69	$0.140	$ 2.87	$0.139
Exploration and development	4.44	0.232	5.26	0.256
Mining	12.01	0.628	9.43	0.458
Milling	3.60	0.188	3.07	0.149
Overhead	3.08	0.161	2.53	0.123
Total mine operating cost	$25.82	$1.349	$23.16	$1.125

The higher operating cost for the most part reflects general wage increases and an increase in the cost of supplies.

Employment and Management

The average number of employees was 113: 82 underground and 31 on surface. E. A. Pearson was mine manager.

WELSH SILVER MINES LIMITED

Welsh Silver Mines Limited was incorporated in March 1968 with an authorized capitalization of 250,000 shares of $1 par value, of which 90,000 shares have been issued. The officers of the company were: R. G. Welsh, president; Ethel Welsh, secretary-treasurer. The head office and mine address is Box 158, Matachewan.

The property, formerly known as the Otisse mine, comprises 11 claims in Mickle township, District of Timiskaming, and is located about seven miles southwest of Elk Lake.

The two compartment No. 1 shaft located on claim EB21 has a total depth of 170 feet with levels at 75 and 150 feet.

Development work on the property proceeded from May until October 1969, and consisted of driving an inclined shaft at —20 degrees a further distance of 20 feet to break through to the level on No. 3 vein; approximately 100 tons of ore was test milled; some 200 feet of surface trenching averaging four feet in depth was completed; buildings on the property were rehabilitated.

Employment and Management

The average number of employees during the period of operation was 3; G. S. Welsh was in charge.

TELLURIUM — see NICKEL-COPPER

THORIUM

The production of thorium decreased 79.1 percent in quantity from 139,191 pounds in 1968 to 29,014 pounds in 1969. The value of production decreased by 79 percent from $261,831 in 1968 to $55,087 in 1969. Thorium is recovered as a by-product from milling of the Elliot Lake uranium ores, and its decrease in recovery is mainly due to the lack of market for this product.

The general statistics are given under URANIUM.

URANIUM

The 1969 value of output of uranium oxide (U_3O_8) in Ontario increased to $40,307,489 from $39,163,777 in 1968, or by about 3 percent.

Since thorium and yttrium are derived as by-products of uranium operations, the general statistics for thorium, yttrium and uranium are combined here. These industries paid a total of $14,883,141 to 1,825 employees.

AGNEW LAKE MINES LIMITED

Agnew Lake Mines Limited was incorporated in June 1967, with an authorized capitalization of 3,000,000 shares of no par value, of which 1,150,000 shares have been issued. The officers and directors were: J. H. Stovel, president and director; E. Futterer, vice-president, general manager and director; F. R. Burton, A. Waters, P. M. Kavanagh and W. S. Row, directors; R. D. Stewart, secretary; B. C. Bone, treasurer. The head office is at Suite 1600, 44 King Street West, Toronto 1. The mine address is Box 1430, Espanola.

The property consists of 26 claims located in Hyman township, District of Sudbury. The company is controlled by Kerr Addison Mines Limited and the property is reached by means of a new seven mile long access road from the High Falls road north of Nairn.

Operations progressed from 1 January to 31 December 1969.

The vertical, six compartment No. 1 shaft, located on claim S127997, was sunk 2,001 feet in 1969 to a depth of 3,411 feet below the collar. The 1,500, 1,630 loading pocket, 1,700, 1,900, 2,100, 2,300, 2,500, 2,700, 2,900, 3,100, 3,230 loading pocket and 3,300-foot levels were established. Some 31 diamond-drillholes, totalling 13,604 feet, were completed from underground.

Development footage completed consisted of 4,344 feet of drifts, 2,506 feet of crosscuts and 2,784 feet of raises. Total development footage to 31 December 1969 was as follows: 4,344 feet of drifts, 3,127 feet of crosscuts and 2,800 feet of raises.

Major construction in 1969 consisted of an explosive storage magazine, concrete block construction 49 x 27 feet.

Added equipment included the following:

2 scooptrams, ST2B, 200 yd., 75 h.p.
1 scooptram, ST4A, 400 yd., 145 h.p.
1 compressor, air 3000 cfm.

Company Annual Report

The following pertaining to the Agnew Lake Mines Limited operation is taken from the Kerr Addison annual report for the year ending 31 December 1969.

The underground work locally confirmed the results of the surface diamond-drilling program which, as previously reported, indicated 7,750,000 tons containing 1.8 pounds U_3O_8 per ton to a vertical depth of 3,500 feet on the property of Agnew Lake Mines and an additional 1,400,000 tons of similar grade on an intervening Kerr Addison claim.

On surface approximately 300,000 cubic yards of overburden were stripped in the proposed hydro-metallurgical plant and ore stockpile areas. A portion of this material as well as shaft rock was used to construct a retaining dam in the tailings area for the control of mine effluents.

Metallurgical studies to permit process design are nearing completion. However, mill construction will not be started until a sales contract has been signed. Engineering was completed for a water treatment plant to remove potential pollutants from underground and stockpile drainage waters.

An additional four houses and sixteen townhouse units were constructed in Espanola.

Employment and Management

The shaft sinking and construction was by contract, the company employing an additional 50 men: 17 underground and 33 on surface. M. D. Rowswell was manager.

CAN-FED RESOURCES CORPORATION
(Faraday Mine)

Can-Fed Resources Corporation was incorporated in April 1967 with an authorized capitalization of 10,000,000 shares of $0.25 par value, of which 20,000 shares have been issued. The officers of the company were: N. W. Stalheim, president, D. V. Peters, secretary-treasurer. The head office is at 1370 South Third West, Salt Lake City, Utah 84115, U.S.A.; the mine address is Faraday Mine, Bancroft.

The property comprises 4,382 acres in Faraday township, County of Hastings. The Faraday mine and mill operated from April 1957 to July 1964, during which time it produced 5,807,693 pounds of uranium oxide. The closure was brought about by lack of markets and not through exhaustion of the ore. An agreement was reached with Federal Resources Corporation which is expected to lead to a resumption of production. Federal is proceeding with a program of underground development designed to increase

the presently known ore reserves and has the right to proceed to rehabilitate the mine and mill. If Federal completes this undertaking, it will have earned a 51 percent interest in the project; Faraday will retain 49 percent and in addition, will receive $1,000,000 out of future profits.

SHAFTS, CAN-FED RESOURCES, FARADAY MINE

Shaft	Location	Inclination	Number of Compartments	Vertical Depth below Collar
				feet
No. 1	lot 16, con. XI Faraday township	Vertical	(3 to 750 feet) (4 below 750 feet)	1,455
No. 2	lot 17, con. XI Faraday township	Vertical	3	196

Development work completed during the year, consisted of 1,471 feet of drifts, 180 feet of crosscuts, and 742 feet of raises. Total development footage completed to 31 December 1969 was as follows: 57,811 feet of drifts, 39,055 feet of crosscuts, 44,053 feet of raises. Some 80 diamond-drillholes totalling 8,947 feet were completed in 1969 from underground.

The underground development work was discontinued in June. Considerable work had been done on the bottom levels over the past year and a half, to substantially increase the proven ore reserves and place the mine in good condition to produce. The work force of nine men, decreased from 39, are maintaining the mine and continuing with a surface exploration program.

Employment and Management

The average number of employees was 23: 9 underground and 14 on surface. D. R. Wilson was mine manager.

