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**ONTARIO
DEPARTMENT OF MINES**

HON. ALLAN F. LAWRENCE, *Minister of Mines*

D. P. DOUGLASS, *Deputy Minister*

Annual Report for the Year 1966

**Statistics of the Mineral Industry
and
Mining Operations in Ontario
for 1966**

**By
G. S. Riddell**

Ontario Department of Mines Volume 76

TORONTO
1968

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INTRODUCTORY LETTER

TO THE HONOURABLE ALLAN F. LAWRENCE
Minister of Mines

SIR:

The undersigned has the honour to submit to you the Seventy-sixth Annual Report of the Ontario Department of Mines, consisting of the statistics of the mineral industry and mining operations in the Province of Ontario in 1966.

Respectfully submitted,
D. P. DOUGLASS
Deputy Minister of Mines

DEPARTMENT OF MINES
Toronto, 1968

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**Statistics of the
Mineral Industry and Mining Operations
in Ontario for 1966**

By

G. S. Riddell

P. Eng., Engineer of Mines

Mines Inspection Branch, R. L. Smith, Chief Engineer of Mines

GENERAL SUMMARY

MINERAL PRODUCTION

The total value of mineral production in Ontario decreased 3.54 percent, from \$992,977,611 in 1965 to \$957,857,765 in 1966. The production value of metals decreased 5.64 percent from \$776,220,397 in 1965 to \$732,411,604 in 1966. The decrease is accounted for by major declines in production and value of nickel, platinum metals, gold, uranium, magnesium, and iron ore; there were minor declines in production of cadmium, cobalt, lead, selenium and tellurium. These losses were in part due to decreased production due to strike action at The International Nickel Company of Canada Limited, and at Dominion Magnesium Limited. Major increases in production and value were recorded for copper and zinc; minor increases in bismuth, calcium, silver, and thorium were recorded, and the first production of yttrium was recorded. Increased production from the Kidd Creek mine of Texas Gulf Sulphur added considerably to the copper, zinc, and silver totals.

The total value of the non-metallic and fuel production increased 5.77 percent from \$32,037,840 in 1965 to \$33,884,890 in 1966. Increases were recorded in the production value of arsenic trioxide, gypsum, natural gas, nepheline syenite, petroleum, quartz, sulphur, and talc. The production value of mica was small; no production was recorded in 1965. Decreased production and value was noted in asbestos, peat moss, and salt when compared with 1965.

The total value of structural material production increased 3.70 percent from \$184,719,374 in 1965 to \$191,561,271 in 1966. Major increases in quantity and value were recorded for cement, sand and gravel, and stone; a minor increase was noted for clay products, and a decrease was recorded for lime.

The value of metallic production from the various areas, in percentage of the total value, was as follows: Sudbury 62.39; Thunder Bay 7.82; Porcupine 7.14; Rainy River and Kenora 6.75; Blind River 6.46; Kirkland Lake and Larder Lake 3.62; Algoma 2.60; Eastern Ontario 1.74; and Cobalt 1.48.

The gold, iron, nickel-copper, silver-cobalt, and uranium mines paid out \$146,791,976 in dividends during the year. Twenty-three of the twenty-seven producing mines received assistance in 1966 under the Emergency Gold Mining Assistance Act.

TOTAL MINERAL PRODUCTION VALUE

YEAR	METALLICS	NON-METALLICS	STRUCTURAL MATERIALS	CLAY PRODUCTS	TOTAL
To 31 Dec.					
1961 ¹	\$11,069,020,552	\$753,933,973	\$1,500,830,479	\$399,382,997	\$13,723,168,001
1962 ¹	729,890,328	36,784,690	126,640,754	20,146,786	913,462,558
1963 ¹	683,639,445	36,435,466	132,397,853	21,819,687	874,292,451
1964 ¹	701,643,732	34,247,115 ²	145,339,854	23,723,512	904,954,213
1965 ¹	776,220,397	32,037,840	159,588,665	25,130,709	992,977,611
1966	732,411,604	33,884,890	165,761,604	25,799,667	957,857,765
To 31 Dec.					
1966	\$14,692,826,058	\$927,323,974	\$2,230,559,209	\$516,003,358	\$18,366,712,599

¹Corrected to include thorium production value.

²Revised figure for salt production for 1964.

Annual Report for 1966

COMPARATIVE OUTPUT AND VALUE OF MINERAL PRODUCTION

PRODUCT	1962	1963	1964	1965	1966
METALLICS					
Bismuth	lb.	65	541	3,883	6,312
	\$	146	703	9,600	15,881
Cadmium	lb. ....	.....	187,609	209,724	217,237
	\$ .....	.....	607,853	583,033	560,471
Calcium	lb. 123,511	98,673	138,357	159,434	249,179
	\$ 124,412	117,247	151,694	152,848	245,125
Cobalt	lb. 2,649,193	2,156,732	2,212,016	2,620,810	2,684,235
	\$ 4,765,808	4,409,262	4,259,215	5,511,436	5,464,495
Copper	lb. 377,990,690	357,919,536	395,833,331	432,544,119	405,951,287
	\$ 116,347,723	112,048,454	131,458,795	161,665,138	181,375,552
Gold	oz. 2,421,249	2,338,854	2,155,370	1,946,003	1,660,750
	\$ 90,578,924	88,291,739	81,365,217	73,420,747	62,626,883
Iron ore	Short tons 6,414,936	6,749,617	8,046,769	8,475,218	8,144,289
	\$ 64,479,510	70,033,690	85,613,354	94,209,236	91,700,740
Lead	lb. 2,287,087	3,077,814	4,054,865	3,887,218	3,970,467
	\$ 226,879	338,560	544,974	602,518	593,188
Magnesium	lb. 17,631,310	17,810,348	18,706,020	20,216,369	13,445,701
	\$ 4,821,823	5,357,816	5,587,909	6,067,057	4,175,743
Molybdenum	lb. ....	.....	11,393	.....	.....
	\$ .....	.....	19,026	.....	.....
Nickel	lb. 333,163,344	298,178,570	324,187,190	382,566,712	320,428,750
	\$ 274,219,955	246,252,488	267,764,039	316,332,366	269,461,584
Platinum metals	oz. 470,782	357,649	376,238	463,217	395,952
	\$ 28,848,262	22,585,055	25,404,117	36,109,799	32,363,556
Pyrrhotite	tons .....	.....	.....	.....	.....
	\$
Selenium	lb. 142,915	95,100	104,905	123,175	111,000
	\$ 821,761	461,235	508,789	597,399	538,350
Silver	oz. 9,383,445	9,601,621	9,929,858	10,822,213	10,900,204
	\$ 10,931,713	13,288,643	13,901,801	15,151,098	15,249,385
Tellurium	lb. 7,011	7,705	7,900	9,315	9,000
	\$ 42,066	50,082	51,350	60,548	58,500
Thorium ³	lb. 31,939	77,539	97,892	46,339	87,393
	\$ 120,384	464,154	371,519	188,865	210,528
Uranium oxide (U ₃ O ₈)	lb. 12,805,203	12,770,421	11,805,143	6,825,046	5,875,698
	\$ 118,283,081	102,951,146	63,606,944	47,234,892	42,758,135
Yttrium	lb. ....	.....	.....	.....	20,724
	\$ .....	.....	.....	.....	130,223
Zinc	lb. 126,264,684	132,939,970	144,152,666	121,349,121	164,789,837
	\$ 15,278,027	16,989,728	20,426,433	18,323,817	24,883,265
Total Value ³	729,890,328	683,639,445	701,643,732	776,220,397	732,411,604

COMPARATIVE OUTPUT AND VALUE OF MINERAL PRODUCTION—concluded

PRODUCT		1962	1963	1964	1965	1966
NON-METALLICS						
Arsenic trioxide	lb.	160,750	187,450	323,900	403,011	701,537
	\$	6,832	7,498	16,195	13,150	35,610
Asbestos	tons	35,551	33,715	15,512	1,758	1,696
	\$	5,686,720	5,372,645	2,199,918	69,258	64,519
Fluorspar	tons	.....	.....	.....	.....	.....
	\$
Garnet	tons	.....	.....	.....	.....	.....
	\$
Gypsum	tons	435,140	439,206	517,239	531,918	565,185
	\$	1,007,818	1,225,301	1,376,992	1,444,293	1,581,010
Mica	lb.	501,272	342,185	432,348	.....	200,920
	\$	9,248	5,114	6,417	.....	4,367
Mineral water	gal.	5,200	.....	.....	.....	.....
	\$	2,780	.....	.....	.....	.....
Natural gas	M cu. ft.	15,648,294	15,920,055	13,815,967	12,619,867	15,537,395
	\$	5,802,387	6,049,621	5,759,876	4,856,125	5,940,000
Nepheline syenite	tons	254,418	254,000	290,300	339,982	366,696
	\$	2,605,421	2,699,202	3,097,172	3,415,387	4,109,744
Peat moss	tons	24,801	30,659	27,065	20,115	1,700
	\$	455,826	610,784	573,538	389,615	30,000
Petroleum, crude	bbl.	1,134,534	1,205,376	1,246,682	1,279,321	1,323,781
	\$	3,661,174	3,459,429	4,014,316	4,093,318	4,236,099
Quartz and quartzite	tons	1,352,613	952,166	1,127,425	1,301,615 ⁴	1,161,057
	\$	1,077,784	644,287	836,937	797,351 ⁴	902,089
Silica brick	M	.....	.....	.....	.....	.....
	\$
Salt	tons	3,155,589	3,187,491	3,335,683	3,900,484	3,782,191
	\$	15,387,911	14,793,161	14,552,559 ²	15,499,274	15,243,719
Sulphur ¹	tons	.....	.....	.....	.....	.....
	\$	952,877	1,460,438	1,676,727	1,322,611	1,517,809
Talc and soapstone	tons	8,082	6,903	8,060	8,028	13,509
	\$	127,912	107,986	136,468	137,458	219,924
Total value	\$	36,784,690	36,435,466	34,247,115	32,037,840	33,884,890
STRUCTURAL MATERIALS						
Portland cement	tons	2,510,783	2,552,665	3,043,771	3,145,873	3,242,591
	\$	38,704,090	39,551,719	46,804,126	50,005,554	52,680,630
Lime, hydrated, and quicklime	tons	910,930	952,945	1,049,798	1,132,193	1,078,350
	\$	10,527,910	11,434,223	13,127,550	13,842,169	12,232,867
Sand and gravel	tons	76,600,813	80,259,750	76,917,396	88,564,687	94,123,982
	\$	52,365,204	56,338,204	54,589,444	63,405,954	67,245,821
Stone	tons	18,797,648	20,402,614	23,845,993	24,659,053	25,702,843
	\$	25,043,550	25,073,707	30,818,734	32,284,988	33,602,286
Clay Products	\$	20,146,786	21,819,687	23,723,512	25,130,709	25,799,667
Total value	\$	146,787,540	154,217,540	169,063,366	184,719,374	191,561,271
Grand Total ³	\$	913,462,558	874,292,451	904,954,213	992,977,611	957,857,765

¹Value of elemental sulphur and sulphur content of sulphuric acid produced from smelter gases.²Revised figures.³Thorium values 1962-1965 added to totals.⁴Revised figures.

SUMMARY OF MINERAL STATISTICS, 1966

PRODUCT	QUANTITY	VALUE	WAGE EARNERS ¹	WAGES
METALLICS²				
Gold	oz.	1,660,750	\$ 62,626,883	6,773 \$ 31,097,863
Silver	oz.	10,900,204	15,249,385	472 2,121,679
Bismuth	lb.	6,312	15,881	.....
Copper in matte, metal and concentrates	lb.	405,951,287	181,375,552	.....
Nickel in matte, metal and salts	lb.	320,428,750	269,461,584	20,817 115,465,111
Platinum metals	oz.	395,952	32,363,556	.....
Selenium	lb.	111,000	538,350	.....
Tellurium	lb.	9,000	58,500	.....
Cobalt, metal and salts	lb.	2,684,235	5,464,495	see note 3 see note 3
Iron Ore	short ton	8,144,289	91,700,740	2,825 14,952,974
Calcium	lb.	249,179	245,125	419 1,361,968
Magnesium	lb.	13,445,701	4,175,743	.....
Cadmium	lb.	217,237	560,471	.....
Lead	lb.	3,970,467	593,188	757 4,738,967
Zinc	lb.	164,789,837	24,883,265	.....
Uranium oxide (U ₃ O ₈)	lb.	5,875,698	42,758,135	.....
Thorium	lb.	87,393	210,528	1,171 7,698,431
Yttrium	lb.	20,724	130,223	.....
Total			\$732,411,604	33,234 \$177,436,993
NON-METALLICS AND FUELS⁴				
Arsenic trioxide	lb.	701,537	\$ 35,610	see note 5 see note 5
Mica	lb.	200,920	4,367	.....
Natural gas	M. cu. ft.	15,537,395	5,940,000	not available
Petroleum	bbl.	1,323,781	4,236,099	.....
Sulphur ⁶	ton	161,159	1,517,809	see note 7 see note 7
Asbestos	ton	1,696	64,519	.....
Gypsum	ton	565,185	1,581,010	.....
Nepheline Syenite	ton	366,696	4,109,744	.....
Peat Moss	ton	1,700	30,000	711 3,769,430
Quartz	ton	1,161,057	902,089	.....
Salt	ton	3,782,191	15,243,719	.....
Talc	ton	13,509	219,924	.....
Total			\$ 33,884,890	711 \$ 3,769,430
STRUCTURAL MATERIALS⁸				
Cement	ton	3,242,591	\$ 52,680,630	882 \$ 5,780,676
Lime	ton	1,078,350	12,232,867	276 1,514,622
Sand and gravel	ton	94,123,982	67,245,821	1,210 5,646,439
Stone	ton	25,702,843	33,602,286	818 5,290,150
Clay Products	.....	.....	25,799,667	1,687 7,951,452
Total			\$191,561,271	4,873 \$ 26,183,339
Grand Total, 1966			\$957,857,765	38,818 \$207,389,762
Grand Total, 1965 ⁹			\$992,977,611	39,006 \$200,588,179

¹"Wage Earners" for any mineral industry represents the employees of companies whose chief product is that mineral, or employees of the companies that produce the greater part of the total quantity of that mineral.

²Further information is given in the "Metallics" section.

³Included with Nickel and Copper, and Silver and Cobalt.

⁴Further information is given in the "Non-Metallics and Fuels" section.

⁵Included with Silver and Cobalt.

⁶Value of elemental sulphur, and sulphur content of liquid sulphur dioxide and sulphuric acid produced from smelter gases.

⁷Included with Nickel and Copper.

⁸Further information is given in "Structural Materials" section.

⁹Revised to include Thorium value.

PRODUCTION VALUE AND PERCENTAGE BY AREAS FOR METALLICS IN 1966

	RAINY			THUNDER BAY			KIRKLAND EASTERN			COBALT		
	SUDBURY	BLIND RIVER	RIVER KENORA	PORCUPINE	BAY	LARDER	ONTARIO	ALGOMA	MATACH-EWAN	TOTAL		
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
Bismuth	.....	.....	.....	.....	.....	.....	.....	.....	15,881	15,881
Cadmium	.....	.....	210,474	349,997	.....	.....	.....	.....	.....	560,471
Calcium	.....	.....	.....	.....	.....	.....	245,125	.....	.....	245,125
Cobalt	4,988,414	.....	.....	.....	.....	.....	.....	.....	476,081	5,464,495
Copper	124,249,676	4,132,881	955,419	16,562,517	30,886,844	585,815	.....	1,668,630	2,333,770	181,375,552	
Gold	3,424,973	30,734	15,079,173	28,589,119	2,638,230	12,739,834	.....	14,707	110,113	62,626,883	
Iron ore	23,051,941	.....	29,896,231	.....	.....	13,101,600	8,353,716	17,297,252	.....	91,700,740
Lead	.....	.....	.....	36,538	556,650	.....	.....	.....	.....	593,188
Magnesium	.....	.....	.....	.....	.....	.....	4,175,743	.....	.....	4,175,743
Nickel	265,944,757	.....	3,474,324	.....	.....	.....	.....	.....	42,503	269,461,584
Platinum metals	32,363,556	.....	.....	.....	.....	.....	.....	.....	.....	32,363,556
Selenium	538,350	.....	.....	.....	.....	.....	.....	.....	.....	538,350
Silver	2,313,567	34,383	53,043	846,702	4,054,679	64,442	.....	52,177	7,830,392	15,249,385	
Tellurium	58,500	.....	.....	.....	.....	.....	.....	.....	.....	58,500
Thorium	.....	210,528	.....	.....	.....	.....	.....	.....	.....	210,528
Uranium	.....	42,758,135	.....	.....	.....	.....	.....	.....	.....	42,758,135
Yttrium	.....	130,223	.....	.....	.....	.....	.....	.....	.....	130,223
Zinc	.....	.....	.....	6,058,907	18,824,358	.....	.....	.....	.....	24,883,265
Total	\$456,933,734	\$47,296,884	\$49,458,190	\$52,304,257	\$57,310,758	\$26,491,691	\$12,774,584	\$19,032,766	\$10,808,740	\$732,411,604		
Percentage of Total	62.39	6.46	6.75	7.14	7.82	3.62	1.74	2.60	1.48	100		

Annual Report for 1966

Metal Production

Metallic minerals have accounted for 80.00 percent of the accumulated mineral production value for the recorded history of the mining industry in Ontario.