DENISON MINES LIMITED

Denison Copper Mines Limited was incorporated in November 1936; it was succeeded in 1946 by Denison Nickel Mines Limited; in 1949 the name was changed to North Denison Mines Limited; in March 1954 it was changed to Consolidated Denison Mines Limited; in March 1960, on amalgamation of Consolidated Denison Mines Limited and Can-Met Explorations Limited, the name was changed to Denison Mines Limited. The authorized capitalization is 6,000,000 shares of $1 par value, of which 4,474,703 shares have been issued. The directors and officers were: S. B. Roman, chairman and chief executive officer; John Kostuik, president and chief operating officer; E. B. McConkey, vice-president (finance), treasurer and director; John C. Puhky, secretary and director; J. W. Berry, Hon. George Drew, F. H. Jowsey, L. R. Perini, C. F. Burns, Hon. H. A. Willis, B. E. Willoughby, Hon. D. Keith Davey, E. A. Merkle, Hon. L. G. Giquere and Anthony Roman, directors. The head office is at 4 King Street West, Toronto 1. The mine address is P.O. Box B-2600, Elliot Lake.

The Denison property comprises 123 claims in Townships 144 and 150, Blind River area, District of Algoma.

SHAFTS, DENISON MINE

Shaft	Claim No.	Inclination	Number of Compartments	Total Depth from Surface
				feet
No. 1	S586071	Vertical	5	1,856
No. 2	S586118	Vertical	8	2,776
Ventilation	On claim line between S67429 and S67430	Vertical	1	330

Development work in 1969 consisted of 9,449 feet of drifting and 44 feet of raising. Total development footage on a single plane to 31 December 1969 was as follows: 210,157 feet of drifts and 3,941 feet of raises. Some 735 diamond-drillholes, totalling 18,350 feet were completed from underground.

Major equipment added in 1969 was as follows:

1 3 boom hydraulic drill, jumbo mounted.
1 hydraulic scissor lift table 12 x 8 feet, truck mounted, 6,000 lb. capacity.
2 low profile loaders, 2 cu. yd. buckets.
1 aluminum steel cage 15 x 8 feet, 9 ton cap. for No. 2 shaft.
2 rockbreakers with hydraulic backhoe and pneumatic impact hammer.
3 scooptrams, ST5A, 5 cu. yd.
1 personnel transport vehicle with 100 hp diesel, cap. 30 passengers.
1 bridge crane, 5 ton cap. manual lift, electric travel.
1 gravity fresh water supply from Quirke Lake complete.

A total of 1,245,280 tons of ore was hoisted; 1,315,650 tons were milled at an average of 3,525 tons daily.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

This marks the thirteenth year of continuous production from the Denison mine. It was a year of progress and accomplishment in the program of preparedness on which much planning and effort has been applied in the past three years. Production of uranium oxide in 1969 reached 4,002,949 pounds, the highest level since 1963; the average grade, 3.43 pounds per ton, was at a record level, reflecting operations in the newly developed northeast section of the mine. Development of new methods, which were dependent on successful development or adaptation of high capacity mobile units to Denison mining conditions, has progressed favourably. The major projects undertaken in recent years are contributing most effectively to improving productivity and efficiency of operations.

Mine Improvements

The continuing objective for underground operations is to improve each element of the mining cycle, and make it increasingly less dependent on interruptions in the production rate of other elements. Improved methods developed and introduced over the last three years have been effective, and by year end 80 percent of the production tonnage was being handled by new loading and haulage equipment. Several new mobile units of the load-haul type were purchased during the year and additional high capacity haulage units will be added in 1970.

Other improvements in successful operation include:

1) the concentration of production activities in the newly developed northeast area of the mine.
2) a network of high capacity belt conveyors for transporting ore from the newly developed areas.
3) the elimination of production delays at truck discharge points through successful development of an effective mechanical rock breaker.
4) more mechanization of mine development and mine service facilities.
5) an enlargement and modernization of facilities for servicing mine mobile equipment.

Milling

No major renewal or expansion projects in the surface plant were planned for 1969; however there is much emphasis on a steady improvement of plant facilities and processing methods. This program was particularly effective during the year. Mechanical and metallurgical changes and improvements in operations reduced the consumption of process re-agents by 10 percent, and increased both leaching circuit efficiency and uranium recovery. Improvement and reconditioning of concentrator plant equipment is a continuing program on which much progress was made in 1969. Additional cost reductions and improvements in reliability and process control are expected from the process development program in 1970. The principal re-agents used for uranium extraction are sulphuric acid and lime. After mid-1970 industrial lime will be supplied from the new plant now being built at Spragge, Ontario in which Denison has a 49 percent interest. The proximity of this plant will reduce the cost of one of our principal re-agents. The normal supply of sulphuric acid from Sudbury was interrupted by the long strike of nickel workers during 1969, and substitute supplies had to be obtained elsewhere at excessive cost.

In 1970 there will be an increasing emphasis on research and development in metallurgical aspects on our operations, including research on rare-earth separation. By-product operation was resumed during the year with the production of yttrium oxide. The uranium ore contains more than a dozen unusual elements which can be separated as commercial applications for rare earth oxides develop. Detailed studies were carried out during the year on a program for extending bacterial leaching operations for the extraction of uranium. This form of solution mining is applied at Denison to supplement normal mine production. Production attributable to underground leaching operations is estimated at 210,000 pounds U_3O_8 for the year.

Employment and Management

The average number of employees was 817; 442 underground and 375 on surface. M. J. deBastiani was mine manager, John Kostuik was president and chief operating officer.

RIO ALGOM MINES LIMITED

Algom Uranium Mines Limited was incorporated in July 1953; Milliken Lake Uranium Mines Limited was incorporated in October 1952; Northspan Uranium Mines Limited was incorporated in June 1956; Pronto Uranium Mines Limited was incorporated in June 1953. In June 1960, the four companies were amalgamated under the name of Rio Algom Mines Limited with an authorized capitalization of 15,000,000 common shares of no par value and 497,000 preferred shares of $100 par value of which 12,249,584 common and 147,000 preferred shares have been issued. The directors and officers were: J. N. V. Duncan, chairman, chief executive officer and director; R. D. Armstrong, president and director; O. S. Leslie, executive vice-president (steel operations) and director; W. P. Arnold, executive vice-president (mining operations) and director; G. R. Albino, executive vice-president and director; Henry Borden, (corporate staff) and director; B. R. MacKenzie, Sam Harris, Leo Model, F. A. Petito, J. I. Crookston, W. A. Arbuckle, L. A. Lapointe, J. G. Edison, Sir Mark Turner, J. H. Smith and R. W. Wright, directors; K. L. Perry, counsel; H. A. Pakrul, corporate finance manager; A. C. Turner, secretary; J. Yan Netten, treasurer. The head office is at Suite 2600, 120 Adelaide Street West, Toronto 1. The address of the mines in the Elliot Lake area is Elliot Lake. Details on the Rio Algom Mines Limited, Pronto mine is included in the NICKEL-COPPER section of this report; the nuclear products department is under THORIUM and YTTRIUM.

Nordic Mine

The property comprises 140 claims in Townships 143, 149 and 155, District of Algoma.

Mining operations were carried on from 1 January to 31 December 1969.

The vertical six-compartment, Nordic No. 1 shaft located on claim S6619, in Township 149, has a total depth of 1,780 feet below the collar. Development work in 1969 consisted of 822 feet of crosscutting. Total development footage to 31 December 1969 was as follows: 121,240 feet of drifts; 22,397 feet of crosscuts; 252,998 feet of raises.

Production by normal mining methods gradually decreased throughout the year as the Nordic mine was phased out. Leaching operations continued in some of the mined-out areas. A drive will be advanced from the bottom level of Nordic to the Lacnor shaft to develop the reserves on the South Limb structure at the Lacnor and Nordic sites.

A total of 11,889 tons of ore was hoisted and trucked to the Rio Algom Quirke Mill.

Quirke No. 1 Mine

The property comprises 18 claims in Township No. 150, District of Algoma.

SHAFTS, QUIRKE NO. 1 MINE

Shaft	Location Claim No.	Inclination	Number of Compartments	Vertical Depth below Surface
				feet
No. 1	S66899	Vertical	5	1,208
No. 2	S67240	Vertical	6	50

Mining and milling progressed from 1 January to 31 December 1969.

Development work consisted of 7,375 feet of drifting and 13,484 feet of raising. Total development footage to 31 December 1969 was 93,632 feet of drifts, 19,924 feet of crosscuts and 129,678 feet of raises. Some 1,365 diamond-drillholes totalling 14,514 feet were completed from underground.

Considerable new and replacement equipment both underground, surface and in the mill was added in 1969.

A total of 1,081,129 tons of ore was hoisted; 1,363,300 tons were milled at an average rate of 3,940 tons daily.

New Quirke Mine

The property comprises 125 claims in Townships 144, 150 and 156, District of Algoma.

The vertical, six-compartment New Quirke mine shaft located in claim S67240 has a depth of 2,261 feet below the collar. Mining operations progressed from 1 January to 31 December 1969.

Development work consisted of 17,440 feet of drifts; 2,061 feet of crosscuts and 16,137 feet of raises. Total development footage to 31 December, 1969 was 23,357 feet of drifts, 10,225 feet of crosscuts and 22,087 feet of raises. Some 175 diamond-drillholes totalling 6,850 feet were completed from underground.

Major construction in 1969 included a single track surface railroad between Quirke and New Quirke mines some 1.3 miles; an access road to main intake and exhaust raises; a burner building for mine air heating plant 32 x 20 feet and an electrical control building for mine air heating plant, 20 x 10 feet.

Added equipment was as follows:

1 transformer, 750 K.V.A.
4 fans, Vaneaxial (two 108 in. with 400 hp motors, two 84 in. with 200 hp motors)
1 burner, propane, 16,000,000 BTU/hr
2 jumbo drills
2 mucking machines
1 jaw crusher, 36 x 48 ins. with 150 hp motor
1 dust filter, type RSF 36-60
1 electric crane, 5 ton cap
3 concrete buggies
3 track toilets
1 skip hoist, 144 x 78 ins., 2,600 F.P.M.
1 trolley locomotive, 37 ton, 500 hp
18 bottom dump ore cars, 15 ton
4 pumps, with 200 hp motors, 1,800 rpm
10 rock drills
1 van ambulance
2 battery chargers
1 battery locomotive
1 drill platform and flat car for loader
1 gun all machine
1 level gauge electronic control unit
1 alpha radioactivity counter

A total of 343,784 tons of ore was hoisted and milled.

Company Annual Report

The following pertaining to the uranium operation was taken from the company annual report for the year ending December 1969.

Mining operations were carried on at the Old Quirke and New Quirke mines and all milling was at the enlarged Old Quirke mill. A total of 1,363,000 tons of ore was milled, a record for a single Rio Algom mine in the Elliot Lake area, compared to 1,167,000 tons in 1968 when production was adversely affected by a twenty-nine day strike. The average daily tons milled was 3,940 tons which is 6½ percent above the 3,700 tons per day rated capacity of the mill. The average recovered grade was 2.41 pounds of uranium oxide per ton and the recovery rate was 94.1 percent compared to 1.96 pounds of uranium oxide per ton and 93.3 percent recovery rate in the previous year.

A total of 3,290,000 pounds of uranium oxide was produced, including 157,000 pounds from underground leaching at the Nordic mine, compared to a total of 2,293,000 pounds in 1968. Deliveries totalling 3,185,600 pounds of uranium oxide were made including 2,006,000 pounds under the master contract to Eldorado Nuclear Limited, 998,800 pounds to a number of Japanese utilities, 125,300 pounds to Canadian Westinghouse Company Ltd. and 55,500 pounds for the Japanese nuclear ship.

In the first quarter the shaft facilities at the New Quirke mine, including ore and waste passes, underground crusher and pumping stations, and the semi-automatic electric railway for the haulage of ore from the new mine to the mill, were completed. During the year tests were conducted to determine the maximum milling rate with present equipment. These tests, the longest of which was over a twenty-one day period, demonstrated that a rate of 4,500 tons per day could be maintained by adjusting the grinding circuit to produce a coarser particle size without a significant loss in recovery. This additional capacity will be utilized as soon as the mines can support this rate of production. The feasibility of a further appreciable increase in mill capacity by additions to the present milling circuit is being studied.

In view of the planned increase in the productive capacity of the Quirke mill, it is unlikely that the Nordic mill will need to be re-activated in the near future. It is now planned to close the Nordic mine and put the surface plant on a care and maintenance basis. In this event, the underground leaching, the miner training program and experimental mining will be transferred from Nordic to the Old Quirke mine.

To alleviate a shortage of housing in Elliot Lake, one hundred building lots were purchased, and forty-three houses were moved from the shutdown mine properties and placed

on lots. The necessary extensive rehabilitation and improvements to the houses have been completed.

A team from the Quirke mine won the annual Ontario Mine Rescue Competition over a field of thirty-nine teams representing most of the mines in the Province of Ontario.

Employment and Management

The average number of employees at the Nordic mine was 90: 47 underground and 43 on surface. R. T. Sullivan was project manager of the Nordic section.

The average number of employees at the Quirke No. 1 and the New Quirke mine was 857: 473 underground and 384 on surface. G. C. B. Bourne was manager at the Quirke section.

STANROCK URANIUM MINES LIMITED

Stanrock Uranium Mines Limited was incorporated in March 1956; in 1967 the authorized capitalization of 6,000,000 shares was increased to 10,000,000 shares of $1 par value, of which 6,546,323 shares have been issued. The directors and officers were: G. W. Rowe Jr., president and director; D. C. Marshall, vice-president, treasurer and director; Harmon Duncombe, secretary and director; J. F. A. Nisco, V. V. Jacomini, J. R. Dunning, Robert Frankel, J. C. Ward Jr., James Bruce and D. S. Robertson, directors. The head office is at Suite 804, 80 Richmond Street West, Toronto 1. The mine address is Box 1700, Elliot Lake.

The property comprises 63 claims, in Township 143, 144, 149, and 150, Blind River area, District of Algoma.

Leaching operations at the mine and milling continued from 1 January to 31 December 1969.

SHAFTS, STANROCK MINE

Shaft	Claim No.	Inclination	Number of Compartments	Total Depth
				feet
No. 1 shaft	S82324	Vertical	3	3,379
No. 2 shaft	S82323	Vertical	2	2,953
Service raise	S82323	Vertical	3	220

The total development footage completed when mining operations were terminated comprised 114,045 feet of drifts, 2,861 feet of crosscuts, and 4,376 feet of raises, that were driven between ore sheets; some 46,000 feet of advance in slot raising for production mining and boxhole raising is not included. One diamond-drillhole totalling 1,522 feet was completed from surface.