METAL PRODUCTION TO 31 DECEMBER 1966

METAL OR PRODUCT	TO		TO 31 DECEMBER 1966
	31 DECEMBER 1965	1966	
Barium	\$ 9,266	\$	\$ 9,266
Bismuth	426,515	15,881	442,396
Cadmium	1,190,886	560,471	1,751,357
Calcium	12,083,794	245,125	12,328,919
Cerium	988	.....	988
Chromite	55,090	.....	55,090
Cobalt	117,982,294	5,464,495	123,446,789
Copper	2,310,894,321	181,375,552	2,492,269,873
Gold	3,302,507,355	62,626,883	3,365,134,238
Iron Ore	788,697,089	91,700,740	880,397,829
Lead	9,581,536	593,188	10,174,724
Magnesium	68,433,726	4,175,743	72,609,469
Molybdenum	243,136	.....	243,136
Nickel	4,836,860,703	269,461,584	5,106,322,287
Pig Iron from domestic ore	98,257,508	.....	98,257,508
Platinum metals	584,063,847	32,363,556	616,427,403
Pyrrhotite	3,495,154	.....	3,495,154
Selenium	13,996,778	538,350	14,535,128
Silver	419,490,294	15,249,385	434,739,679
Tellurium	601,980	58,500	660,480
Thorium ¹	2,064,748	210,528	2,275,276
Tungsten	808,338	.....	808,338
Uranium oxide (U ₃ O ₈)	1,266,589,583	42,758,135	1,309,347,718
Yttrium	.....	130,223	130,223
Zinc	122,079,525	24,883,265	146,962,790
Total¹	\$13,960,414,454	\$732,411,604	\$14,692,826,058

¹Thorium: corrected total production value to 31 December 1965.

DIVIDENDS

DIVIDENDS PAID BY METAL MINING COMPANIES TO 31 DECEMBER 1966

INDUSTRY	TO		TO 31 DECEMBER 1966
	31 DECEMBER 1965	1966	
Base Metal	\$1,549,337,642	\$110,281,379	\$1,659,619,021
Gold	828,651,976	22,612,666	851,264,642
Iron ¹	7,656,919	2,419,096	10,076,015
Silver-cobalt	109,002,962	343,251	109,346,213
Uranium	100,377,018	11,135,584	111,512,602
Total	\$2,595,026,517	\$146,791,976	\$2,741,818,493

¹The dividends from one company accumulated from 1962.

METAL PRICES AND EXCHANGE

METAL PRICES AND EXCHANGE, 1965 AND 1966

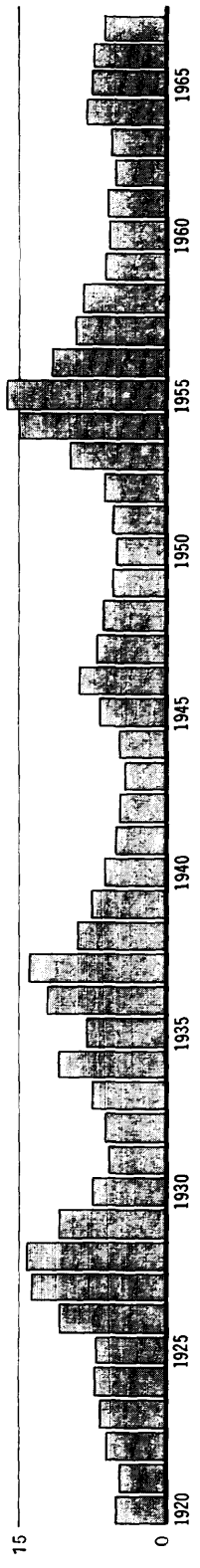
MONTH	AVERAGE EXCHANGE RATE, U.S. DOLLAR IN CANADIAN DOLLARS	POUND STERLING IN CANADIAN DOLLARS	SILVER CENTS PER OUNCE		COPPER	GOLD
			NEW YORK MARKET U.S. FUNDS	MONTREAL CANADIAN FUNDS	CENTS PER POUND NEW YORK EXPORT U.S. FUNDS	IN CANADIAN DOLLARS PER OUNCE
1965						
January	1.0738	2.9977	129.300	139.38	33.376	37.584
February	1.0758	3.0070	129.300	139.60	32.994	37.652
March	1.0811	3.0192	129.300	140.32	33.191	37.840
April	1.0792	3.0177	129.300	140.03	33.223	37.770
May	1.0795	3.0194	129.300	140.12	35.921	37.778
June	1.0823	3.0222	129.300	140.48	36.107	37.878
July	1.0835	3.0241	129.300	140.68	36.052	37.922
August	1.0784	3.0099	129.300	139.96	35.688	37.744
September	1.0764	3.0106	129.300	139.75	35.605	37.675
October	1.0751	3.0136	129.300	139.58	38.083	37.628
November	1.0749	3.0140	129.300	139.50	38.460	37.623
December	1.0758	3.0148	129.300	139.68	38.549	37.653
Average	1.0780 ¹	3.0143 ¹	129.300	139.92	35.604	37.728
1966						
January	1.0746	3.0134	129.300	139.540	41.770	37.613
February	1.0763	3.0166	129.300	139.730	42.845	37.671
March	1.0762	3.0084	129.300	139.700	44.298	37.668
April	1.0770	3.0086	129.300	139.830	43.438	37.693
May	1.0767	3.0067	129.300	139.760	55.433	37.686
June	1.0765	3.0035	129.300	139.730	57.278	37.678
July	1.0748	2.9977	129.300	139.530	57.718	37.621
August	1.0751	2.9985	129.300	139.540	48.797	37.630
September	1.0762	3.0020	129.300	139.680	47.086	37.667
October	1.0793	3.0133	129.300	140.180	52.376	37.777
November	1.0820	3.0201	129.300	140.500	53.342	37.871
December	1.0831	3.0220	129.300	140.600	49.763	37.910
Average	1.0773 ¹	3.0090 ¹	129.300	139.860	49.512	37.707

¹Computed from daily quotations.

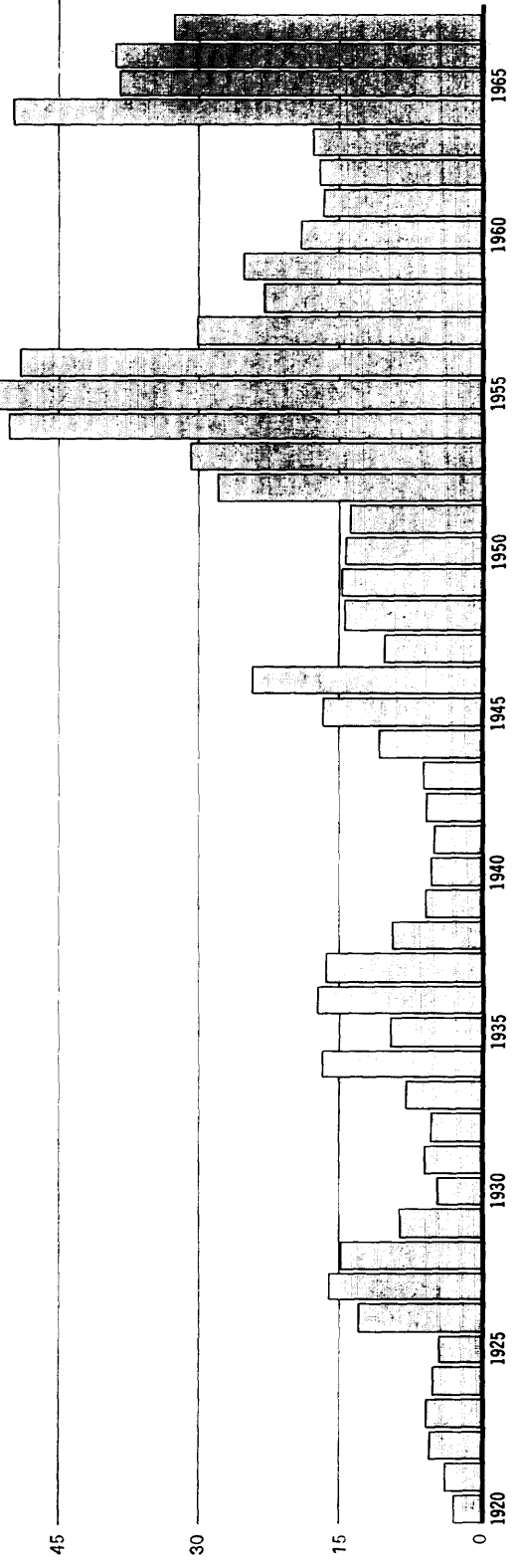
PROSPECTING

There was a slight increase in prospecting activity during 1966; a total of 39,097 claims was recorded as compared with 38,757 in 1965. The Porcupine mining division was the most active, recording 5,724 mining claims, closely followed by Port Arthur with 5,707, Sudbury with 5,610, and Sault Ste. Marie with 5,502. Increases in staking activity were also noted in five other mining divisions. The number of miners' licences issued and renewed during the year totalled 7,628, down from the total of 7,935 for 1965.

THOUSANDS OF LICENSES ISSUED AND RENEWED.



THOUSANDS OF CLAIMS RECORDED.



MINERS' LICENCES AND MINING CLAIMS, 1966

MINING DIVISION	MINERS' LICENCES		MINING CLAIMS	
	ISSUED	RENEWED	RECORDED	CANCELLED
Eastern Ontario	.....	.....	986	977
Fort Frances	55	83	1,186	393
Kenora	100	140	1,856	1,169
Kowkash ¹	.....	.....	516	402
Larder Lake	247	298	3,795	6,520
Montreal River	70	105	2,363	3,177
Parry Sound	.....	.....	391	125
Patricia	105	74	1,608	1,794
Porcupine	309	549	5,724	10,352
Port Arthur	491	650	5,707	5,619
Red Lake	101	130	2,405	1,470
Sault Ste. Marie	275	277	5,502	4,966
Sudbury	365	324	5,610	4,358
Timiskaming	136	205	1,448	1,404
Toronto Office	609	1,930	.....	.....
Total	2,863	4,765	39,097	42,726

¹Handled by the office of the Patricia Mining Division since April 1956.

MINING CLAIMS RECORDED IN THE ONTARIO MINING DIVISIONS

MINING DIVISION	1960	1961	1962	1963	1964	1965	1966
Eastern Ontario	507	806	504	383	461	981	986
Fort Frances	402	199	444	699	261	918	1,186
Kenora	1,162	961	856	347	525	2,019	1,856
Kowkash	774	1,043	1,362	388	466	358	516
Larder Lake	1,430	1,421	1,701	1,505	8,143	6,079	3,795
Montreal River	1,670	1,211	1,705	1,871	3,530	1,762	2,363
Parry Sound	186	136	58	152	142	160	391
Patricia	1,912	1,612	1,272	739	1,184	1,703	1,608
Porcupine	1,321	1,443	1,440	1,971	20,823	4,790	5,724
Port Arthur	3,095	2,064	2,088	3,678	3,993	7,755	5,707
Red Lake	1,227	1,076	1,055	423	1,219	1,214	2,405
Sault Ste. Marie	943	1,436	2,055	2,472	3,270	5,084	5,502
Sudbury	1,921	2,098	1,348	1,445	6,383	4,444	5,610
Timiskaming	1,924	1,117	1,269	1,334	1,167	1,490	1,448
Total	18,474	16,623	17,157	17,407	51,547	38,757	39,097

MINING CLAIMS CANCELLED IN THE ONTARIO MINING DIVISIONS

MINING DIVISION	1960	1961	1962	1963	1964	1965	1966
Eastern Ontario	1,629	728	658	729	441	353	977
Fort Frances	619	356	305	333	612	299	393
Kenora	1,368	1,133	1,195	957	546	395	1,169
Kowkash	1,975	1,412	1,805	1,139	875	273	402
Larder Lake	3,667	1,450	1,452	1,631	967	4,027	6,520
Montreal River	1,986	1,494	999	1,125	1,651	1,899	3,177
Parry Sound	196	281	60	134	162	150	125
Patricia	2,560	3,089	2,043	1,780	1,024	686	1,794
Porcupine	2,296	1,578	1,425	1,326	931	9,922	10,352
Port Arthur	3,833	3,549	2,823	2,382	3,230	2,583	5,619
Red Lake	3,081	1,859	1,342	1,041	667	739	1,470
Sault Ste. Marie	2,004	1,020	1,284	1,789	1,876	2,214	4,966
Sudbury	4,409	2,245	1,949	1,742	1,297	3,980	4,358
Timiskaming	1,094	1,507	1,577	1,139	1,266	980	1,404
Total	30,717	21,701	18,917	17,247	15,545	28,500	42,726

STATISTICS AND MINING OPERATIONS

METALLICS

BISMUTH

The production of bismuth in Ontario in 1966 amounted to 6,312 pounds, valued at \$15,881; it was recovered from the smelting of the silver-cobalt ores, from the Cobalt-Gowganda area.

CADMIUM

The production of cadmium increased 3.58 percent in quantity, from 209,724 pounds in 1965 to 217,237 pounds in 1966; the value decreased 3.87 percent from \$583,033 in 1965 to \$560,471 in 1966.

CALCIUM—see MAGNESIUM AND CALCIUM

COBALT—see NICKEL AND COPPER, and SILVER AND COBALT

COPPER—see NICKEL AND COPPER

GOLD

In 1966 there were 27 gold mines operating in Ontario; four mines ceased operations during the year (McKenzie, Pickle Crow, Porcupine Paymaster and Stairs). Lake Shore continued the milling of tailings and Sapawe recommenced production. The mines reported milling 5,939,243 tons of ore, from which were recovered 1,598,336 ounces of gold and 313,426 ounces of silver for a total value of \$60,711,734. The average recovery-value per ton of ore milled was \$10.22. In the operations of the nickel-copper mines there was a recovery of 51,605 ounces of gold; the base-metal mines recovered a further 10,809 ounces; hence the total production of gold was 1,660,750 ounces valued at \$62,626,883, a decrease of 14.66 percent in quantity and 14.70 percent in value from the 1,946,003 ounces produced in 1965, valued at \$73,420,747.

The gold mines paid \$6,705,441 to 1,027 salaried employees and \$31,097,863 to 6,773 wage-earners; fuel and electricity cost \$3,692,320 and process supplies \$12,719,302.