A series of reinforced concrete bulkheads have been built to permit the leaching of approximately half the underground workings by flooding. The water is being pumped to the mill continuously for the recovery of U_3O_8 with the barren solution being returned underground. Some 781,053 tons of mine water was pumped for the recovery of U_3O_8.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1969.

In 1969 the company produced by bacterial leaching uranium oxide with a sales price of $427,885. For the year as a whole, after other miscellaneous income of $38,830 and costs of $598,873, a net loss of $132,158 was incurred. Deferred expenses primarily relating to the refurbishing of the plant and equipment at Elliot Lake in anticipation of future conventional mining and milling operations were $115,001 in 1969. During the year additional bulkheads were constructed underground, which permitted a reservoir of uranium-containing water to be built up in the mine. The year's results were adversely affected by a considerable reduction in U_3O_8 recoveries in the fourth quarter and by a year-end write down of warehouse obsolete inventory.

The company remains confident that U_3O_8 prices will advance within the next few years to the point where it will be economic for the company to resume conventional mining and milling of its sizeable uranium deposits at Elliot Lake.

Employment and Management

The average number of employees was 34: 10 underground and 24 on surface. B. G. MacDermid was mine manager.

YTTRIUM

The production of yttrium decreased 24.6 percent in quantity from 113,330 pounds in 1968 to 85,443 pounds in 1969. The value of production decreased 28.3 percent from $936,067 in 1968 to $671,500 in 1969. Yttrium is recovered as a by-product from the milling of the Elliot Lake uranium ores. The general statistics for yttrium are included under URANIUM.

ZINC — see LEAD AND ZINC

NON-METALLICS AND FUELS

ARSENIC

In 1969, 339,875 pounds of arsenic trioxide, valued $34,000 was recovered from concentrates shipped from the Cobalt-Gowganda area to Cobalt Refinery, comparing with 689,004 pounds valued at $48,527 in 1968 — a decrease of 50.7 percent in volume and 30 percent in value.

ASBESTOS

The production of asbestos in Ontario increased to 36,068 tons in 1969 from 17,554 tons in 1968 or by 105.5 percent, while the value of the production increased from $2,107,014 in 1968 to $4,375,475 or by 107.7 percent.

The general statistics for asbestos, gypsum, nepheline syenite, peat moss, salt and talc and quartz are combined here, in order to protect the individual company's confidential data. These industries in 1969 paid $7,271,196 to 1,047 employees.

CANADIAN JOHNS-MANVILLE COMPANY LIMITED (Matheson)

Canadian Johns-Manville Company Limited is a subsidiary of Johns-Manville Corporation of New York. The officers of the company were: A. G. Sinclair, president; J. Kaczkowski, secretary; H. W. Clarkson, treasurer. The head office address is at 565 Lakeshore Road E., Port Credit; the property address is Drawer 610, Matheson.

The property comprising 50 claims is located in Garrison and Rand townships, District of Cochrane. It is approximately 25 miles east of Matheson and about two miles north of Highway 101.

Mining operations progressed from 1 January to 31 December 1969.

The vertical three-compartment No. 1 shaft located in claim 54626 has a depth of 314 feet with the 632 level established at a depth of 294 feet below the collar. Some 5,505 feet of drifting and 3,296 feet of crosscutting was completed. Total development footage to 31 December 1969 comprised 6,895 feet of drifts and 3,296 feet of crosscuts. Some 29 diamond-drillholes, totalling 18,251 feet were completed from surface. The asbestos ore obtained was graded, stock piled separately in surface dumps, with samples bagged and shipped to Asbestos, Quebec for assay and pilot test milling.

Employment and Management

Development work on the property in 1969 was completed by Patrick Harrison and Company Limited who employed an average of 30 men; 12 underground and 18 on surface, under J. MacDonald, superintendent; T. A. Wood-Smith, project engineer was in charge for Canadian Johns-Manville Company Limited.

JOHNS-MANVILLE MINING AND TRADING LIMITED
(Reeves Mine)

Canadian Johns-Manville Company Limited was incorporated in December 1918. In July 1966 Johns-Manville Mining and Trading Limited was incorporated as a wholly owned subsidiary of Canadian Johns-Manville Company Limited to take over operating control of the Reeves mine. The company officers were: C. B. Burnett, president; H. M. Ball, secretary, and J. M. Shackelford, treasurer. The head office is at 22 East 40th Street, New York, N.Y. 10016, U.S.A., the mine address is P.O. Box 2003, Timmins.

The property comprises 37 claims in Reeves township, District of Sudbury and is located southwest of Timmins. Mining in the open pit and milling progressed from 2 January to 31 December 1969. The vertical three compartment No. 1 shaft, some 277 feet in depth used for ore testing purposes, has been backfilled.

Some 1,604,926 tons of waste rock was removed from the orebody in 1969. Total stripping operations to 31 December 1969 consisted of the removal of 377,717 tons of overburden and 6,729,066 tons of waste rock.

Construction in 1969 comprised the commencement of a mill extension 48 x 24 feet, steel frame, asbestos cement lining.

Added equipment included one front end loader model 980, 5 cu. yds.; one fork lift truck, 3,000 lbs. capacity and an open rotor model K 75.

Total ore hauled from the open pit was 1,355,049 tons; the mill treated a total of 1,317,575 tons, averaging 4,130 tons daily. The total ore removed from the open pit to 31 December was 2,048,099 tons.

Employment and Management

The average number of employees was 168: 128 on surface and 40 in the open pit. R. W. Winson was mine manager.

HEDMAN MINES LIMITED

Hedman Mines Limited was incorporated in August 1956 with an authorized capitalization of 3,000,000 shares of $1 par value; all shares have been issued. The directors and officers were: J. J. Mangan, president and managing director; J. C. Lavigne, vice-president and director; H. K. Passmore, secretary-treasurer and director; S. S. Goodwin, L. F. Johnson, F. H. Main and G. W. Wunder, directors. The head office address is Box 590, Timmins. The mine address is P.O. Box 650, Matheson.

The property comprises 29 claims about 1,164 acres, located in Warden and Munro townships, District of Cochrane, about 25 miles northeast of Matheson. The open pit is located near the centre of the Warden township property; the pilot plant on the railway siding at Matheson operated from 1 January to 22 January 1969 being destroyed by fire. The new crushing and processing plant operated from 1 February to 31 December 1969. The plant, located one half mile south of Matheson is in Bowman township and is presently operating on a two shift basis milling about 100 tons daily.

Added equipment in 1969 consisted of an ore tripper, a set of truck weigh scales, and a 30 in. fiberizer classifier.

A total of 9,286 tons of ore was removed and milled during the period of operation.

Employment and Management

The average number of employees was 25; 5 in the open pit and 20 on surface; E. W. Gagan was consulting engineer in charge of operations.

BARITE

EXTENDER MINERALS OF CANADA LIMITED

Extender Minerals of Canada Limited was incorporated in December 1966, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 200,005 shares have been issued. It is a subsidiary of L. V. Lomas Limited, a chemical company located in Rexdale. The directors and officers of Extender Minerals were: R. A. Hill, president and director; L. V. Lomas, secretary-treasurer and director; A. J. Cavan, Howard Garfield and R. W. Gardner, directors. The head office is at 6365 Northwest Drive, Malton; the mine address is Matachewan.

The property comprises four claims in Yarrow township, Matachewan area, District of Timiskaming. It is located on the west shore of Mistinikon Lake and is known as the Yarrow Barite Mine.

Operations progressed from 1 May to 31 October 1969.

Exploration and development work consisted of some surface trenching and sampling on the open pit barite showing.

New construction consisted of a detonator storage building.

Progress at the new milling plant site, located about five miles west of Swastika, consisted of land clearing, contour surveys, and construction of an access road. Some 200 tons of barite ore was mined and stock piled.

Employment and Management

R. A. Hill, president and director was in charge and two men were employed during the period of operations.

CALCITE

CONONACO MINES LIMITED

Cononaco Mines Limited was incorporated in 1965 with an authorized capitalization of 200,000 shares of $1 par value; all shares have been issued. The officers of the company were: R. E. Manley, president; F. N. Davis, vice-president; W. C. Fannin, treasurer; Dorothy A. Manley, secretary. The head office and mine address is Box 20, R.R. No. 1, Parry Sound.

The company own or have optioned a number of properties in the Parry Sound area. A processing plant was constructed at Waubamik station, west of Highway No. 124, between Parry Sound and Sundridge. The calcite deposit bisects the highway north of McKellar, on lot 32, concession B, Hagerman township, District of Parry Sound.

During 1969 many test runs were made from bulk samples taken from various locations along the calcite deposit. Changes and additions to milling equipment to achieve a product of high purity essential to industrial requirements, chiefly in the pharmaceutical, paint, and rug manufacturing industries, were made. The integration of a large pebble mill in the mill circuit, to achieve a more consistent fine product was in progress at year end.

Employment and Management

The average number of employees was 6; E. M. Searle was manager.

GYPSUM

The production of gypsum in Ontario increased to 622,058 tons in 1969 from 570,715 tons in 1968, or by 9 percent. In the same period, the production value of gypsum increased to $1,597,938 from $1,461,189 or by 9.3 percent.

The general statistics for the industry are included in the section on ASBESTOS.

CANADIAN GYPSUM COMPANY LIMITED

Canadian Gypsum Company Limited was incorporated in September 1907 with an authorized capitalization of 3,000 shares of $100 par value, of which 2,710 shares have been issued. The directors and officers were: G. A. Long, president and director, H. F. Kent and P. B. Mather, vice-presidents and directors; D. C. McConkey, secretary-treasurer and director; B. Matthews, R. M. Thomson, E. W. Duffy, G. C. Gray and William James, directors. The head office is at 790 Bay Street, Toronto 2. The mine address is Hagersville.

The company operates a gypsum mine and plant in lots 14 and 15, concession IV, Oneida township, County of Haldimand. The company own or hold the mining rights on approximately 4,673 acres in Oneida and Tuscarora townships.

The mine is operated through the three-compartment, No. 1 vertical shaft, 102 feet deep in lot 15. There is a vertical two-compartment ventilation and escapement shaft, 90 feet deep, known as No. 2 in lot 15. In 1959, No. 3 vertical two-compartment, ventilation and escapement shaft was completed at a depth of 86 feet below the collar in lot 14, all shafts in concession IV, Oneida township. The room-and-pillar method of mining is used.

The mine and mill operated from 2 January to 31 December, 1969.

The tonnage of gypsum mined during 1969 was slightly greater than in 1968. The demand for plaster and wallboard and other building products was sustained.

The initial phase to complete mechanization of the room-and-pillar mining method in the four foot thick bed of gypsum was achieved during the year. Increased productivity was accomplished with three electric, four-wheel-drive, auger drill-mobiles, five 250 volt dc. shuttle cars, three electrically powered loaders, a rotary percussive electrically powered roof bolter and other associated equipment which was integrated with the existing ore transfer facilities. Added equipment in 1969 included two mine tractors, gas, model 80.

A total of 363,165 tons or ore was hoisted, and milled; the mill averaged 1,456 tons daily.

Employment and Management

The average number of employees, excluding the mill was 76; 65 underground and 11 on surface. R. C. Nelson was works manager.

DOMTAR CONSTRUCTION MATERIALS LIMITED (Gypsum Division)

Gypsum, Lime and Alabastine Canada Limited was incorporated in July 1927. The company became a wholly owned subsidiary of Dominion Tar and Chemical Company Limited in February 1959 and in March 1961 the name was changed to Domtar Construction Materials Limited, (Gypsum Division). The company officers were: J. Cochran, president; S. A. Kerr, secretary; F. H. Dickinson, treasurer; T. Oosterhoff, general manager. The head office address is P.O. Box 6138, Montreal 101, Quebec, the mine address is Caledonia.

The company has two gypsum properties and a mill in Seneca township, County of Haldimand. The old mine, in lot 10, range 1 west, has been abandoned. Operations at the new mine in lot 8, range 2 west, continued from 2 January to 31 December 1969. The room-and-pillar method of mining is used, which consists of rooms or pockets, leads, and crosscuts, all approximately 21 feet in width by 8.5 feet in height. A ton of gypsum ore in place is equivalent to about 13.7 cubic feet; each foot of advance produces an average 13.3 tons of gypsum. The total advance in 1969 was 15,214 feet, approximately 10.3 acres were mined out.

The tonnage of gypsum mined during 1969 to meet the demands of the board and plaster divisions of the company and the cement industry exceeded that of the previous year.

The underground crushing and conveying system was relocated closer to the new mining panel in order to reduce the ore handling distances. A central control electrical blasting system from power lines superseded the firing using blasting machines. The room-and-pillar mining method and ore disposal system will be slightly revised to permit additional mechanization in line with projected tonnage schedules.

Added equipment in 1969 included an electric belt driven, tube axial fan, a submersible sump pump 115v60 cycle and a vertical sump pump 550v, 210 U. S. gpm.

During the year a total of 253,132 tons of ore was hoisted; 216,463 tons were milled at an average of 787 tons daily.

Employment and Management

The average number of employees, excluding the mill, was 22; 19 underground and 3 on surface. C. L. Dryden was plant manager; J. H. Bennie was mine superintendent.

NATURAL GAS AND PETROLEUM

Production of natural gas decreased to 11,237,888 thousand cubic feet in 1969 from 11,974,385 thousand cubic feet in 1968, or by 6.1 percent. At the same time, the value of production decreased to $4,275,152 from $4,598,927 or by 7 percent.

Production of crude petroleum increased one percent from 1,150,779 barrels in 1968 to 1,161,889 barrels in 1969; the value of production, however, decreased to $3,117,031 in 1969 from $3,166,826 in 1968, or by 1.6 percent.

Full details on these industries are given in the 1969 annual report of the Department of Energy and Resources Management.

NEPHELINE SYENITE

In 1969, the production of this commodity increased to 500,571 tons from 426,595 tons in 1968 or by 17.3 percent. Moreover, the value of this production increased to $5,935,239 from $4,738,008 or by 25.3 percent.

The general statistics for the industry are included in the section on ASBESTOS.