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GOLD PRODUCTION

AREAS AND MINES	RATED DAILY MILL CAPACITY	DAILY OPERATING AVERAGE	ORE MILLED		GOLD		SILVER		TOTAL VALUE OF BULLION OF BULLION IN CANADIAN DOLLARS
			tons	tons	ounces	value	ounces	value	
			tons	tons	ounces	value	ounces	value	
For 1966									
PORCUPINE									
Aunor	750	697	254,303	78,693	\$ 2,967,513	5,525	\$ 7,729	\$ 2,975,242	
Dome	1,985	1,985	712,500	177,515	6,694,090	40,073	56,062	6,750,152	
Hallnor	400	370	133,774	50,206	1,893,268	2,855	3,994	1,897,262	
Hollinger	3,900	2,840	715,789	191,866	7,235,267	25,217	35,279	7,270,546	
McIntyre	1,500	1,138	406,140	126,125	4,756,174	79,927	111,818	4,867,992	
Pamour	1,700	1,678	612,496	64,527	2,433,313	8,287	11,594	2,444,907	
Porcupine Paymaster	750	304	33,129	14,192	535,180	2,556	3,576	538,756	
Preston	800	425	155,000	29,881	1,126,813	3,939	5,511	1,132,324	
Ross	450	441	150,762	24,380	919,370	39,419	55,147	974,517	
Total	12,235	9,878	3,173,893	757,385	\$28,560,988	207,798	\$290,710	\$28,851,698	
KIRKLAND LAKE									
Lake Shore	2,000	891	123,867	8,341	314,539	1,216	1,701	316,240	
Macassa	500	359	130,909	55,044	2,075,709	9,806	13,719	2,089,428	
Teck-Hughes Div.	650	229	83,545	20,775	783,425	4,023	5,628	789,053	
Upper Beaver	Milled at Upper Canada		60,397	19,187	723,542	6,229	8,714	732,256	
Upper Canada	600	570	147,636	47,606	1,795,223	13,535	18,936	1,814,159	
Total	3,750	2,049	546,354	150,953	\$ 5,692,438	34,809	\$48,698	\$ 5,741,136	
LARDER LAKE									
Kerr-Addison	1,800	1,481	540,536	186,884	7,047,396	11,254	15,744	7,063,140	
SUDBURY									
Renabie	550	445	162,580	39,219	1,478,948	14,163	19,814	1,498,762	
MATACHEWAN									
Stairs	75	34	5,113	2,062	77,758	939	1,314	79,072	
RAINY RIVER									
Sapawe	50	56	14,600	1,587	59,846	563	788	60,634	

PATRICIA PORTION OF KENORA									
Ancco	Milled at Cochenour	42,133	14,771	577,014	751	1,051	558,065		
Campbell	700	257,884	168,132	6,340,258	13,027	18,225	6,358,483		
Cochenour	400	64,613	18,132	683,758	1,173	1,641	685,399		
Dickenson	490	172,526	95,589	3,604,661	7,747	10,838	3,615,499		
Madsen	850	246,505	71,264	2,687,366	11,956	16,726	2,704,092		
McKenzie	300	8,197	4,371	164,830	569	796	165,626		
Pickle	300	60,743	24,889	938,564	2,026	2,834	941,398		
Total	3,040	852,601	397,148	\$14,976,451	37,249	\$ 52,111	\$15,028,562		
THUNDER BAY									
Consolidated Mosher	Milled at M-Cockshutt	535,008	52,217	1,969,103	5,520	7,722	1,976,825		
MacLeod-Cockshutt	1,900	108,558	9,546	359,980	1,012	1,416	361,396		
Total	1,900	643,566	61,763	2,329,083	6,532	9,138	2,338,221		
SUNDRIES	.....	.....	1,335	50,343	119	166	50,509		
TOTAL FOR GOLD MINES	23,400	5,939,243	1,598,336	\$60,273,251	313,426	\$438,483	\$60,711,734		
OTHER									
Nickel-Copper refining			51,605	1,946,025					
Base metal mines			10,809	407,607					
TOTAL GOLD PRODUCTION, 1966			1,660,750	\$62,626,883					
For 1965									
Porcupine	.....	3,775,900	899,530	33,938,367	244,754	342,656	34,281,023		
Kirkland Lake	.....	503,948	187,267	7,065,397	47,965	67,151	7,132,548		
Larder Lake	.....	653,757	222,896	8,409,643	13,764	19,270	8,428,913		
Sudbury	.....	165,018	36,642	1,382,466	12,734	17,827	1,400,293		
Matachewan	.....	10,722	1,511	57,008	728	1,019	58,027		
Rainy River	.....	1,001	289	10,904	58	81	10,985		
Patricia Portion of Kenora	.....	1,013,352	450,988	17,015,327	41,427	57,998	17,073,325		
Thunder Bay	.....	671,052	80,912	3,052,729	8,153	11,414	3,064,143		
Sundries	.....	.....	580	21,882	570	798	22,680		
TOTAL FOR GOLD MINES, 1965		6,794,750	1,880,615	\$70,953,723	370,153	\$518,214	\$71,471,937		
Nickel-Copper refining			54,271	2,047,591					
Base metal mines			11,117	419,433					
TOTAL GOLD PRODUCTION, 1965			1,946,003	\$73,420,747					

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DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES, BY AREAS

YEAR	PORCUPINE	KIRKLAND LAKE LARDER LAKE AND SUDBURY	NORTHWESTERN ONTARIO	TOTAL
1912—1961	\$366,368,044	\$304,745,297	\$ 70,358,536	\$741,471,877
1962	8,192,173	5,451,358	3,586,588	17,230,119
1963	16,354,446	3,543,946	3,947,095	23,845,487
1964	15,055,602	3,836,730	4,098,690	22,991,022
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
	<hr/>	<hr/>	<hr/>	<hr/>
Total	\$437,841,998	\$325,274,078	\$ 88,148,566	\$851,264,642

Ancco Mines Limited

Ancco Mines Limited was incorporated in July 1963 with an authorized capitalization of 3,000,000 shares of \$1 par value, of which 2,425,488 shares have been issued. The directors and officers were: E. C. Cochenour, president and director; J. R. Mooney, vice-president and director; J. E. J. Fahlgren, general manager and director; J. B. McLellan, G. C. McCartney, and C. E. Mooney, directors; C. V. Maltby, secretary-treasurer. The head office is at Suite 1203, 2200 Yonge Street, Toronto 12; the mine address is Cochenour.

The property comprises 184 acres lying south of 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 1966.

Development work was carried out from the 15th, 16th, 18th, 19th, 20th, and 22nd levels of Cochenour as follows: 332 feet of drifting, 419 feet of cross-cutting, and 935 feet of raising. Total development footage to 31 December 1966 was as follows: 4,555 feet of drifts; 2,062 feet of crosscuts; 4,271 feet of raises. Some 104 diamond-drillholes totalling 11,546 feet, were completed from underground.

A total of 42,133 tons of ore was hoisted and milled at an average of 115 tons per working day in the Cochenour mill.

See page 22 of this volume under Cochenour Willans Gold Mines Limited for further information contained in that company's annual report for the year ending 31 December 1966, which pertains to Ancco Mines Limited.

Employment and Management

J. E. J. Fahlgren was general manager, 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: R. V. Porritt, president and director; W. S. Row, vice-president and director; D. E. G. Schmitt, general manager and director; A. W. Stollery, and K. C. Gray, directors; R. C. Ashenurst, 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 1966.

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SHAFTS, AUNOR MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
A1	HS850	Vertical	3	feet	feet
A2	TRS828 } HR1246 }	62°	2 (inactive)	Surface	3,082
D2	TRS825	Vertical	3	2,110	2,907
D3	TRS825	Vertical	4	Surface	3,030
				2,888	5,395

Development work in 1966 consisted of 108 feet of drifting, 31 feet of cross-cutting, and 62 feet of raising. Total development footage to 31 December 1966 was as follows: 77,010 feet of drifts; 13,501 feet of crosscuts; 33,092 feet of raises. Diamond-drilling in 1966 consisted of 299 holes, totalling 21,915 feet, from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Production

Ore broken in stopes amounted to 258,200 tons and ore drawn off was 257,300 tons. The broken ore remaining in stopes was estimated at 8,100 tons at year-end.

Backfill placed in stopes amounted to 92,800 tons of sand and about 16,780 tons of classified mill tailings.

Development

An underground excavation was made to provide storage to improve the efficiency of hydraulic placement of classified mill tailings for backfill in stopes. About 1,700 feet of connecting holes were diamond-drilled to integrate the storage reservoir with the system which had previously been established for test purposes. It is expected that this system will be in full operation to all new stopes by mid 1967.

Ore Reserves

At 1 January 1967, ore reserves were estimated at 812,000 tons averaging 0.32 ounce of gold per ton compared to 798,000 tons averaging 0.31 ounce at the beginning of 1966. Newly developed ore below the 2,900-foot level comprised 184,000 tons of the above total with an average content of 0.34 ounce of gold per ton. Additional ore developed in operating stopes above the 2,900-foot level amounted to 84,300 tons.

Mill

The following tabulation provides production and performance figures for the year as compared with 1965 and the period since production commenced in January 1940.

		1966	1965	TOTAL TO DATE
Milled	tons	254,300	265,700	5,375,800
Milled per calendar day	tons	697	728	546
Average gold content	oz. per ton	0.32	0.31	0.34
Average tailings loss	oz. per ton	0.014	0.013	0.012
Total recovery	percent	95.7	95.7	96.5
Gold production	oz.	79,440	78,600	1,797,700
Value of total production	\$	3,004,500	2,973,600	65,160,700
Recovery per ton	\$	11.81	11.19	12.12

The decrease in tonnage milled was due entirely to high labour turnover, inexperienced replacements, absenteeism and difficulty in recruiting men for employment in the mining department.

Employment and Management

The average number of employees was 404: 264 underground and 140 on surface. J. M. Gordon was manager.

Broulan Reef Mines Limited

Broulan Reef Mines Limited was incorporated in June 1951 with an authorized capitalization of 6,000,000 shares of \$1 par value, of which 5,961,142 shares have been issued. The directors and officers were: H. F. Brownbill, president and director; W. H. Maedel, vice-president, secretary-treasurer and director; F. G. Lawson, vice-president and director; L. B. Harder and D. G. Lawson, directors; M. K. Coffin, assistant-treasurer. The head office is at Suite 705, 105 Adelaide Street West, Toronto 1; the mine address is Pamour.

The company owns the Broulan Reef mine and the old Bonetal and Bonwhit mines, consisting of 81 claims, in Whitney, Murphy, and Tisdale townships, Porcupine area, District of Cochrane.

Mining and milling of company ore was terminated in September 1965. Changes to the mill were commenced in preparation for custom-milling and test-milling of ores, which included Texas Gulf Sulphur ore.

Major construction in 1966 included an addition to the mill, 56 x 33 ft. of wood-frame construction with shiplap siding.

The mill was operated from 11 April to 31 December 1966 and treated 59,134 tons of ore averaging 224 tons daily.

Employment and Management

The average number of employees for the custom milling operation was 29; J. P. Paguette was general superintendent.

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; 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 1966.

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

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Development work in 1966 was as follows: 5,949 feet of drifting, 762 feet of crosscutting, 3,519 feet of raising. Total development footage to 31 December 1966 was as follows: 159,336 feet of drifts; 27,832 feet of crosscuts; 50,219 feet of raises. Diamond-drilling in 1966 consisted of 169 holes totalling 29,760 feet from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Mining

Broken ore totalling 170,100 tons remains in the stopes, a decrease of 37,100 tons from the previous year, a decrease normal to the conversion to the cut-and-fill method of mining. The main stoping operations were above the 11th level or 1,600-foot level.

Ore Production

The mine produced 257,884 tons of ore during the year which averaged 14.26 dwt. The stopes produced 220,091 tons averaging 14.25 dwt. and development work produced 37,793 tons averaging 14.28 dwt.

Ore Reserves

The ore reserves are estimated at 1,238,800 tons, an increase of 62,500 tons over last year. The ore reserves include 170,100 tons of broken ore.

A summary of the distribution of ore in place, broken ore, and total ore extracted from stopes to the end of 1966 is as follows:

SUMMARY OF ORE RESERVES AND EXTRACTION BY LEVELS

LEVEL	ORE IN PLACE	AVERAGE GRADE	BROKEN ORE	TOTAL TONS ORE EXTRACTED FROM STOPES TO END OF 1966
	tons	dwt. per ton	tons	tons
Surface to 1st	8,100	12.08	.....	245,845
1st to 2nd	16,800	12.00	.....	311,888
2nd to 3rd	26,400	11.48	.....	325,859
3rd to 4th	27,300	10.00	.....	423,373
4th to 5th	37,600	11.90	26,600	404,508
5th to 6th	68,500	15.17	18,100	402,886
6th to 7th	112,900	13.48	43,100	369,905
7th to 8th	69,600	11.83	18,300	291,930
8th to 9th	104,300	14.47	12,100	210,929
9th to 10th	87,700	16.30	32,100	143,349
10th to 11th	63,000	12.47	2,300	29,417
11th to 12th	71,100	11.88	4,600	35,302
12th to 13th	94,600	14.34	10,300	29,723
13th to 14th	142,300	15.54	2,600	35,550
14th to 15th	89,100	14.32	.....	.....
15th to 16th	23,200	13.86	.....	.....
16th to 17th	26,200	11.16	.....	.....
Total	1,068,700	13.79	170,100	3,260,464

Milling

The following are the results of milling operations:

Ore treated	tons	257,884
Average per calendar day	tons	706
Average grade of ore treated	dwt. per ton	14.26
Recovery	dwt. per ton	13.21
Recovery	percent	92.68

Costs

The expenditure on mining was \$933,686 or \$3.62 per ton milled.
The expenditure on development was \$538,082 or \$2.09 per ton milled.
Operating costs (including Mint handling charges) were \$9.98 per ton milled.

Employment and Management

The average number of employees was 270: 137 underground and 133 on surface. Joseph Chisholm was general manager.

C.G.C. Mines Limited

C.G.C. Mines Limited (Crooked Green Creek), was incorporated in July 1966 with an authorized capitalization of 3,000,000 shares of no par value of which 798,000 shares have been issued. The directors and officers were: J. H. Morlock, president and director; G. H. Gibbs, vice-president and director; G. W. Armstrong, secretary and director; G. W. Moore and W. H. Gross, directors. The head office is at Suite 801, 21 King Street East, Toronto 1. The mine address is P.O. Box 75, Beardmore.

The property comprises 1,760 acres in Pifher township, District of Thunder Bay. Operations progressed from 1 August to 10 December 1966.

A two-compartment shaft, inclined at 45°, located in claim TB113679 was collared and sunk to a depth of 15 feet below collar. Some 500 feet of surface trenching averaging two feet in depth was completed.

Major construction in 1966 included:

- 3 camp buildings moved to the property and renovated
- 1 bunkhouse, 30 x 20 ft.
- 1 cookery, 20 x 16.5 ft.
- 1 office, 18.5 x 13 ft.
- 1 shafthouse, 20 x 10 ft.
- 1 timber headframe, 40 x 20 x 34 ft. high.

Major equipment installed comprised the following:

- 1 compressor, 250 cfm.
- 1 single drum hoist, 28 x 24 ins.
- 1 sheave, 36 in. diam.
- 1 lighting plant, 3 kw., 110V.
- Rock drills.
- 1 sump pump.
- 1 water supply pump.
- Miscellaneous tools and camp equipment.

A test shipment of 175 to 200 tons was made.

Employment and Management

R. A. Belanger was manager and several men were employed during the period of operation.

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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 3,574,655 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 R. E. Shibley, directors; C. V. Maltby, assistant secretary. The head office is at Suite 1203, 2200 Yonge Street, Toronto 12; the mine address is Cochenour.

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

Mining and milling continued throughout 1966.

SHAFTS, COCHENOUR WILLANS MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	VERTICAL DEPTH BELOW SURFACE
No. 1	KRL322	Vertical	3	2,768
No. 2	KRL462	Vertical	3	446

Development work in 1966 consisted of the following: drifting, 3,894 feet; crosscutting, 2,369 feet; raising, 1,733 feet. Total development footage on Cochenour property to 31 December 1966 was as follows: 113,701 feet of drifts; 71,946 feet of crosscuts; 75,514 feet of raises. Diamond-drilling consisted of 396 holes, totalling 58,902 feet from underground.

Major equipment added was in connection with the mill expansion and consisted chiefly of: a ball mill, 6 x 9 ft. with 150 hp. motor, a thickener and four pumps, and an electric motor rotor.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Production and Costs

During the year 106,746 tons of ore were milled producing 33,645.830 fine ounces of gold and 1,957.640 fine ounces of silver. The total value of this bullion was \$1,271,944 for an average recovery of \$12.10 per ton milled. The price received for gold averaged \$37.73 Canadian per fine ounce and for silver \$1.39 per ounce. All bullion was shipped to the Royal Canadian Mint.

The company and its subsidiary, Annco Mines Limited, qualified for Emergency Gold Mining Assistance. Total income estimated to be received under the provisions of this Act is \$345,711 or \$10.27 per ounce of gold.

A total of 158,483 tons was hoisted, of which 64,613 tons were ore from Cochenour and 42,133 tons were ore from Annco. The balance of 51,575 tons was development waste.