INDUSMIN LIMITED
(Nepheline Syenite Division)

American Nepheline Limited was incorporated in January 1945; in 1961 the name was changed to Industrial Minerals of Canada Limited; in 1962 to Indusmin Limited; in

July 1965, Indusmin Limited and Canadian Silica Corporation Limited were amalgamated under the name of Industrial Minerals of Canada Limited; in 1968 it became the Nepheline Syenite Division of Indusmin Limited. It is a subsidiary of Falconbridge Nickel Mines Limited. The authorized capitalization was increased to 2,000,000 shares of no par value, of which 1,167,901 shares have been issued. The directors and officers were: J. J. Mather, president and managing director; J. R. Archibald, F. D. Hart, E. L. Healy, J. T. McWhirter, G. T. N. Woodrooffe and P. L. Dessaulles, directors; D. D. Anderson, secretary. The head office is at 7 King Street East, Toronto 1, the mine address is Nephton.

The property consisting of approximately 2,466 acres, is located in concession IX, Methuen township, County of Peterborough, about 35 miles northeast of Peterborough.

Operations continued throughout 1969 in the open pit on the Cabin Ridge section of the property. Some 23 diamond-drillholes, totalling 5,852 feet were completed from surface.

New construction in 1969 comprised a mill addition, 34 X 18 feet, a conveyor gallery 7 X 7.5 X 105 feet and a conveyor transfer discharge enclosure 15 X 13 feet, all steel frame with asbestos siding.

Added equipment included a 2½ yd. shovel and a portable compressor 600 c.f.m.

A total of 387,779 tons of ore was hauled; 364,286 were crushed and milled at a daily average of 1,060 tons per working day.

Employment and Management

The average number of employees was 103: 83 in the plant and 20 in the pit. D. C. McDonald was general manager; D. C. Cook was resident manager.

INTERNATIONAL MINERALS AND CHEMICAL CORPORATION (CANADA) LIMITED

Canadian Flint and Spar Company Limited was incorporated in March 1930. In December 1955, the name was changed to International Minerals and Chemical Corporation (Canada) Limited. The company is wholly owned by International Minerals and Chemical Corporation, Old Orchard Road, Stokie, Illinois, U.S.A. The company officers were: N. C. White, president and director; J. R. Taylor, secretary; J. T. Gibson, treasurer. The head office is at 4 King Street West, Toronto 1. The mine address is Box 309, Havelock.

The company owns about 450 acres, in Methuen township, County of Peterborough. The quarry and plant are located at the east end of Blue Mountain, some 25 miles north of Havelock. The Blue Mountain nepheline syenite deposit is some five miles long with an average height of about 350 feet above the surrounding country; the width varies from about one quarter of a mile at the narrow portion to one mile at the widest part. The ore reserves and the quarry type of mining used do not present too many problems; however, selective mining and mixing of the ores to meet customer specifications is required.

The rock is quarried, crushed and ground to a granular sand size, about 30 mesh; at this size minor iron minerals are removed by magnetic separation. Some of the material is then ground further to produce various grades of powder from 200 mesh to micron size. The material is used mainly in the glass industry, in ceramics and as a filler in paints, rubber and plastics. Some 14 diamond-drillholes, totalling 2,572 feet were completed in 1969 from surface.

Additional grinding, screening, magnetic separation and dust collection equipment was installed to further increase production, and included the following:

4 belt conveyors
2 magnetic separators 30 in.
2 screens, 10 x 4 ft. Tyler
3 bucket elevators
1 filter dust collector, 10,720 cfm.
2 storage bins, 7 x 15 ft.
1 storage, 400 ton capacity.

Mining and milling continued throughout 1969. The mill treated 260,513 tons averaging 811 tons daily compared to 224,000 tons in 1968.

Employment and Management

The average number of employees was 59; 44 in the plant, and 15 in the pit. L. F. McDonnell was area manager.

PEAT MOSS

The production of peat moss in Ontario increased to 22,786 tons in 1969 from 17,881 tons in 1968, or by 27.4 percent. However, the value of this production increased only by 0.7 percent from $483,626 in 1968 to $487,087 in 1969. The general statistics for the industry are included in the section on ASBESTOS.

QUARTZ

The production of quartz and quartzite in 1969 decreased to 865,385 tons from 1,205,799 tons in 1968 or by 28.2 percent. At the same time the value of production decreased to $429,163 from $573,430 or by 25.2 percent.

In 1969, the major portion of recorded quantity was extracted from the quarries in the Sudbury area.

INDUSMIN LIMITED
(Ontario Silica Division, Killarney Quarry)

The directors and officers, incorporation date, and company changes are given in the NEPHELINE SYENITE section of this report. The head office address is 7 King Street East, Toronto 210; the quarry address is Killarney and the address of the Ontario Silica Division is Midland.

The property, formerly operated by Union Carbide Canada Limited, comprises 54 claims and 657 acres, including Badgeley Island.

The quarry operated from 22 April to 20 December. Some four diamond-drillholes totalling 307 feet were drilled from surface. The primary and secondary crusher buildings were moved from the Killarney quarry to Badgeley Island and two reclaim tunnels each 450 feet long were constructed.

During the period of operation 78,000 tons of quartzite fines were reclaimed and shipped.

Added equipment at Badgeley Island included two radial stackers each 190 feet long, 150 t.p.h.; two reclaim conveyors, 48 ins. each 2,500 t.p.h. and two ship loader conveyors 48 ins. 180 feet long, 2,500 t.p.h.

Silica is used in the production of glass, abrasives, fibre glass, concrete block, cement products, silicon carbide, silicon metal, and for other miscellaneous purposes.

In 1970, Indusmin Limited, already producing silica in Quebec and nepheline syenite in Ontario, will be opening Ontario's first large, high-purity silica deposit. The Ontario Silica Division will operate at two locations: the first being the open pit mining, crushing, washing and sizing operation at Badgeley Island near Killarney; the second a processing plant at Midland, Ontario.

Construction at both sites started in the spring of 1969 and total costs are estimated at $6,000,000.

The Badgeley Island operation will have an initial capacity of approximately 3,000 tons per day of washed lump and fine material. The lump will be shipped by lake freighters directly to the ferrosilicon and silicon metal markets, while the fines will be shipped to Midland for further processing.

The Midland operation will consist of drying, crushing and rod milling to produce glass sand. The fines portion will be further ground in pebble and ball mills for silica flour. Elaborate precautions, amounting to approximately 10 percent of the project cost, have been taken to maintain good dust control and working environment.

Employment and Management

The average number of employees was 18. A. R. Watt was resident manager of the Ontario Silica Division and JoHo Zuefle was Superintendent at the Killarney quarry which includes Badgeley Island.

THE INTERNATIONAL NICKEL COMPANY OF CANADA LIMITED (Lawson Quarry)

The company details are given under the International Nickel Company of Canada Limited in the NICKEL-COPPER section of this report.

The quarry is operated to supply quartzite rock used as a flux in Sudbury smelting operations. The quarry address is Willisville.

Operations continued throughout the year, except for 128 days lost time due to strike action, 10 July to 14 November inclusive.

Some 94 churn-drillholes, totaling 5,667 feet were drilled for quartzite production in 1969.

A total of 238,779 tons of quartzite was mined and delivered to the rockhouse, 236,609 net tons were shipped at a daily average of 1,425 tons during the period of operation.

Employment and Management

The average number of employees was 16: W. G. Tilston was superintendent.

PENAGE QUARTZ LIMITED

Penage Quartz Limited was incorporated in December 1965 with an authorized capitalization of 3,500 preferred shares of $10 par value and 5,000 common shares of no par value, of which 100 common shares have been issued. The directors and officers were: Carmen Fielding Sr., president; Carmen Fielding Jr., and Douglas Fielding, directors. The head office address is Sudbury, c/o Carmen Construction Company Limited.

The quartz deposit is located on the shores of Lake Panache some 15 miles southwest of Sudbury accessible from Highway 549. The quartz is transported across the lake by scow where it is loaded on trucks for delivery.

In 1969 approximately 100 tons of quartz granules were removed from the open pit mine and shipped.

Employment and Management

The operation employed an average of two fulltime employees with extra help as required under the direction of Carmen Fielding Sr.

SALT

The production of salt in Ontario decreased 9.3 percent from 4,143,759 tons in 1968 to 3,760,042 tons in 1969; the value of production decreased 11.6 percent from $21,605,938 in 1968 to $19,104,176 in 1969.

Brining operations continued at Allied Chemicals Canada Limited (Amherstburg Plant) in Essex County; Canadian Brine Limited and Canadian Salt Co. Ltd. in the Windsor-Amherstburg area; Dow Chemical of Canada Ltd., in Lambton county and by Domtar Chemicals Limited (Sifto Salt Division) in the Goderich area in Huron County.

The general statistics for the industry are included in the section on ASBESTOS.

THE CANADIAN ROCK SALT COMPANY LIMITED

The Canadian Rock Salt Company Limited was incorporated in September 1952, with an authorized capitalization of 50,000 shares of no par value, which was later increased to 4,500,000 shares of no par value, of which 2,250,000 shares have been issued. The directors and officers were: Daniel Peterkin, Jr., chairman of the board and director; W. D. Mahaffy, president and director; H. A. Clarke, vice-president, secretary-treasurer and director. The head office is at The Canada Cement Building, Montreal, P.Q. The Ojibway mine address is Windsor 10.

The company's property is in concession I, Sandwich West township, County of Essex, on the shore of the Detroit River between Windsor and Amherstburg.

Mining and milling operations continued from 2 January to 31 December 1969, except for lost time due to strike action from 31 March to 8 September.

SHAFTS, CANADIAN ROCK SALT MINE

	Inclination	Number of Compartments	Total Depth
			feet
No. 1 shaft	Vertical	4	1,082
No. 2 shaft	Vertical	3	1,025

Production and shipments were adversely affected in 1969 due to a strike lasting about five months. An increased demand in both the export and domestic markets were experienced after the resumption of operations in September.

A new larger ore wagon was added to the underground fleet of mining equipment in line with the phasing out of older and smaller haulage units. The mining pattern of room-and-pillar layout with faces to a height of 20 feet and a recovery factor of 56

percent remains in effect. Rooms are 50 feet wide, and crosscuts 40 feet in width to accommodate the larger face units.

Development work 1969 on the 975-foot level consisted of 600 feet of drifting, 4,370 feet of crosscutting and 11,050 feet of rooms. Total development footage to 31 December 1969 was as follows: 63,608 feet of drifts; 77,014 feet of crosscuts; 155,824 feet of rooms.

A total of 1,075,740 tons of salt was hoisted and milled as compared to 1,821,924 tons in 1968. The mill treated a daily average of 6,874 tons during the period of operation.

Employment and Management

The average number of employees was 123: 62 underground and 61 on surface. W. M. Rice was mine manager.

DOMTAR CHEMICALS LIMITED
(Sifto Salt Division, Goderich Mine)

Astrea Company Limited was incorporated in March 1956, under Dominion charter. In December 1956, the name was changed to Dominion Rock Salt Company Limited, in July 1959 to Sifto Rock Salt Limited, in 1960 to Sifto Salt (1960) Limited, and in 1962 to Domtar Chemicals Limited, Sifto Salt Division, Goderich mine. The company is a wholly owned subsidiary of Domtar Limited. The head office is at 2240 Sun Life Building, Montreal, P.Q. The mine address is Box 96, Goderich.

Mining and milling operations continued from 1 January to 30 December 1969.

SHAFTS, SIFTO SALT DIVISION, GODERICH MINE

	Inclination	Number of Compartments	Total Depth
			feet
No. 1 shaft	Vertical	3	1,867.5
No. 2 shaft	Vertical	—	1,835

Production and shipments in 1969 were at an all time high to meet the demand in both the export and domestic markets. A new circular storage building was completed which holds 15,000 tons of rock salt and adds to the surface storage facilities in order to meet the increasing demand for rock salt by water movement in vessels of greater capacities.

The mining pattern of room-and-pillar layout with faces to a height of about 45 feet continues. The rooms and truckways are about 45 feet wide, resulting in an overall recovery factor of about 40 percent. Approximately 30 feet of salt is left in the roof.

A start was made on a general expansion program which is scheduled to be spread over several years. This includes speeding up the production hoist during 1970 from 350 to 500 tons per hour. The plant, the underground mining equipment and the work force, will be integrated to meet the proposed expansion of 2,000 tons per day. Added equipment included a caterpillar truck, 35 ton, 400 hp; a giraffe with 18 hp boom engine and 80 hp. tramming engine, a tractor with 50 hp. engine and a personnel carrier with 50 hp. engine.

Development footage in 1969 on the main level at 1,760 feet consisted of 14,435 feet of drifts. Total development footage to 31 December 1969 consisted of 87,990

lineal feet of drifts, and does not include 220 feet of drifting and 108 feet of raising driven for mine ventilation.

A total of 1,692,000 tons of salt was hoisted; 2,018,000 tons were milled at an approximate average of 5,000 tons daily.

Employment and Management

The average number of employees was 183; 123 underground and 60 on surface. W. G. Muir was mine manager.

SULPHUR

The production of Ontario's sulphur and sulphuric acid decreased 18.2 percent from 309,353 tons in 1968 to 253,091 tons in 1969. At the same time the value of production decreased 27.4 percent from $4,676,198 to $3,393,087. Although some elemental sulphur in Ontario is recovered from the refining of nickel sulphides, about 99 percent of sulphur production is represented by the sulphur content of liquid sulphur dioxide and sulphuric acid, manufactured from smelter gases in the Sudbury area and in the Port Maitland area, from the roasting of zinc concentrates received from the mines in the Manitouwadge and Porcupine areas.

CANADIAN INDUSTRIES LIMITED
(Industrial Chemicals Division)

The Sudbury area plants of this Company lie adjacent to the Copper Cliff Reduction works and Iron Ore Recovery plants of the International Nickel Company of Canada Limited. Sulphur dioxide gas is utilized to manufacture liquid sulphur dioxide and sulphuric acid.

Flash furnace gas from Copper Cliff Smelter is treated to produce liquid sulphur dioxide at the rate of about 270 tons per day. The old No. 1 sulphuric acid plant in this area has been phased out but the drying facility, for pre-treatment of sulphur dioxide gas, is still being used. Sulphuric acid of 99 percent is the drying agent used to reduce the moisture content of the gas with the resulting commercial grade of 93 percent sulphuric acid sent to market.