	1966		1965	
	TOTAL	PER TON MILLED	PER OUNCE	PER TON MILLED
COCHENOUR OPERATION				
Tons milled: 64,613				
Development	\$ 307,371	\$ 4.757	\$16.839	\$ 3.566
Mining	415,540	6.431	22.765	6.384
Milling	221,341	3.426	12.126	2.999
General and administrative	212,149	3.283	11.622	2.741
Marketing	5,302	0.082	0.290	0.116
Total operating costs	\$1,161,703	\$17.979	\$63.642	\$15.806
Deduct Est. E.G.M.A.	187,555	2.903	10.275	4.277
Net operating costs	\$ 974,148	\$15.076	\$53.367	\$11.529
ANSCO OPERATION				
Tons milled: 42,133				
Development	\$ 142,925	\$ 3.392	\$ 9.285	\$
Mining	443,219	10.520	28.795	5.825
Milling	144,332	3.426	9.377	3.033
General and administrative	107,441	2.550	6.980	2.699
Marketing	4,590	0.108	0.298	0.145
Total operating costs	\$ 842,507	\$19.996	\$54.735	\$11.702
Deduct Est. E.G.M.A.	158,156	3.754	10.275	.....
Net operating costs	\$ 684,351	\$16.242	\$44.460	\$11.702

Source of Ore

The Cochenour mill feed was supplied from the mining of 77 stopes which produced 55,973 tons of ore averaging 0.32 ounce gold per ton, and from 41 development headings which produced 5,384 tons of ore averaging 0.21 ounce gold per ton.

The Ancco mill feed was supplied from the mining of 25 stopes which produced 39,682 tons of ore averaging 0.41 ounce gold per ton and from 14 development headings which produced 2,451 tons of ore averaging 0.27 ounce gold per ton.

Milling and Metallurgy

The mill extension was completed and tonnage at the rate of 400 tons per day was attained in November. With the exception of minor changes, the newly developed circuit operated smoothly and with satisfaction. A slight increase over 400 tons per day has proven to be possible.

In the past it was the practice to cyanide only the coarse portion of the flotation tails due to limited capacity. The mill circuit has now been arranged to treat all the ore milled by cyanidation.

The characteristics of the ore have not altered. It is still the same refractory material, with all the inherent resistances and reluctancy associated with the talc ore. Percentage recovery is down due to a lower grade of ore.

Due to the comprehensive plan for backfill underground it was necessary to combine surface pit sand with separated mill sand tailing to fulfill that need. Sufficient mill backfill is now produced for normal underground operations.

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

		1966	1965
Milled	tons	106,746	103,670
Operating time of total time	percent	93.10	98.69
Average milled daily	tons	292	284
Average gold assay of head	oz.	0.353	0.472
Average gold assay of tails	oz.	0.038	0.047
Extraction	percent	89.33	90.19

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General

Operational adjustments involving complete retraining of both men and supervision to the acceptance of the merits of cut-and-fill mining were accomplished during the year. By changing the method of mining, the company have been able to bring the mine under control and operate in a safe manner, but much is still to be achieved with respect to speed and efficiency.

The change over in the Ancco operations was a slow process and it has taken far more time to recover collapsed stopes and to stabilize ground conditions with supporting timber and fill due to the incompetency of the rock, than normally anticipated. To meet the emergency it was necessary to place the most experienced and qualified miners in the Ancco operations. At the same time ten timbering crews had to be trained. In these circumstances Ancco could not produce the expected mill tonnage for increased mill capacity. It was necessary to resort to the mining of lower grade chert and north/south vein ores which were quickly accessible, using less experienced and new men. The grade of these ores has not been sufficient to combat the increase in costs.

Introduction of the 40 hour week, higher wage rates, job training due to the shortage of experienced miners, and the continuing inflation affecting cost of materials and supplies contributed to further substantial cost increases. Adjustments in insurance and medical plans and introduction of the Canada Pension plan were other items affecting costs. To settle the talcose ores in the milling circuit, additional reagents had to be introduced.

Employment and Management

The average number of employees at the Cochenour, Ancco, Marcus, and Wilmar operations was 248: 117 underground and 131 on surface. J. D. Jeffries was mine manager.

Consolidated Marcus Gold Mines Limited

Consolidated Marcus Gold Mines Limited was incorporated in September 1954, with an authorized capitalization of 4,000,000 shares of \$1 par value, of which 3,000,000 shares have been issued. The directors and officers were: E. C. Cochenour, president and director; R. M. Elliot, F. J. Mills, and J. M. Philip, directors; C. V. Maltby, secretary-treasurer. The head office is at Suite 1203, 2200 Yonge Street, Toronto; the mine address is Cochenour.

The property comprises 857 acres in Dome and Balmer townships, Red Lake area, District of Kenora; it is controlled by Cochenour Willans Gold Mines Limited.

The vertical, three-compartment No. 1 shaft located in claim KRL7696 had been sunk to a depth of 183 feet below the collar in 1965. Total development footage completed to 31 December 1966 was as follows: 9,542 feet of crosscuts, and 40 feet of raises, all from the Cochenour 1,300-foot horizon. Exploratory diamond-drilling continued throughout the year from surface and the long Consolidated Marcus drive to the east on the Cochenour Willans 1,300-foot level. The drive starts at the Cochenour No. 1 shaft and runs eastward across the Marcus property, then northeast paralleling the Consolidated Marcus and Campbell Red Lake boundary for a total distance of 14,523 feet. Seven diamond-drillholes, totalling 2,899 feet, were completed from underground and five holes totalling 2,005 feet were completed from surface during 1966.

Management and Operation

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

Consolidated Mosher Mines Limited

New Mosher Longlac Mines Limited was incorporated in June 1950 to succeed Mosher Long Lac Gold Mines Limited. In February 1954 the name was changed to Consolidated Mosher Mines Limited; the authorized capitalization was changed from 5,000,000 shares of \$1 par value to 5,000,000 shares of \$2 par value; 3,264,810 shares have been issued. The directors and officers were: R. C. Stanley Jr., president and director; H. E. Rudd, vice-president, general manager and director; P. K. Hanley, vice-president and director; Miss B. A. Argo, secretary and director; J. C. L. Allen, P. A. Allen, and J. D. Bryce, directors. The head office is at Suite 400, 112 King Street West, Toronto 1. The mine address is Geraldton.

The main property comprises 20 claims west of the MacLeod-Cockshutt mine, in Errington township, District of Thunder Bay.

SHAFTS, CONSOLIDATED MOSHER MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
No. 1	TB10046	Vertical	3	feet	feet
No. 2	TB10065	Vertical	4	Surface	2,530
No. 3	.....	Vertical	3	2,022	52 3,173

Development work in 1966 consisted of 4,513 feet of drifting, 571 feet of crosscutting, and 1,327 feet of raising. Total development footage to 31 December 1966 was as follows: 21,340 feet of drifts; 10,393 feet of crosscuts; 8,095 feet of raises. Diamond-drilling in 1966 consisted of 150 holes totalling 23,491 feet from underground.

Major equipment added included the following:

- 1 loading pocket on 20th level, No. 3 winze.
- 1 skip dump on 13th level, No. 3 winze.
- 1 electric cable, 2,200V., 13th to 20th level, No. 3 winze.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

During the year a total of 535,008 tons of ore was treated at MacLeod-Cockshutt Gold Mines Limited mill, yielding 49,930 ounces of gold and 5,276 ounces of silver, an average of 0.093 ounce of gold recovered per ton.

Revenue from this production amounted to \$1,890,736 or \$3.53 per ton. Additional income from E.G.M.A. is estimated to be \$485,000 increasing total revenue to \$2,375,736 or \$4.44 per ton.

The growing shortage of labour seriously affected all operations, delaying stope development of the ore on the new levels and restricting production from the stopes above the 13th level. Low grade ore from earlier development which had been stockpiled on surface was trucked to the mill to augment underground production. This ore dump contained 26,533 tons averaging 0.079 ounce per ton raising daily production to an average of 1,466 tons per day.

The west drive on the 17th level to check the downward extension of the ore zones was considered of sufficient importance to be continued in spite of the labour shortage. A large fault zone was encountered 440 feet west from No. 3 shaft and after drilling had revealed a 150-foot vertical displacement in the ore zone to the west, the drive was transferred to the 18th level.

Annual Report for 1966

This program required 671 feet of lateral development with 3,250 feet of diamond-drilling on the 17th level, and 1,705 feet of development with 6,799 feet of diamond-drilling on the 18th level.

Diamond-drilling confirmed further major changes in the shape of the porphyry and an increasing irregularity with little continuity in the mineralized zones.

In view of these results it is considered that under present conditions there is no profitable ore in the downward extensions of the known ore zones, and it was therefore decided to put the mine on a salvage basis as of 1 February 1967.

Management and Operation

H. E. Rudd was vice-president and general manager, and the operation was carried on by the MacLeod-Cockshutt organization.

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 3,514,340 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; R. A. Jodrey, S. C. Smith, M. L. Urquhart, and R. F. Rock, directors; H. R. Heard, secretary-treasurer; J. Geddes, assistant secretary; L. V. Barbisan, assistant treasurer. 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 1966.

SHAFTS, DICKENSON MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING 1966	TOTAL DEPTH BELOW SURFACE
				feet	feet	feet
Detta	KRL19502	Vertical	3 (inactive)	.....	.....	280
No. 1	KRL19497	Vertical	{ 3 to 8th level }	.....	.....	3,589
No. 2	KRL19503	Vertical	{ 4 to bottom }	3,365	1,231	4,614

The vertical, four-compartment No. 2 internal shaft was collared at a depth of 3,365 feet, was sunk 1,231 feet to a total depth of 4,614 feet below surface. The 24th, 25th, 26th, 27th, 28th, 29th, 30th, and 31st levels were established at depths of 147, 294, 442, 589, 736, 883, 1,030, and 1,177 feet respectively below the shaft collar.

A total of 3,043 feet of drifting, 1,538 feet of crosscutting, and 2,298 feet of raising was completed. Total development footage to 31 December 1966 was as follows: 84,945 feet of drifts; 64,328 feet of crosscuts; 50,197 feet of raises. Diamond-drilling consisted of 246 holes totalling 46,146 feet from underground.

Major equipment added was as follows:

SURFACE:

- 1 head sheave, 96 in. grooved for 1½-in. rope complete.
- 1 filter, type 18-60, 5,000 cfm., for assay dept.
- 1 fan, 15-in. dia., for assay dept.
- 1 truck, 3-ton capacity.
- 1 forging hammer for machine shop.
- 2 calculators for office.

UNDERGROUND:

- 3 cage over skip combinations, 4½-ton, for No. 2 shaft
- 8 mine cars, Granby, 90 cu. ft., 24-in. gauge
- 1 pump, air driven, 6 x 4 x 6 in., for No. 2 shaft
- 1 head sheave, 42 in., grooved for 1¼-in. rope.
- 3 battery chargers, various types.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Production

A total of 172,526 tons of ore was milled yielding 95,563.5 fine ounces of gold and 7,765 fine ounces of silver. The total value of this bullion was \$3,615,000 or a recovery of \$20.95 per ton milled. In addition, benefit received and receivable under the Emergency Gold Mining Assistance Act is estimated to be \$276,000 or \$2.89 per ounce of gold.

The company qualified for Emergency Gold Mining Assistance for the year and gold produced was sold to the Royal Canadian Mint. The average value received from the Mint was \$37.71 per ounce for gold, and \$1.39 per ounce for silver.

To date the mine has produced 1,272,811.5 ounces of gold and 108,269 ounces of silver with a total value of \$45,515,000 for an average value received from the Mint and the Bank of Nova Scotia of \$35.67 per ounce of gold and \$1.04 per ounce of silver; total tons milled amount to 2,566,138 for a recovery of 0.50 ounce of gold per ton.

Operating Costs

	1966			1965
	TOTAL	PER TON MILLED	PER OUNCE	PER OUNCE
Shaft sinking (No. 2 shaft)	\$ 457,835	\$ 2.65	\$ 4.79	\$ 2.07
Exploration and development	316,127	1.83	3.31	3.94
Mining	1,177,249	6.82	12.32	11.32
Milling	503,509	2.92	5.27	5.17
Mine general expense	374,461	2.17	3.92	3.75
Head office expense	135,765	.79	1.42	1.34
Interest on bank loans	107,697	.63	1.12	.85
Marketing charges	27,713	.16	.29	.27
Total	\$3,100,356	\$17.97	\$32.44	\$28.71

Mining

Broken ore totalling 83,737 tons remained in the stopes, a decrease of 4,737 tons from the previous year. Also 1,523 tons remained in ore bins and ore passes at year-end.

Of the 172,326 tons of ore hoisted, 17,739 tons grading 0.412 ounce per ton were obtained from development and 154,587 tons grading 0.623 ounce per ton were obtained from stoping and stope preparation. Waste hoisted amounted to 46,951 tons.

Stoping operations were carried on in the North "C", South "C", East South "C", "D", "F", and "H" zones on the upper 22 levels. At year-end 22 stopes were operating as cut-and-fill stopes and two were shrinkage. Most new stopes are being prepared for cut-and-fill. Tons broken per rock drill shift in stopes and back stopes were 51.4 compared to 43.6 in 1965. The average stope width was 6.3 feet compared to 7.2 feet the previous year.

Annual Report for 1966

Ore Reserves

At 31 December 1966, positive ore reserves, broken and in place, were calculated to be 571,986 tons, having an average grade of 0.536 ounce of gold per ton. This compares with 586,777 tons grading 0.546 ounce per ton at 31 December 1965.

Milling

Summary of mill operations with the previous year given as comparison.

		1966	1965
Treated	tons	172,526	177,353
Operating time	percent	99.35	99.48
Treated per day	tons	472.7	485.9
Average millheads	oz. per ton	0.601	0.562
Mill tails	oz. per ton	0.047	0.043
Recovery	oz. per ton	0.554	0.519
Recovery	percent	92.2	92.4

ROBIN RED LAKE MINES LIMITED

The property owned by Robin Red Lake Mines Limited adjoining Dickenson mine to the east is being developed by the Dickenson mine organization from the 17th, 19th, and 23rd levels of the Dickenson mine. In 1966 development work consisted of slashing on the 23rd level for diamond-drilling; some 1,868 feet of drilling was completed from underground. Total development footage to 31 December 1966 was as follows: 3,114 feet of drifts; 874 feet of crosscuts.

EMPLOYMENT AND MANAGEMENT

The average number of employees was 291: 159 underground and 132 on surface. J. Gillis 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, treasurer and director; J. B. Redpath, president and director; B. R. MacKenzie, secretary and director; W. R. Biggs, F. W. Pershing, A. T. Lambert, H. C. Brunie, A. B. Matthews and W. F. James, directors; C. P. Girdwood, vice-president and general manager. The head office and mine office address is South Porcupine. The secretary's office is at 36 Toronto Street, Toronto 1.

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

Mining and milling continued throughout 1966.

SHAFTS, DOME MINES

NAME OR NO.	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING 1966	VERTICAL DEPTH BELOW SURFACE
No. 1	12866	Vertical	3 (inactive)	feet	feet	feet
No. 1	12864	Vertical	3 (inactive)	Surface	.....	105
No. 3	12864	Vertical	{4 to 10th level}	Surface	.....	805
No. 4	.....	Vertical	{6 to bottom }	Surface	.....	2,456
No. 5	.....	Vertical	Inactive	1,587	.....	2,053
No. 6	.....	Vertical	3	2,026	.....	3,137
No. 7	.....	Vertical	5	2,000	.....	4,062
No. 1 Dome Ext.	.....	Vertical	3	3,950	255	5,323
No. 1 Foley-O'Brien	13191	Vertical	Inactive	Surface	.....	222
No. 2 Foley-O'Brien	13403	Vertical	Inactive	Surface	.....	70
No. 3 Foley-O'Brien	13403	Vertical	Inactive	Surface	.....	160
Foley-O'Brien winze	Lot 2, Con. 2, Tisdale	Vertical	Inactive	Surface	.....	240
No. 1 Temiskaming	.....	70°	Inactive	160	.....	250
No. 2 Temiskaming	Lot 3, Con. 2, Tisdale	Vertical	Inactive	Surface	.....	260
No. 2 Temiskaming	Lot 3, Con. 2, Tisdale	Vertical	Inactive	Surface	.....	60

No. 7 winze was sunk 255 feet in 1966, to a vertical depth of 5,323 feet below surface. The 37th level was established at 1,194 feet below the collar.