C.I.L. has three sulphuric acid plants located alongside the iron ore recovery plant using roaster gas as the raw material for acid production. The No 4 acid plant came into production in April 1967 and is the largest metallurgical sulphuric acid plant in the free world. The total acid production at this site exceeds 2,000 tons per day. The product is shipped by tank truck to the uranium mines and by tank car to Southern Ontario, Quebec and to the U.S.A.

The sulphuric acid and sulphur dioxide plants were inoperative during the strike at INCO from 10 July to 18 November 1969.

Production

	1969 Tons	1968 Tons
Sulphuric acid	513,499	641,133
Sulphur dioxide (liquid)	55,596	83,948

Employment and Management

The average number of employees was 121; E. R. J. Cook was works manager.

TALC

The production of talc in Ontario increased from 20,254 tons in 1968 to 20,269 tons in 1969 — less than one percent. However, the value of production increased by 5.5 percent from $298,991 to $315,347.

The general statistics for the industry are given in the section on ASBESTOS.

CANADA TALC INDUSTRIES LIMITED

Canada Talc Industries Limited was incorporated in July 1951, with an authorized capitalization of 3,000,000 shares of no par value, of which 1,536,841 shares have been issued. The officers were: A. D. Dickson, president; C. H. Windeler, secretary-treasurer. The head office and mine office is at P.O. Box 250, Madoc.

The company's property consisting of three lots in Huntingdon, two in Elzevir and one in Madoc townships, County of Hastings, and includes the former Conley and Henderson mines located in the Madoc area.

Operations continued from 2 January to 31 December 1969. Mining is through No. 3 shaft of the Conley mine, and No. 4 shaft of the Henderson mine.

SHAFTS, CANADA TALC MINE

Shaft	Inclination	Number of Compartments	Collar Depth	Vertical Depth Below Surface
			feet	feet
Conley Mine (lot 15, concession XIV, Huntingdon twp.)				
No. 1	Vertical	2 (inactive)	Surface	431
7th level winze	Vertical	2 (inactive)	420	451
No. 2 (escape)	Vertical	1 (inactive)	Surface	185
No. 3	Vertical	3	Surface	611
Henderson Mine; lot 14, concession XIV, Huntingdon twp.				
No. 4	Vertical	2	Surface	456

Development work in 1969 consisted of 274 feet of drifting, 118 feet of crosscutting, and 192 feet of raising all on the third level of the Conley mine. Total development footage to 31 December 1969 was as follows: 17,119 feet of drifts; 6,820 feet of crosscuts; 4,506 feet of raises.

Added equipment in 1969 comprised three 200 KVA transformers and a bulk loading system of 10 t.p.h. in the mill building.

The company is the sole producer of talc in Ontario. The total tonnage handled averaged about 125 tons per day, which was a slight increase over 1967. Seven different grades of talc are produced from very finely ground to nearly 100 percent minus 325 mesh, along with a small quantity of white marble chips. There is also a high grade mine run crude talc shipped to South Plainfield, New Jersey, U.S.A., where it is beneficiated and processed for the pharmaceutical industry. The company's high grade white finished product is used as a filler in the paint industry. The lower, off white, grade talc is used as a filler in crop dusting insecticides, filler for glue, in the carpet industry, and also for white lines on sports fields.

A total of 21,205 tons of ore was hoisted and 15,625 tons was milled, at an average of 75 tons daily.

Employment and Management

The average number of employees was 32: 16 underground and 16 on surface. R. M. Kirkwood was manager.

STRUCTURAL MATERIALS

CEMENT

The production of cement in Ontario increased by 8,848 tons from 3,103,849 tons in 1968 to 3,112,697 tons in 1969. However, the value of cement production increased by $2,966,139 or by 5.5 percent from $53,683,873 to $56,650,012.

In 1969, the cement industry paid $1,818,811 to 223 salaried employees, $6,430,392 to 828 wage earners.

The following companies were engaged in the production of cement in 1969:

Canada Cement Co. Ltd., Belleville Plant, Belleville; Woodstock Plant, Woodstock.
Lake Ontario Cement, Picton.
St. Lawrence Cement Co. Ltd., Clarkson.
St. Mary's Cement Co. Ltd., St. Mary's and Bowmanville.

CLAY PRODUCTS

The value of clay products manufactured in Ontario increased 3.4 percent from $30,629,362 in 1968 to $31,672,797 in 1969.

The clay products manufacturing industry in 1969 paid $2,594,179 to 323 salaried employees and $9,641,551 to 1,620 wage earners.

LIME

In 1969, the total production of lime increased 11.4 percent to 1,129,274 tons or to 61.1 percent of the Canadian total output in that year from 1,013,712 tons in 1968. In the same time the value of lime increased to $12,433,063 from $11,771,960 or only by 5.6 percent.

Production of quicklime increased 12.8 percent from 889,860 tons valued $9,455,-458 in 1968 to 1,014,795 tons valued $10,045,795 in 1969.

Production of hydrated lime increased 0.6 percent from 113,852 tons valued $2,316,502 in 1968 to 114,479 tons valued $2,387,820 in 1969.

There were 6 operators with 8 plants, and a total of 51 kilns of which 46 were operated in 1969.

In 1969, the industry paid $2,267,868 in wages and salaries to 352 employees.

The following operators produced lime in Ontario:

Allied Chemical Canada Ltd., Amherstburg;
Bonnechere Lime Limited, Carleton Place;
Canadian Gypsum Co. Ltd., Guelph;
Cyanamid of Canada Ltd., Ingersoll;
Cyanamid of Canada Ltd., Niagara Falls;
Domtar Chemicals Ltd., Lime Division, Beachville;
Domtar Chemicals Ltd., Lime Division, Hespeler;
The Steel Co. of Canada Ltd., Chemicals Lime Works, Ingersoll.

SAND AND GRAVEL

Production of sand and gravel in Ontario decreased 1.7 percent from 84,095,642 tons in 1968 to 82,657,386 tons in 1969. The value of production decreased by 16 percent from $55,094,706 to $46,245,525. There were 211 pit operators and 7 dredge operators active in 1969.

The general statistics compiled from 88 reporting companies indicate that $3,287,853 was paid to 355 salaried employees and $7,471,556 was paid to 1,173 wage earners.

STONE

Production of stone decreased 5.6 percent from 28,636,257 tons in 1968 to 27,034,506 tons in 1969. The value of this production decreased from $37,733,856 in 1968 to $32,293,526 in 1969 or by 14.4 percent.

The stone producers in 1969 paid $1,199,036 to 149 salaried employees and $3,786,523 to 609 wage earners.

The variety of stone produced in the 1965-1969 period is indicated in the following table:

OUTPUT OF STONE 1965-1969

Variety		1965	1966	1967	1968	1969
Limestone	tons	23,241,567	23,813,409	24,088,653	26,538,776	26,202,850
	$	27,227,844	27,685,394	27,218,197	31,408,180	28,638,664
Marble	tons	50,420	38,657	28,373	29,207	9,485
	$	660,641	576,990	509,678	467,503	215,475
Trap & Granite	tons	1,320,619	1,809,034	1,602,402	2,048,327	769,407
	$	3,688,385	4,741,209	4,449,687	5,554,570	2,962,757
Sandstone	tons	46,447	41,743	25,561	19,947	52,764
	$	708,118	598,693	344,893	303,603	476,630
Total	tons	24,659,053	25,702,843	25,744,989	28,636,257	27,034,506
	$	32,284,988	33,602,286	32,522,455	37,733,856	32,293,526

INDEX