Development work in 1966 consisted of 9,625 feet of drifting, 5,171 feet of crosscutting, and 4,521 feet of raising. Total development footage to 31 December 1966 was as follows: 463,812 feet of drifts; 208,189 feet of crosscuts; 250,825 feet of raises. Diamond-drilling in 1966 consisted of 640 holes totalling 119,456 feet from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Costs

The expenditure on development was \$1,164,738 or \$1.63 per ton as compared with \$1,330,432 or \$1.87 per ton milled in 1965.

The expenditure on shaft sinking was \$96,206 or \$0.14 per ton as compared with \$43,769 or \$0.06 per ton milled in 1965.

The expenditure on mining was \$4,371,141 or \$6.13 per ton as compared with \$3,769,863 or \$5.28 per ton milled in 1965.

The total operating charges for the year were \$7,050,231 or \$9.90 per ton as compared with \$6,480,298 or \$9.09 per ton milled in 1965.

The operating cost per ounce of gold produced was \$39.39 as compared with \$36.29 in 1965.

Mining

The 712,500 tons of ore milled during the year were produced as follows:

	MINED	AVERAGE GRADE
	tons	dwt. per ton
From stopes	613,200	5.51
From development	99,300	3.19
Total	712,500	5.19

Annual Report for 1966

Ore Reserves

Ore reserves at the close of the year were estimated at 2,211,000 tons with an average grade of 5.44 dwt. as compared with 2,285,000 tons with an average grade of 5.34 dwt. for 1965.

	1966	1965
	tons	tons
Unbroken ore	1,940,000	2,065,000
Broken ore	271,000	220,000
Total	2,211,000	2,285,000

Ankerite ore comprises 43 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	tons	712,500
Average per day worked	tons	1,985
Average grade of ore treated	dwt. per ton	5.19
Recovery	dwt. per ton	5.02
Recovery	percent	96.85

Employment and Management

The average number of employees was 922: 629 underground and 293 on surface. C. P. Girwood was general manager.

Golsil Mines Limited

Golsil Mines Limited was incorporated in June 1959, with an authorized capitalization of 5,000,000 shares of no par value, of which 2,590,659 shares have been issued. The officers and directors were: W. C. Arrowsmith, president and director; A. J. Lewis, vice-president, secretary-treasurer and director; J. A. Murphy, J. A. Gilbert, and L. Pancer, directors. The head office is at Suite 507-9, 55 York Street, Toronto 1; the mine address is c/o Ontario Central Airlines, Red Lake, Ontario.

This gold-silver-lead-zinc property comprising 38 claims is located at Favourable Lake, 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.

Operations progressed from 1 January to 30 December 1966.

SHAFTS, GOLSIL MINES

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING 1966	VERTICAL DEPTH BELOW SURFACE
				feet	feet	feet
No. 1	KRL45330	Vertical	3	Surface	.....	1,898
Winze	.....	Vertical	3	1,700	.....	3,246
No. 2	KRL45333	Vertical	3	Surface	275	765

No. 2 shaft was sunk 275 feet in 1966 to a depth of 765 feet below collar, and two levels were established at depths of 625 and 740 feet below the collar. Development work consisted of 540 feet of drifting. Total development footage on the property to 31 December 1966 was: 23,027 feet of drifts; 15,666 feet of crosscuts; and 10,154 feet of raises. Some 16 diamond-drillholes, totalling 4,184 feet, were completed from underground.

Some buildings on the property were repaired and moved to new locations. A boiler heating system was installed in the buildings and a compressor was installed in the power house.

Employment and Management

The average number of employees was 30: 20 underground and 10 on surface. J. M. Kilpatrick was manager.

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: R. V. Porritt, president and director; W. S. Row, vice-president and director; D. E. G. Schmitt, general manager and director; W. G. Brissenden, and J. H. Stovel, directors; R. C. Ashenurst, 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 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 1966.

SHAFTS, HALLNOR MINE

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
Main Shaft	N½ lot 7, con.V, Whitney twp.	Vertical	3	Surface	3,477
2230 winze	N½ lot 7, con.V, Whitney twp.	45°	2	3,354	3,742
No. 3 shaft	N½ lot 7, con.V, Whitney twp.	Vertical	3	3,198	4,455

Development work in 1966 consisted of 2,076 feet of drifting, 1,222 feet of crosscutting, and 1,164 feet of raising. Total development footage to 31 December 1966 was as follows: 72,753 feet of drifts; 22,077 feet of crosscuts; 26,370 feet of raises. Diamond-drilling consisted of 149 holes, totalling 28,027 feet from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Annual Report for 1966

Stoping

Ore broken in stopes amounted to 124,900 tons and 123,000 tons were trammed. The broken ore reserve at the year-end was approximately 12,700 tons. Tonnage hoisted from below the 22nd level amounted to 71 percent of the total.

The hydraulic fill system provided some 41,000 tons of classified mill tailings to the lower section of the mine. In addition, 8,000 tons of sand backfill was placed in the upper level stopes.

A tabulation of ore production by levels for the year 1966, and since production commenced in June 1936, follows:

LEVEL	BELOW SURFACE	1966	TOTAL 1936 TO 1966
	feet	feet	
1st to 8th	1,400	14,900	2,560,020
18th	2,750	.....	25,635
19th	2,900	19,225	241,760
20th	3,050	.....	128,090
21st	3,200	.....	40,605
22nd	3,350	1,700	12,960
23rd	3,500	9,280	42,395
24th	3,700	31,730	90,310
25th	3,850	16,535	46,525
26th	4,000	29,860	68,150
Stoping total		123,230	3,256,450
Development		9,310	235,565
Total		132,540	3,492,015

Mill

The mill was in continuous operation throughout the year. The primary ball mill operated 98.5 percent of the possible running time and averaged 367 tons per day compared to 360 tons per day in 1965.

Ore treated was 133,770 tons averaging 0.38 ounce of gold per ton and recovery was 97.3 percent. Production amounted to 50,200 ounces of gold and 2,840 ounces of silver.

To 31 December 1966, the mill had treated 3,489,200 tons of ore yielding 1,371,400 fine ounces of gold and 101,900 ounces of silver, having a combined value of \$50,114,400.

Ore Reserves

AT 1 JANUARY	1967		1966	
	TONS	GOLD OZ./TON	TONS	GOLD OZ./TON
Above 8th level	21,800	0.21	16,800	0.20
18th to 22nd level	11,100	0.24	26,000	0.32
22nd to 26th level	253,100	0.44	191,100	0.44
Total	286,000	0.41	233,900	0.41

Employment and Management

The average number of employees was 210: 137 underground and 73 on surface. W. J. Marshall was manager.

Hollinger Consolidated Gold Mines Limited

Hollinger Consolidated Gold Mines Limited was incorporated in May 1916. 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

Mining and milling operations continued throughout 1966.

SHAFTS, HOLLINGER MINE

SHAFT	CLAIM NUMBER	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
				feet	feet
Main	P13156	Vertical	3	Surface	2,770
Central	P13157	Vertical	6	Surface	3,194
No. 26	P13156	Vertical	5	Surface	3,063
No. 11	P13144	Vertical	2	Surface	2,755
No. 19	Schumacher Veteran Lot	Vertical	3	Surface	3,954
No. 6	P13218	Vertical	2 (0-200 ft. filled; 200-425 ft. travel)	Surface	425
No. 21	.....	Vertical	2 (1,550-2,750 ft. filled; 2,750-3,950 ft. travel)	1,550	3,950
No. 25	.....	Vertical	3	3,950	5,438
No. 27	.....	Vertical	4	2,750	5,293

NOTE: No. 25 shaft—Hoist is on 3800-foot level.
 No. 27 shaft—Hoist is on 2450-foot level.
 All other shafts have been stoped, filled, etc.
 Inactive shafts from surface have been bulkheaded.

Development work in 1966 consisted of 2,004 feet of drifting, 1,156 feet of crosscutting, and 16,676 feet of rock passes, development and stope raising. Total development footage from 1931 to 31 December 1966 was as follows: 1,315,296 feet of drifts; 695,990 feet of crosscuts; 1,006,491 feet of raises. Diamond-drilling in 1966 consisted of 579 holes totalling 50,421 feet from underground, and four holes totalling 1,515 feet from surface.

A total of 722,012 tons of ore was hoisted; 715,789 tons were milled at a daily average of 2,831 tons per operating day.

Employment and Management

The average number of employees was 1,026: 617 underground and 409 on surface. C. B. Ross was general manager.

Annual Report for 1966

ROSS MINE

The Ross property comprises 456 acres located in Hislop township, District of Cochrane. The mine address is Holtyre.

Mining and milling continued throughout 1966.

SHAFTS, ROSS MINE

	LOCATION	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
				feet	feet
No. 1 shaft	N½, lot 1, con. 11, Hislop twp.	Vertical	3	Surface	2,646
No. 2 winze	N½, lot 1, con. 11, Hislop twp.	Vertical	2	291	1,526

Development work in 1966 consisted of 1,846 feet of drifting, 87 feet of crosscutting, and 179 feet of raising. Total development footage to 31 December 1966 was as follows: 48,519 feet of drifts; 46,114 feet of crosscuts; 35,178 feet of raises. Diamond-drilling consisted of 101 holes, totalling 17,120 feet, from underground.

A total of 150,307 tons of ore was hoisted; 150,762 tons were milled at a daily average of 440 tons per operating day.

The average number of employees was 113: 60 underground and 53 on surface; C. B. Ross was general manager; J. J. Caty was resident manager.

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 1966:

The value of bullion production from the Hollinger and Ross mines declined from \$10,521,192 in 1965 to \$8,040,496 in 1966. Production from the Hollinger was \$7,049,914 and from the Ross \$990,582. Assistance received under The Emergency Gold Mining Assistance Act amounted to \$1,357,075 for the Hollinger and \$250,501 for the Ross for a 1966 total of \$1,607,576 compared to \$1,366,264 in 1965. Operating losses before taxes, depreciation, and E.G.M.A. payments were \$634,305 at the Hollinger and \$41,339 at the Ross, for a total of \$675,644 in 1966 compared to an operating profit of \$699,714 in 1965. Profit on the two operations after taxes and depreciation, and including assistance under E.G.M.A., was \$796,730 in 1966 compared to \$1,774,376 the previous year. Mining and milling costs were higher at Hollinger in 1966 than in 1965, largely as a result of lower utilization of the mine's large facilities and an increase in labour rates. Lower operating costs were recorded at the Ross but the beneficial effects were offset by lower metal recoveries. This occurred because normal mining sequence during the year made it necessary to mine and treat ore of lower than average reserve grade.

The price of gold was fixed by international monetary agreement at \$35 (U.S.) per ounce in 1934. In the succeeding years, gold mining has been the only industry in Canada unable to adjust the price of its product to the rising cost of operations. This cost price squeeze became so intense by 1948 that, as a means of preserving some semblance of a gold mining industry in Canada and of maintaining communities heavily dependent on this activity, The Emergency Gold Mining Assistance Act was enacted. The beneficial effect of this federal legislation is visible in the continued existence, albeit at lower and declining operating rates, of a number of gold mining enterprises. The Hollinger mine which is still one of the largest employers in the Timmins area, would have been closed long ago without this economic assistance, as would the Ross mine. As long as the price of gold remains fixed in a manner that prohibits normal cost price relationships, it is apparent that assistance of this nature is necessary if Canada's gold production is to be maintained at any significant level.

Kenilworth Mines Limited

Kenilworth Mines Limited was incorporated in January 1962 with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 4,643,895 shares have been issued. The directors and officers were: V. E. Irons, president, treasurer, and director; P. H. Clarke, vice-president and director; John Hotson, secretary and director; Herb Johnson, James Barnett, and D. A. Stevenson, directors. The head office and mine address is Box 945, Timmins.

The property, formerly known as the Naybob Gold Mine, consists of 17 claims in Ogden and Deloro townships, Porcupine area, District of Cochrane. In 1963 Kenilworth Mines Limited leased the adjoining New Hope Porcupine Gold Mines Limited property, comprising 35 claims in Ogden township, Porcupine area, District of Cochrane.

Mining operations continued from 1 January to 23 August 1966.

The vertical three-compartment No. 1 shaft located on the Kenilworth property in claim HR-938 (TRS-1021) has a depth of 1,347 feet below surface. There were two shafts on the New Hope property: No. 1 shaft on claim HS805 (TRP-421) was 200 feet deep with levels at 90 and 200 feet and had been used for ventilation purposes; the vertical, three-compartment No. 2 shaft collared on claim HS961 (TRP-492) was some 1,244 feet deep and serviced the mine. Development work in 1966 was on the De Santis part of the property and consisted of 570 feet of drifting and 226 feet of crosscutting. Total development footage on the Kenilworth property to 31 December 1966 (including Naybob to end 1947) was: 25,326 feet of drifts; 8,905 feet of crosscuts; 9,800 feet of raises. Total development footage on the New Hope property to 31 December 1966 (including the development footage by De Santis Porcupine) was: 11,616 feet of drifts; 5,942 feet of crosscuts; 7,118 feet of raises.

Some 30 diamond-drillholes totalling 2,088 feet were completed from underground.

Employment and Management

The average number of employees was 10: 4 underground and 6 on surface. Lloyd Hutchinson was 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. The authorized capitalization was increased to 10,000,000 shares of no par value, of which 7,082,952 shares have been issued. The directors and officers were: W. S. Row, president and director; J. H. Stovel, executive vice-president and director; K. C. Gray, M. S. Fotheringham, J. R. Bradfield, H. E. Langford, R. V. Porritt, W. H. Rea, H. H. Leather, and W. D. Smith, directors; B. C. Bone, treasurer; R. D. Stewart, secretary; J. B. Sage, assistant secretary. The head office is at Suite 1600, 44 King Street West, Toronto 1. The mine address is Virginiatown.

Annual Report for 1966

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 1966.

SHAFTS, KERR ADDISON MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	TOTAL DEPTH FROM SURFACE
No. 3	T1751	Vertical	5	feet	feet
No. 4	T2018	Vertical	3	Surface	3,995
				3,850	6,022

Development work in 1966 consisted of 311 feet of drifting; 98 feet of crosscutting; and 1,428 feet of raising. Total development footage to 31 December 1966 was as follows: 217,225 feet of drifts; 85,696 feet of crosscuts; 167,232 feet of raises. The total footage includes some development work on Chesterville and Arjon properties. Diamond-drilling in 1966 consisted of 22 holes, totalling 1,117 feet, from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Production

		1966	1965
Milled	tons	540,536	653,757
Average milled per day	tons	1,480.9	1,791.1
Total gold recovered	oz.	188,458.82	223,252.31
Total silver recovered	oz.	11,353.96	13,755.38
Average millhead value per ton (bullion plus tails)	oz. per ton	0.357	0.350
Gold at \$35.00	\$	12.51	12.25
Recovery	percent	97.6	97.6
Total realized value of bullion (Canadian funds)	\$	7,124,161	8,444,945
Total realized value of bullion per ounce of gold	\$	37.80	37.83
Total realized value of bullion per ton milled	\$	13.18	12.92

The overall recovery of gold in the milling operation was 97.6 percent. The retreatment of the cyanidation tailing by flotation and roasting improved the recovery by 6.47 percent and increased the operating profit by \$349,552, or 65 cents per ton milled.

Cost of Production

	1966		1965	
	Total	Per ton	Total	Per ton
Development	\$ 65,497	\$ 0.12	\$ 53,652	\$0.08
Stope development	76,919	0.14	43,460	0.07
Mining	2,269,247	4.20	2,414,736	3.69
Haulage	251,314	0.47	297,177	0.46
Hoisting	251,883	0.47	269,143	0.41
General mine charges	1,343,728	2.49	1,335,288	2.04
Crushing and conveying	103,746	0.19	138,917	0.21
Milling	720,725	1.33	858,168	1.31
General expense	644,314	1.19	606,943	0.93
Bullion marketing	49,518	0.09	56,908	0.09
Total operating cost at mine	\$5,776,891	\$10.69	\$6,074,392	\$9.29

The total operating cost per ton increased by \$1.40. This reflects the decrease in tons milled and is also due in part to the increase in the percentage of ore mined by the higher cost square-set and undercut-and-fill methods. Labour costs rose during the last four months following a wage adjustment on 24 August 1966.

A summary of the tonnages of ore broken by the different mining methods follows:

MINING METHOD	1966		1965	
	tons broken	percent	tons broken	percent
Cut-and-fill stoping	104,878	21.1	201,901	32.4
Cut-andfill pillar recovery	.....	.....	.....	.....
Total cut-and-fill mining	104,878	21.1	201,901	32.4
Square-set stoping	226,705	45.7	260,357	41.8
Square-set pillar recovery	138,280	27.9	131,315	21.1
Total square-set mining	364,985	73.6	391,672	62.9
Undercut-and-fill stoping	7,767	1.6	4,460	0.7
Undercut-and-fill pillar recovery	9,512	1.9	16,419	2.6
Total undercut and fill mining	17,279	3.5	20,879	3.3
Total cut-and-fill, square-set, and undercut-and-fill mining	487,142	98.2	614,452	98.6
Shrinkage stoping	.....	.....	1,328	0.2
Total mining	487,142	98.2	615,780	98.8
Development ore	8,706	1.8	7,291	1.2
Total ore broken	495,848	100.0	623,071	100.0
Percentage of tons milled		91.7		95.3

A total of 241,783 cubic yards of backfill, of which 234,364 cubic yards, or 96.9 percent was obtained from mill tailings, were placed in the mine.

Ore Reserves

At the end of 1966, proven ore reserves including allowances for dilution, were as follows:

	TONS	OUNCES OF GOLD PER TON
Surface to 1,600-foot level	301,730	0.297
1,600- to 2,500-foot level	815,081	0.324
2,500- to 3,700-foot level	909,753	0.398
3,700- to 4,550-foot horizon	2,163,001	0.520
Total reserve at the end of 1966	4,189,565	0.439
Total reserve at the end of 1965	4,825,543	0.433

Included with the total ore reserves at the end of 1966 are 3,930 tons of broken ore with a grade of 0.373 ounces per ton. During the year 95,442 tons, the greater part of which was between the 3,400-foot and 4,000-foot levels, were removed from the ore reserves for economic reasons following a re-appraisal of the original diamond-drilling results.

Diamond-drilling was confined to short exploratory holes largely from stopes to check ore outlines. No new ore of any significance was found during the year.

Employment and Management

The average number of employees was 743: 468 underground and 275 on surface. S. C. Yule was manager.

Annual Report for 1966

Kostynuk Brothers Limited

Kostynuk Brothers Limited was incorporated in September 1964, with an authorized capitalization of 40,000 shares of \$1 par value; no shares have been issued. The officers of the company were: A. Kostynuk, president; M. Kostynuk, vice-president; Wm. Kostynuk, treasurer; S. Kostynuk, secretary. The head office and mine address is Box 25, Red Lake.

The property comprises 15 claims on the north shore of Richardson Lake, in the Brownstone area, District of Kenora; it is about 60 miles northeast of the town of Red Lake, and 3 miles north of the old Jason mine at Casummit Lake.

Mining operations progressed from 10 June to 27 September; and the mill operated from 22 July to 21 September, 1966.

Total development footage to 31 December 1966 was as follows: 111 feet of drifts; 35 feet of crosscuts; 10 feet of raises.

A total of 260 tons of ore was hoisted and milled at an average of 10 tons daily during the period of operation.

Employment and Management

The average number of employees was 2: 1 underground and 1 on surface. A. Kostynuk, president was in charge.

Labrador Exploration (Ontario) Limited

Labrador Exploration (Ontario) Limited was incorporated in July 1964, it is a wholly owned subsidiary of Labrador Mining and Exploration Company Limited. The directors and officers were as follows: A. L. Fairley Jr., president and director; P. C. Finlay, vice-president and director; C. G. Cowan, secretary and director; J. F. Lake and H. E. Lyle, directors; F. R. Hunt, treasurer. The head office is at Suite 2400, Bank of Nova Scotia Building, 44 King Street West, Toronto 1. The mine address is 23 Government Road East, Kirkland Lake.

The property comprises 42 claims, located in Lebel township, District of Timiskaming, about one mile south of King Kirkland. Pawnee Kirkland Gold Mines Limited previously operated the property, terminating all work in December 1928. Regal Kirkland Gold Mines Limited acquired four claims in 1936, commenced a program of sampling, diamond-drilling and development in June, terminating all work in November 1936.

Present work on the property is being carried out by Labrador Explorations and Upper Canada Mines Limited. Operations progressed from 1 August to 31 December 1966.

The vertical two-compartment No. 1 shaft located in claim LS466, having a depth of 780 feet below collar, was dewatered and rehabilitated. Development work in 1966 consisted of 1,793 feet of drifting and 161 feet of crosscutting. Total development footage completed to 31 December 1966 was: 4,115 feet of drifts; and 1,787 feet of crosscuts. Some 34 diamond-drillholes, totalling 4,323 feet, were completed from underground, and two holes totalling 405 feet were completed from surface in 1966.

Major construction in 1966 consisted of the following:

- 1 power line and transformer station, 3,000 ft.
- 1 pump line and pump power line, 1,720 ft.
- 1 office, 18 x 18 ft.
- 1 core shack, 18 x 18 ft.
- 1 hoistroom and dry, 73 x 22 ft.
- 1 collar house, 30 x 28 ft.
- 1 trestle and cover, 28 x 10 ft.
- 1 pumphouse, 10 x 8 ft.

Major equipment installed consisted of the following:

- 1 hoist, double drum electric, 42 x 30 ins.
- 1 hoist motor, 75 hp., 3-phase, 550V, 25 cycle.
- 1 compressor, horizontal type, 17 x 10½ x 12, PRB 2.
- 1 compressor motor, 150 hp., 3-phase, 550V, 25 cycle.
- 1 air receiver, 13 ft. x 4 ft. diam., with safety valves set at 105 psi.
- 1 pump underground horizontal, 2 piston 3½ in., 30 hp. motor.
- 1 pump surface, 3450 rpm., 300 ft. head with 40 hp. motor.

Employment and Management

The work is being done by F. A. McIntyre Limited on contract; the average number of employees was 5: 2 underground and 3 on surface. F. Tuffy, supervising geologist was in charge.

Lake Shore Mines Limited

Lake Shore Mines Limited was incorporated in February 1914, with an authorized capitalization of 2,000,000 shares of \$1 par value; all shares have been issued. The directors and officers were: R. C. Stanley, Jr., president and director; J. C. L. Allen, vice-president and director; Miss B. A. Argo, secretary and director; P. K. Hanley, P. A. Allen, J. D. Bryce, and D. M. Giachino, directors; D. M. Lorimer, comptroller. The head office and mine office is at Kirkland Lake. The executive office is at Suite 400, 112 King Street West, Toronto 1.

The company's main property consisting of about 287 acres, is in Teck township, Kirkland Lake area, District of Timiskaming.

Operations in 1966 consisted of mill cleanup and retreatment of mill tailings.

Major added equipment for tailings retreatment consisted of a barge, 26 x 14 feet, equipped with pumps, compressor and electrics, and one tractor.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Production

Production for the year was 6,717.066 ounces of gold, value \$253,440.37 and 639,170 ounces of silver, value \$888.50. Average prices for gold and silver per ounce received from the Mint was \$37.73 and \$1.39, about the same as 1965. Total production was \$254,328.77.

Source of Production

	GOLD		SILVER	
	ounces	value	ounces	value
Mill cleanup	3,613.142	\$136,119.32	406.96	\$565.26
Lake tailings	3,103.924	117,320.95	232.21	323.24

Annual Report for 1966

Lake Operation

Early in 1966, the efforts of all personnel were directed to the rehabilitation of machinery and equipment in the mill and roaster, changes in the circuit, and repair of the tailings line to the main disposal area. In addition a barge was constructed and equipped with a pumping plant.

Work noted above was completed and on 17 June the barge pumps were started to send old mill tailings from the Kirkland Lake basin to the mill for retreatment.

A number of operating problems were encountered, in pumping, which had not been apparent in the test work done the previous year. Changes were required in the pump header arrangement. Pump wear was excessive due to the very abrasive nature of the material being handled and led to two rebuilds of barge pumps and the use of very hard steel parts. Certain changes were made in the circuit as experience dictated.

During the period June to the end of October, 98,962 tons of tailings were treated; however, it was only in the month of October that normal operating conditions were achieved, when a daily average of 1,495 tons, including 365 tons from Macassa, were treated. On the basis of the results obtained in October and further test work in November a decision has been reached that the tailings operation can be operated on a profitable basis during an eight to ten month period per year.

The operation was shut down by very cold weather and snow on 2 November. At this time all barge equipment was moved to storage, the mill and roaster shut down, and all services were cut off on all plant buildings, where possible.

Employment and Management

The average number of employees was 68, all on surface. M. R. MacPherson was general manager.

Little Long Lac Gold Mines Limited

McKenzie Red Lake Gold Mines Limited was incorporated in February 1933; in June 1966, McKenzie Red Lake Gold Mines Limited and Little Long Lac Gold Mines Limited were amalgamated under the name of Little Long Lac Gold Mines Limited. The authorized capitalization was 3,500,000 shares of no par value of which 2,170,000 shares have been issued. The officers and directors were: J. C. L. Allen, president and director; R. C. Stanley Jr., executive vice-president and director; P. K. Hanley, vice-president and director; Frank Buckle, vice-president; P. A. Allen, treasurer and director; T. D. Carlson, director; Miss B. A. Argo, secretary; D. M. Lorimer, comptroller. The head office is at Suite 400, 112 King Street West, Toronto 1. The mine address is McKenzie Island.

The property consists of 12 claims at the north end of McKenzie Island in Red Lake, Dome township, District of Kenora.

The mine operated from 1 January to 5 March; the mill from 1 January to 10 March 1966.

SHAFTS, MCKENZIE RED LAKE MINE

	CLAIM NUMBER	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
No. 1 shaft	KRL87	Vertical	3 (inactive)	feet	feet
No. 5 shaft	KRL87	-47 $\frac{1}{2}$ °	3	0	456
No. 2 winze	.....	-36°	3	250	2,480
No. 4 winze	.....	Vertical	3	1,250	1,252
					1,670

The following table gives the accumulated development footage to the time of closure, 5 March 1966:

LEVEL	DRIFTS	CROSSCUTS	RAISES
	TOTAL	TOTAL	TOTAL
	feet	feet	feet
150	1,828	384	475
250	3,689	1,184	1,322
350	3,460	616	2,262
450	8,251	1,721	3,691
550	5,596	1,033	2,266
650	8,945	1,810	5,124
750	4,908	1,194	1,563
850	13,494	3,048	5,979
950	3,869	1,009	1,401
1,050	14,536	4,665	10,870
1,150	312	186	165
1,250	15,015	3,762	10,265
1,350	.....	16	.....
1,450	8,320	2,489	8,423
1,600	4,527	4,310	5,356
1,650	24	353	.....
1,800	948	1,042	1,582
1,950	2,111	2,694	3,089
2,100	490	494	1,404
2,250	470	462	872
2,400	787	444	448
No. 5 shaft	121	5	3,730
Total	101,701	32,921	70,287

During the period of operation a total of 7,903 tons of ore was hoisted; 8,197 tons were milled at a daily average of 128 tons.

Employment and Management

The average number of employees was 21: 7 underground and 14 on surface. Alex Watt was 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; J. C. L. Allen, P. K. Hanley, T. D. Carlson, C. C. Huston, and P. A. Allen, directors; Miss B. A. Argo, secretary-treasurer; D. M. Lorimer, 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.

Annual Report for 1966

MACASSA DIVISION

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

Mining and milling operations continued throughout 1966.

SHAFTS, MACASSA DIVISION

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING 1966	VERTICAL DEPTH FROM SURFACE
				feet	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	574	6,927

The No 2 winze was sunk 574 feet in 1966, to a total depth of 2,302 feet below the collar, or a vertical depth of 6,927 feet below surface.

Development work during the year consisted of 2,905 feet of drifting, 1,545 feet of crosscutting, and 1,196 feet of raising. Total development footage to 31 December 1966 was as follows: 169,824 feet of drifts; 54,788 feet of crosscuts; 36,477 feet of raises. Macassa Gold Mines Limited is doing development work on Tegren Goldfield's property on contract. A total of 346 feet of drifting, and 118 feet of crosscutting was done from the 5,600-foot level of Macassa mine. Diamond-drilling in 1966 consisted of 79 holes totalling 14,558 feet from underground on Macassa property.

Added equipment installed included the following:

- 1 crusher, coarse bowl
- 2 stopers
- 2 rockdrills
- 1 tigger hoist

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

		1966	1965	1964
Gross	\$	2,062,733.09	2,192,785.13	2,402,229.52
Milled	tons	130,133	129,536	141,408
Recovery per ton	\$	15.85	16.93	16.99
Milled Tegren	tons	776	7,255	.....

In Canadian funds, average prices per ounce for gold and silver were \$37.72 and \$1.39. Prices were the same in 1965.

Estimated assistance under The Emergency Gold Mining Assistance Act is \$300,000.

Milling

In the plant, 139,909 tons were milled, which included 776 tons for Tegren mines. This gave a calendar day average of 358.7 tons. Total recovery was 93.2 percent.

For 1965, these figures were 374.8 tons and 93.8 percent.

Bullion recovery for Macassa comprised 54,328.38 ounces of gold and 9,613.30 ounces of silver. Since 1933 when milling started 4,075,901 tons of ore have been milled from which 1,708,045.39 ounces of gold and 273,562.65 ounces of silver have been extracted. Excluding cost aid, value amounts to \$61,886,190.25 and is equal to \$15.18 per ton.

It was found that the Macassa tailings were useful in keeping material in suspension in mill tanks at the lake tailings recovery of Lake Shore Mines. Tailings will be turned into their plant during the open season and some income from this source is expected during 1967.

Ore Reserves

Based on sampling from development faces, diamond-drilling and extension of known veins from stoping operations, the calculated ore reserves as of 31 December 1966 was as follows:

	TONS	OUNCES OF GOLD PER TON	VALUE AT \$35.00 PER OUNCE
Unbroken	579,600	0.43	\$15.16
Broken	27,084	0.37	12.88
Total reserve	606,684	0.43	\$15.09

Note:

Dilution factor of 10 percent applied to grade only. Classed as inaccessible and not included in the above figures, 17,600 tons, grade 0.43 ounce/ton.

Change in position for the year:

Unbroken ore is down	96,700 tons
Broken ore is down	2,888 tons
Total reserve is down	99,588 tons

Mining

The total break from all stoping operations was 118,475 tons of which 75 percent was obtained from filled and/or timbered stopes. During the period 38,802 tons of waste were placed as backfill.

Costs

	1966		1965	
	TONS MILLED	OUNCES PRODUCED	TONS MILLED	OUNCES PRODUCED
	130,133	54,328	129,536	59,120
	COST PER TON	COST PER OUNCE	COST PER TON	COST PER OUNCE
Development	\$ 3.353	\$ 8.031	\$ 2.014	\$ 4.413
Mining	9.018	21.601	8.406	18.418
Milling	2.915	6.982	2.655	5.816
Undistributed mine operating expense	0.669	1.603	0.616	1.351
	\$15.955	\$38.217	\$13.691	\$29.998
Add:				
Depreciation	0.292	0.700	0.304	0.667
Ontario Mining Tax	0.025	0.059	0.209	0.457
Head office administration	0.745	1.785	0.760	1.665
	\$17.017	\$40.761	\$14.964	\$32.787

Employment and Management

The average number of employees was 298: 199 underground and 99 on surface. M. R. MacPherson was mine manager.

Annual Report for 1966

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: M. K. Madsen, president and director; F. R. Marshall, vice-president and director; Miss Margaret Masterson, secretary-treasurer and director; H. H. Mackay and P. H. McCloskey, directors. The head office is at Suite 1109, 55 Yonge Street, Toronto 1. The mine address is Madsen.

The company's main property, comprising 64 claims, is located in Baird and Heyson townships, Red Lake area, District of Kenora. It is about 7½ miles southwest of the town of Red Lake.

Mining and milling operations continued throughout 1966.

SHAFTS, MADSEN RED LAKE GOLD MINE

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	DEPTH FROM SURFACE
No. 1 shaft	KRL11505	Vertical	2 (inactive)	feet 573
No. 2 shaft	KRL12528	Vertical	5	4,176

Development work in 1966 consisted of 1,680 feet of drifting and 1,127 feet of raising. Total development footage to 31 December 1966 was as follows: 166,995 feet of drifts; 32,203 feet of crosscuts; 67,201 feet of raises. Diamond-drilling in 1966 consisted of 793 holes, totalling 74,548 feet from underground, and 18 holes, totalling 14,622 feet from surface.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

The following figures show the production for 1966 and comparable figures for 1965:			
		1966	1965
Gold	oz.	69,999.031	87,632.198
Silver	oz.	11,743.14	14,335.83
Gross value of bullion	\$	2,657,165.51	3,326,452.29
Average price gold/oz.	\$	37.73	37.73
Average price silver/oz.	\$	1.39	1.39

Operating Costs

		1966		1965	
Milled	tons	246,505		292,681	
Produced	oz.	69,999.031		87,632.198	
		1956		1965	
		TOTAL COST	PER OUNCE	TOTAL COST	PER OUNCE
Development and exploration		\$ 254,347.34	\$ 3.634	\$ 402,374.07	\$ 4.592
Stopping and stope preparation		934,954.99	13.356	1,008,568.19	11.508
Tramming, hoisting and pumping		368,591.40	5.266	464,334.52	5.299
Crushing and conveying		81,114.37	1.159	90,050.52	1.028
Milling		341,993.95	4.886	352,200.19	4.019
Mine general		251,588.04	3.594	259,127.86	2.956
Employee benefits		321,344.80	4.590	296,169.22	3.380
Administration expenses		78,662.77	1.124	82,518.58	0.942
Marketing charges		23,886.43	0.341	25,983.23	0.297
		\$2,656,484.09	\$37.950	\$2,981,326.38	\$34.021
Deduct: estimated E.G.M.A.		625,000.00	8.929	585,000.00	6.676
Net operating cost		\$2,031,484.09	\$20.021	\$2,396,326.38	\$27.345

Ore Reserves

The estimated ore reserves for 1966 and comparable figures for 1965 are shown in the following table:

BLOCK	31 DECEMBER 1966		31 DECEMBER 1965	
	tons	grade	tons	grade
Surface to 7th level	.....	.....	20,380	0.260
7th level to 11th level	12,440	0.347	15,000	0.304
11th level to 17th level	174,910	0.253	156,690	0.272
17th level to 23rd level	372,650	0.303	472,930	0.311
Broken reserve	.....	.....	.....	.....
Total Reserves	560,000	0.289	665,000	0.300

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

New ore found in the walls of active stopes and free ore drawn from old workings amounted to 141,000 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.

		1966	1965	1964	11 AUGUST 1938 TO 31 DECEMBER 1966
Treated	tons	246,505	292,681	305,823	6,673,787
Operating time of total time	percent	80.42	95.75	98.01	95.62
Treated per calendar day	tons	675.36	801.87	835.58	643.57
Average gold assay heads	oz.	0.30865	0.32268	0.33415	0.31736
Average gold assay tails	oz.	0.02468	0.02327	0.02321	0.01968
Recovery	percent	92.00	92.79	93.04	93.80

The deslimed mill tailings placed as backfill amounted to 115,690 tons for a total of 1,571,369 tons to date.

Employment and Management

The average number of employees was 301: 157 underground and 144 on surface. K. R. North was manager.

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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 2,389,182 shares have been issued. The directors and officers were: J. D. Barrington, president and managing director; W. B. Dix, vice-president, treasurer and director; M. A. Cooper, H. J. Fraser, J. C. Fraser, Norman D'Arcy, J. G. Glassco, J. O. Hambro and S. M. Wedd, directors; M. L. Urquhart, senior vice-president; J. K. Godin, general manager; F. T. McKinney, secretary. The address of the head office and the mine office is Schumacher. The executive office is at Suite 1500, 25 King Street West, Toronto.

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-Trethewey Mines Limited was purchased by McIntyre and became the Castle Division of McIntyre and is reported on in the section on "Silver-Cobalt" in this Volume.

Mining and milling at the McIntyre mine continued throughout 1966.

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.	Surface	2,389
			4 below 1,375 ft.		
			3 to 1,000 ft.		
No. 6	13710	Vertical	4 below 1,000 ft.	Surface	3,015
No. 7	13318	Vertical	2 and 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 2,157 feet of drifting, 1,068 feet of crosscutting, and 365 feet of raising. Total development footage for gold ore to 31 December 1966 was as follows: 671,564 feet of drifts; 309,183 feet of crosscuts; 61,639 feet of raises. Development for copper ore in 1966 consisted of 10,712 feet of drifts and crosscuts, 2,756 feet of raises. Total development for copper ore to 31 December 1966 was 60,034 feet of drifts and crosscuts; 19,539 feet of raises. Diamond-drilling in 1966 consisted of 597 holes, totalling 49,821 feet, from underground.

Added equipment in 1966 consisted of the following:

- 1 slusher hoist, double drum, 125 hp.
- 2 folding scrapers (one 72 in., one 60 in.)
- 1 loader, MR 250
- 1 drill, model SFH 99, deep-hole
- 1 loader, M-104A
- 1 fan, 72 in., 150,000 cfm.

A total of 406,140 tons of gold ore was hoisted and milled; 665,545 tons of copper ore was hoisted and milled.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

During the year, 665,545 tons of copper ore were milled from which were recovered 10,416,113 pounds of copper and 9,434 ounces of gold. The fold operation produced 113,649 ounces of gold and 9,299 ounces of silver from the milling of 403,665 tons. Revenue for all metals sold amounted to \$10.9 million resulting in an operating profit of \$3.4 million after depreciation and amortization but including Emergency Gold Mining Assistance. Capital expenditures were \$167,200 with \$36,765 being spent underground on the copper operation and the remainder of \$130,435 on surface, mostly for alterations to the copper milling circuit and replacement of equipment.

Copper Development

Development amounted to 13,468 feet made up of 10,712 feet of lateral work and 2,756 feet of raising. Of the above total 10,327 feet were for slope preparation and 3,141 feet for permanent openings. Diamond-drilling amounted to 24,185 feet. An agreement was reached with Westfield Minerals whereby McIntyre may explore the old Coniaurum mine up to a maximum distance of 500 feet from the common boundary. At the time of writing, limited diamond-drilling from 3,375-foot level indicates that the ore extends into Coniaurum with the copper grade being slightly lower and the gold content appearing to be a little higher.

Diamond-drilling from 2,625-line drive outlined the tops of two stopes with the addition of 160,000 tons and indicated three additional orebodies which require further drilling. Three stopes were pulled empty during the year and a total of 260,000 tons of hydraulic backfill was placed. Long hole drilling in stopes totalled 266,705 feet and 344,000 tons of ore were drilled off but not blasted at the year end.

Gold Development

Development work in potential ore areas totalled 3,590 feet. On the Hollinger lease some ore was outlined between the 5,525-, and 5,675-foot levels. In the No. 15 shaft area, drifting and diamond-drilling indicates an ore shoot between the 7,275-, and 7,575-foot levels. Exploration is continuing in the hope that reserves here can be enlarged.

Copper Ore Reserves

	1966			1965		
	TONS	COPPER TONS	PERCENT	TONS	COPPER TONS	PERCENT
Defined by drilling	3,676,000	32,183	0.88	3,426,000	34,348	1.00
Broken	289,000	2,525	0.88	297,430	2,916	0.98
	<u>3,965,000</u>	<u>34,708</u>	<u>0.88</u>	<u>3,723,430</u>	<u>37,264</u>	<u>1.00</u>

Annual Report for 1966

Gold Ore Reserves

	1966		1965	
	TONS	FINE OZ. GOLD	TONS	FINE OZ. GOLD
Estimated in place	804,000	268,400	1,036,000	333,592
Broken ore	54,000	12,800	57,000	14,478
	<u>858,000</u>	<u>281,200</u>	<u>1,093,000</u>	<u>348,070</u>
Average grade per ton		0.328		0.318

Employment and Management

The average number of employees was 830: 513 underground and 317 on surface. P. B. McCrodan was mine manager.

MacLeod-Cockshutt Gold Mines Limited

MacLeod-Cockshutt Gold Mines Limited was incorporated in September 1933 with an authorized capitalization of 3,000,000 shares of \$1 par value, of which 2,862,490 shares have been issued. Late in 1958 control of the company was acquired by the Little Long Lac Gold Mines Limited interests. The directors and officers were: J. C. L. Allen, president and director; R. C. Stanley Jr., vice-president and director; H. E. Rudd, vice-president, general manager and director; Miss B. A. Argo, secretary and director; J. D. Bryce, P. A. Allen and P. K. Hanley, directors; D. M. Lorimer, comptroller. The head office is at Suite 400, 112 King Street West, Toronto 1. The mine address is Geraldton.

The property comprises 24 claims in Ashmore and Errington townships, District of Thunder Bay.

Mining and milling continued throughout 1966.

SHAFTS, MACLEOD-COCKSHUTT MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	TOTAL DEPTH FROM SURFACE
				feet	feet
No. 1	TB10040	Vertical	3	Surface	2,250
No. 2	TB10038	Vertical	4	Surface	1,921
No. 3	.....	45°	3	1,571	2,001

Development work during the year consisted of 7 feet of drifting and 62 feet of crosscutting. Total development footage to 31 December 1966 was as follows: 107,280 feet of drifts; 29,449 feet of crosscuts; 34,743 feet of raises. Diamond-drilling in 1966 consisted of 2 holes totalling 199 feet of underground.

Major construction in 1966 consisted of an addition to the garage, and a cyanide tank in the mill.

New added equipment included the following:

- 2 trucks
- 1 cyanide feeder
- 2 scrapers, 48-in.
- 1 loader
- 1 battery, 48 cell
- 6 rock drills
- 1 hoist panel, No. 2 shaft, from 250 to 400 hp.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

During 1966 the mine produced 9,783 ounces of gold and 1,039 ounces of silver from 108,558 tons of ore averaging 0.090 ounce of gold recovered per ton. Revenue from this production amounted to \$370,467 or \$3.41 per ton.

A growing shortage of labour was responsible for a delay in the stope development of the small higher grade ore lenses in the porphyry zone so that the average grade of ore mined was below the ore reserve estimate.

The labour shortage also resulted in a reduction in the quantity of ore hoisted. The mill operated at an average rate of 1,763 tons per day, treating 297 tons per day from MacLeod-Cockshutt and 1,466 tons per day from Consolidated Mosher.

Mosher's deep development program on the 17th and 18th levels was completed in early 1967 and showed that under present conditions there was no profitable ore in the downward extension of the known ore zones. In view of these results and Mosher's operating loss in 1966, it was decided to place both mines on a salvage basis as of 1 February 1967.

Mine Rescue Trophy

The provincial mine rescue trophy was won in 1966 by the team from MacLeod-Cockshutt mine.

Employment and Management

The average number of employees at the MacLeod and Consolidated Mosher operations was 371: 186 underground and 184 on surface. H. E. Rudd was vice-president and general 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: R. V. Porritt, president and director; W. S. Row, vice-president and director; D. E. G. Schmitt, general manager and director; J. O. Hinds, P. D. P. Hamilton, J. H. Stovel and K. C. Gray, directors; R. C. Ashenhurst, secretary; E. 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 33 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 1966.

Annual Report for 1966

SHAFTS, PAMOUR MINE

	CLAIM NUMBER	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	TOTAL DEPTH FROM SURFACE
No. 1 shaft	P13793	Vertical	2 (inactive)	feet	feet
No. 2 shaft	P13793	Vertical	2 (inactive)	Surface	220
No. 3 shaft	P13783	Vertical	5	Surface	110
No. 4 shaft	.....	Vertical	3	600	3,144
					2,437

Development work during the year consisted of 3,556 feet of drifting, 2,581 feet of crosscutting, and 3,647 feet of raising. Total development footage to 31 December 1966 was as follows: 186,696 feet of drifts; 45,784 feet of cross-cuts; 128,999 feet of raises.

Major equipment installed consisted of replacing 4½-ton skips with 6½-ton aluminum steel skips, bottom dump.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Stoping

Stoping was carried on in the east and west sections of the mine, with 25 percent of the ore produced being from lava formations. The east end accounted for 78 percent of the tonnage mined. Cut-and-fill stopes provided 3 percent of the ore, slusher stopes 11 percent, blast hole stopes 27 percent, and shrinkage the remainder.

Ore Reserves (at 31 December 1966)

	ORE	GRADE
	tons	oz. per ton
BROKEN		
East end	574,800	0.101
West end	139,750	0.100
Total	714,550	0.101
IN-PLACE		
East end	707,790	0.114
West end	193,550	0.130
Total	901,340	0.117
TOTAL ORE		
East end	1,282,590	0.108
West end	333,300	0.117
Grand Total	1,615,890	0.110

Allowance for normal dilution was made in calculating the tonnage and grade of ore reserves. After milling 612,500 tons, total ore reserves were decreased by 85,760 tons, and the grade increased slightly.

Mill

		1966	1965
Milled	tons	612,500	584,500
Milled per calendar day	tons	1,678	1,601
Average gold content	oz. per ton	0.114	0.118
Average tailings loss	oz. per ton	0.009	0.009
Total recovery	percent	92.3	92.2
Gold production	oz.	64,530	63,565
Value of total production	\$	2,444,200	2,409,200

Employment and Management

The average number of employees was 365: 202 underground and 163 on surface. W. J. Marshall was manager.

Pick Mines Limited

Pick Mines Limited was incorporated in July 1959, with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 3,693,750 shares have been issued. The directors and officers were: George Sherman, president and director; Ronald Sherman, vice-president and director, C. A. Walton, director; Harry Findlay, secretary; Irwin Dubros, treasurer. The head office is at Suite 800, 100 Adelaide Street West, Toronto 1. The mine address is Lochalsh.

The company acquired the Cline and Pick groups of 16 claims, comprising approximately 693 acres in Township 48, District of Algoma about 12 miles east of Goudreau, from Cline Lake Gold Mines Limited in 1960. Between 1938 and 14 October 1942 Cline Lake had milled some 331,842 tons of ore and had recovered 62,328 ounces of gold and 10,598 ounces of silver having a total value of \$2,369,053. During 1960-1961 Pick Mines completed a limited amount of development and construction after which the property was idle.

SHAFTS, PICK MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
				feet	feet
1	SSM2186	Vertical	.....	Surface	140
2	SSM2185	—70°	.....	Surface	202
3	SSM2185	Vertical	.....	Surface	115
4	SSM2171	Vertical	(3 surf. to 625 ft.) (4 625 ft.—bottom)	Surface	1,196

There was no development work carried out in 1966.

Total development footage to 31 December 1966 was as follows: 12,707 feet of drifts, 6,496 feet of crosscuts and 1,900 feet of raises. Some 15 diamond-drillholes, totalling 1,566 feet were completed from underground, and 8 holes totalling 2,500 feet were completed from surface.

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Employment and Management

R. Last was in charge; the company and contractor employed a total of 6 men during the period of operation.

Pickle Crow Gold Mines Limited

Pickle Crow Gold Mines Limited was incorporated in January 1934; in April 1959, the capitalization was increased to 5,000,000 shares of \$1 par value, of which 3,554,818 shares have been issued. The directors and officers were: N. B. Keevil, president and director; C. G. MacIntosh, and J. B. Anderson, vice-presidents and directors; Sir Michael Butler, Bt., and J. H. Westell, directors; J. A. S. Gibson, secretary; D. S. Brown, treasurer. The head office is at Suite 1000, 11 Adelaide Street West, Toronto 1. The mine address is Pickle Crow.

The property consists of 98 claims in Connell and McCullagh townships, Pickle Lake area, District of Kenora.

Mining operations continued from 1 January to 31 August, milling from 1 January to 2 September, 1966.

SHAFTS, PICKLE CROW MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
				feet	feet
No. 1	747	Vertical	3 (0—1,200-foot) 4 (1,200—2,450-foot) 3 (2,450 to bottom)	Surface	3,042
No. 3	2062	Vertical	3 (0—1,554-foot) 4 (1,554—2,600-foot) 3 (2,600 to bottom)	Surface	3,025
No. 2	.....	Vertical	3 (inactive)	721	1,518
No. 4	.....	Vertical	3 (2,900—3,707-foot) 4 (3,707—3,835-foot) 3 (3,825 to bottom)	2,900	4,038

The following table gives the accumulated development footage to the time of closure, 31 August 1966.

	LEVEL TOTAL	DRIFTS TOTAL	CROSSCUTS TOTAL	RAISES TOTAL
No. 1 Vein	feet	feet	feet	feet
	125	1869	140	652
	250	1216	222	359
	375	1643	379	300
	500	1561	291	468
	625	1311	232	405
	750	2426	7055	370
	900	1417	229	657
	1050	1415	384	530
	1200	1750	354	571
	1350	1132	1129	799
	1500	1315	668	638
	1650	1030	623	594
	1800	1074	940	531
	1950	936	724	1149
	2075	793	.....	367

	LEVEL TOTAL	DRIFTS TOTAL	CROSSCUTS TOTAL	RAISES TOTAL
	feet	feet	feet	feet
	2200	775	806	1046
	2450	1923.5	1380	971
	2600	689	617	123
	2900	737	.....	713
	3200	705	1144	358
	3500	.....	200	.....
I.F. Zone	3800	.....	501	.....
	2450	233	.....	.....
	2600	874	310	345
	2750	10	396	.....
No. 2 Vein	2900	.....	595	.....
	250	907	1915	434
	400	1996	1355	2035.5
	550	1279	857	1147
	600	.....	.....	75
	750	2454	1727	1512
	850	1432	771	1141
	975	2405	1585.5	1850
	1100	1265	1892	1549
	1225	1085	1060	1023
	1350	.....	144	182
	1475	923	1549	1866
No. 5 Vein	1600	866	2164	296
	375	637	1362	511
	750	1621	539	461
	1050	1642	.....	383
	1350	790	1603	605
	1500	341	1179	368
	1800	525	937	650
	2200	1464	.....	735
	2450	371	.....	411
	2600	467	.....	402
	2900	1811	67	963
	3050	377	414	170
	3200	396	381	157
	3350	392	294	164
	3500	303	269	182
	3650	328	254	186
No. 6 Vein	3800	314	261	50
	1225	459	611	37
	1475	697	213	669
	1600	841	23	373
	1750	1146	739	834
	1900	900	781	791
	2050	674	670	401
	2200	836	617	425
	2350	981	568	649
	2460	982	758	364
	2600	1439	.....	774
	2725	1726	.....	346
	2850	481	702	410
No. 7 Vein	3000	346	16	.....
	2200	208	142	.....
	2350	820	98	74
	2460	283	279	85
	2600	360	122	11
	2725	362
	2850	274	140	52
	3000	394	325

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	LEVEL TOTAL	DRIFTS TOTAL	CROSSCUTS TOTAL	RAISES TOTAL
No. 8 Vein	feet	feet	feet	feet
	2350	326	151	59
	2460	648	482	110
	2600	381	.....	226
	2725	219	.....	168
	2850	159	.....	167
	3000	187	171	168
No. 9 Vein				
	2200	311	.....	468
	2450	185	144	336
	2600	427	.....	207
	2750	527	285	243
	2900	591	.....	178
	3050	374	.....	130
	3200	220	90	128
	3350	268	113	154
	3500	278	.....	153
	3650	308	171	87
	3800	553	368	.....
No. 10 Vein	2460	327	322	107
No. 11 Vein	750	167	.....	.....
No. 12 Vein	2900	219	.....	37
No. 13 Vein				
	250	188	.....	.....
	400	318	175	40
	750	370	449	95
	1225	174	370	.....
No. 1 Shaft General				
	250	.....	31	6
	500	.....	.....	6
	625	.....	.....	7
	750	.....	.....	330
	900	.....	.....	6
	1050	.....	.....	8
	1200	.....	.....	5
	2600	.....	25	212
	2750	205	126	7
	2900	219	4145	1282.5
No. 3 Shaft General				
	400	.....	26	220
	550	.....	20	222
	750	.....	517	105
	1900	.....	.....	171
	2200	.....	.....	394
	2350	32	.....	579
	2460	.....	.....	281
	2525	.....	.....	100
	2600	23	.....	.....
	2725	.....	.....	186
	2850	.....	543	179
	2900	.....	.....	30
	3000	.....	7	253.0
No. 4 Shaft General				
	3050	.....	176.5	8
	3200	.....	54	189
	3350	.....	156	213
	3500	.....	101	253
	3650	.....	86	314
	3800	.....	521	519
	3860	.....	.....	84
Total		75,638.5	58,528.0	47,180.0

Diamond-drilling in 1966 consisted of 4 holes, totalling 495 feet, from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

From 1 January to the close of operations in September and October, the mill treated a total of 60,743 tons of ore yielding 26,852 ounces of gold and 2,185 ounces of silver. Total production amounted to \$1,013,975 for a recovery of \$16.67 per ton treated.

Grade of ore milled was above mine average for the period due to salvage mining being concentrated on the higher grade sections of the reserves. The mill cleanup is reflected in the increased production. A comparison of milling results is as follows:

		1966 TO SEPT.		1965
Milled	tons	60,743	105,864	
Gold recovered	oz.	26,852	33,304.87	
Silver recovered	oz.	2,185	2,474.39	
Gold recovered per ton	oz.	0.442	0.3146	
Recovery	percent	N/A	98.55	

Operating Costs

Total operating costs amounted to \$1,222,489. This figure was reduced by \$263,827 cost aid to \$958,662, or \$15.78 per ton, leaving an operating profit of \$55,313. A comparative analysis of operating costs for 1966 and 1965 follows:

	1966	1965	PER TON ORE TREATED		PER OUNCE GOLD RECOVERED	
			1966	1965	1966	1965
Development	\$ 9,113	\$ 155,351	\$ 0.15	\$ 1.47	\$ 0.34	\$ 4.66
Mining	522,178	874,592	8.60	8.26	19.45	26.26
Milling	189,329	233,432	3.12	2.20	7.05	7.01
General mine expense	452,717	348,682	7.45	3.30	16.86	10.47
Administrative expense	49,152	56,123	0.81	0.53	1.83	1.69
	<u>\$1,222,489</u>	<u>\$1,668,180</u>	<u>\$20.13</u>	<u>\$15.76</u>	<u>\$45.53</u>	<u>\$50.09</u>

Operational Data, Years 1935 to 1966

Milled	tons	3,217,572
Gold produced	oz.	1,448,177
Silver produced	oz.	168,916
Production	\$	52,079,000
E.G.M.A.	\$	3,794,000
Salaries and wages paid	\$	21,619,000
Supplies and equipment purchased	\$	21,105,000
Taxes	\$	3,238,000
Dividends to shareholders	\$	12,375,000

Ore Reserves

Despite considerable investigation by re-entry and sampling of previously abandoned areas, no new ore was found during the year. Economic and ground conditions enforced the withdrawal of much of the previous year's ore reserve from the category of "mineable ore". The last ore was hoisted on 29 August 1966.

Annual Report for 1966

Mining

All mining was completed on the known economic vein systems to the lowest levels of No. 3 and No. 4 shafts. In addition, pillar and remnant extraction took place on the upper levels of the mine including 110 west stope, which was mined up to a short distance of surface between the hoist room and No. 1 shaft itself.

Employment and Management

The average number of employees was 117: 51 underground and 66 on surface. G. A. Vary was mine manager.

Porcupine Paymaster Limited

Paymaster Consolidated Mines Limited was incorporated in February 1930 with an authorized capitalization of 9,000,000 shares of \$1 par value, of which 8,629,090 shares had been issued. In April 1964, the name was changed to Porcupine Paymaster Limited, and the authorized capitalization was reduced to 5,000,000 shares of no par value, of which 2,876,370 shares have been issued. Shareholders received one share Porcupine Paymaster for three shares of Paymaster Consolidated. The directors and officers were: W. C. Ringsleben, president and managing director; H. D. Rothwell, vice-president and director; L. G. Sams, Marshal Stearns, S. A. Caldbick, C. A. Burns, and G. A. Hunter, directors; A. C. Buckley, secretary-treasurer. The head office and mine office are at P.O. Box 100, South Porcupine.

The main property, comprising 751.6 acres is in Deloro and Tisdale townships, Porcupine area, District of Cochrane.

The mine operated from 1 January to 12 April; the mill from 1 January to 19 April 1966.

SHAFTS, PORCUPINE PAYMASTER MINE

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
Shaft 1	TRS776	Vertical	2 (inactive)	Surface	80
Shaft 2	TRS776	Vertical	2 (inactive)	Surface	814
Shaft 3	TRS776	Vertical	4 (inactive)	Surface	400
Shaft 4	HS747	Vertical	2 (inactive)	Surface	253
Shaft 5	14115	Vertical	3	Surface	4,462
Shaft 6	13128	60°	2 (inactive)	Surface	482
Shaft 7	14114	Vertical	2 (filled)	Surface	75
Shaft 8	14115	Vertical	2 (filled)	Surface	185
Shaft 9	14115	Vertical	1 (inactive)	Surface	185
Winze 1	.....	75°	2 (inactive)	1,040	1,202
Winze 2	.....	Vertical	2 (inactive)	1,033	1,615
Winze 3	.....	Vertical	2 (inactive)	1,023	2,093
Winze 4	.....	Vertical	2 (inactive)	428	1,043
Winze 5	.....	Vertical	3	2,046	4,202
Winze 6	.....	Vertical	3	4,059	6,157

The following table gives the drifting completed in 1966, and the accumulated development footage to the time of closure, 12 April 1966.

LEVEL	DRIFTS		CROSSCUTS	RAISES
	1966	TOTAL	TOTAL	TOTAL
	feet	feet	feet	feet
SHAFTS 2 AND 3				
Tunnel	144.0	130.0	.....
38	76.0	27.0	.....
100	920.9	1,156.0	.....
200	769.1	395.2	70.0
300	4,543.3	2,335.5	602.4
400	2,422.5	3,500.2	577.5
600	1,520.9	901.9	991.0
800	892.0	839.0	.....
VIA ANKERITE SHAFT				
475	1,537.0	.....
1,400	505.0	218.0	141.0
1,550	627.0	.....	184.0
1,700	314.0	29.0	386.0
2,000	140.0	.....	68.0
3,100	640.0	50.0	.....
3,250	172.0	49.0	.....
3,450	175.0	.....	210.0
SHAFT 4				
100	450.0	312.0	.....
200	467.0	240.0	.....
SHAFT 5				
60	988.0	393.0	.....
120	1,171.0	303.0	.....
180	2,769.0	713.0	5.0
300	2,543.0	887.0	.....
400	3,430.0	1,493.0	186.0
500	1,406.0	927.0	67.0
600	2,224.4	338.0	53.0
750	1,806.4	251.4	.....
900	2,735.6	367.4	263.0
1,050	8,463.0	4,660.1	1,887.6
1,200	3,210.0	545.0	687.5
1,325	3,202.2	662.1	805.1
1,450	3,135.0	710.9	400.0
1,575	6,974.9	2,163.8	984.5
2,075	6,348.9	4,166.9	3,640.4
2,575	7,018.6	12,809.4	1,673.9
2,700	149.0
2,850	202.0
3,000	198.5	207.5
3,150	14.0	200.5
3,300	1,382.0	1,531.5	383.0
3,450	205.5
3,600	1,407.0	1,140.3	273.5
3,750	2,197.5	1,016.0	658.5
3,900	2,442.0	1,283.4	1,812.0
4,075	7,528.4	7,068.2	4,673.0
4,375	67.0
SHAFT 6				
100	266.0	908.0
200	2,804.0	317.0	318.0
300	5,824.2	1,863.8	426.9
400	3,959.5	820.0	488.0

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LEVEL	DRIFTS		CROSSCUTS	RAISES
	1966	TOTAL	TOTAL	TOTAL
	feet	feet	feet	feet
WINZE 3				
1,225	2,763.3	1,176.2	501.3
1,400	2,345.3	1,585.0	433.5
1,740	5,567.9	1,283.7	1,659.0
1,910	6,158.4	1,183.6	3,090.3
WINZE 4				
525	3,661.5	833.7	848.8
675	4,258.5	782.1	1,210.7
800	1,547.1	512.1	773.8
1,000	1,172.8	255.2	391.5
WINZE 5				
2,200	4,939.0	710.4	2,168.6
2,325	5,584.9	1,259.8	2,090.8
2,450	2,976.0	286.1	1,428.7
2,700	4,579.8	730.4	2,857.7
2,825	5,128.8	1,470.7	3,068.0
2,950	5,057.1	519.9	3,014.9
3,075	5,217.4	645.8	2,433.2
3,200	4,780.0	529.8	2,445.4
3,325	3,764.9	472.5	1,548.8
3,450	3,424.0	515.9	1,616.4
3,575	3,462.2	708.3	2,154.0
3,700	3,626.0	702.6	1,848.9
3,825	2,716.6	666.2	1,749.3
3,950	2,725.8	791.3	1,431.8
WINZE 6				
4,225	2,429.0	1,027.0	1,728.0
4,375	64.0	2,598.0	1,782.0	1,858.0
4,525	1,204.0	680.0	175.0
4,675	12.0	169.0
4,825	159.0
4,975	26.0	632.0
5,425	1,232.0	420.0	15.0
5,575	1,578.0	448.0	291.0
5,725	60.0	703.0	416.0	191.0
5,875	1,083.0	421.0	198.0
6,025	994.0	452.0	297.0
Total	124.0	197,293.6	82,576.8	68,245.7

Diamond-drilling in 1966 consisted of 3 holes from underground, totalling 493 feet.

A total of 30,261 tons of ore was hoisted; 33,129 tons were milled at a daily average of 304 tons.

Company Annual Report

The following is taken from the company annual report for the year ending 30 June 1966.

Ore Reserves

	TONS	GRADE
Above 4,375-foot level	88,500	.232
Between 4,375- and 6,025-foot level	295,300	.256
	<u>383,800</u>	<u>.250</u>

Milling

Milled	tons	108,284
Average per day	tons	365
Gold produced	oz.	30,681.18
Average mill head grade	oz. per ton	0.283
Average recovery	percent	95.16

Costs

The following is an analysis of the mine operating costs for the portion of the fiscal year to the time of commencing mill clean-up operations.

	TOTAL COST	COST PER TON MILLED
Diamond-drilling	\$ 1,589.35	\$.01
Drifting	72,790.42	.67
Raising	8,540.78	.08
Mining	829,163.11	7.66
Ore transportation	16,806.11	.16
Crushing	35,760.37	.33
Milling	184,876.12	1.71
General expense	110,479.27	1.02
	<u>\$1,260,005.53</u>	<u>\$11.64</u>

Employment and Management

The average number of employees was 84: 55 underground and 29 on surface. W. C. Ringsleben was president and general manager.

Preston Mines Limited

Preston East Dome Mines Limited was incorporated in January 1911, and was reorganized in February 1936 and in September 1957. In August 1960 the name was changed to Preston Mines Limited, on the amalgamation of Preston East Dome Mines with Stanleigh Uranium Mining Corporation Limited, with an authorized capitalization of 10,000,000 shares of no par value, of which 6,728,000 have been issued. The directors and officers were: W. B. Malone, president and director; W. P. Arnold, G. Baker, vice-presidents and directors; R. D. Lord, director and general manager of operations; J. I. Crookston, G. B. Langford, W. C. Pitfield, and G. R. Albino, directors; E. S. W. Hunt, vice-president; G. R. Devey, secretary; D. G. Scott, treasurer. The head office is at 120 Adelaide Street West, Toronto 1. The mine address is South Porcupine.

The property comprising 16 claims, immediately south and east of the Dome mine, is located in Tisdale and Deloro townships, Porcupine area, District of Cochrane.

Mining and milling operations continued throughout 1966.

SHAFTS, PRESTON MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	TOTAL DEPTH FROM SURFACE
No. 1	P13151	63°	2 (escape)	feet	feet
No. 2	P13151	Vertical	5	Surface	95
No. 3	Vertical	3 to 69 feet above 28th; 4 to bottom	2,166	4,170
No. 4	P12971	Vertical	3 (inactive)	Surface	400

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Development work during the year consisted of 2,641 feet of drifting, 1,308 feet of crosscutting, and 1,364 feet of raising. The total development footage to 31 December 1966 was as follows: 138,907 feet of drifts; 165,576 feet of crosscuts; 71,082 feet of raises. Diamond-drilling in 1966 consisted of 107 holes, totalling 9,996 feet from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

		1966	1965
Milled	tons	155,000	180,810
Average per milling day	tons	587	613
Gold produced (est.)	oz.	29,880	33,995
Silver produced (est.)	oz.	3,949	3,989
Average mill heads	oz. per ton	0.201	0.196
Average net recovery	oz. per ton	0.193	0.188
Average gold in tailings	oz. per ton	0.0083	0.0084
Average recovery	percent	95.9	96

Tons milled were 14 percent less than in 1965, mainly because of the 40-hour week introduced in May 1966, and labour shortage during part of the year. The grade of mill feed was marginally better than last year.

Costs

	PER TON MILLED	
	1966	1965
Development and diamond drilling	\$1.24	\$1.48
Mining	6.35	5.88
Milling	1.43	1.32
Total cost per ton milled	\$9.02	\$8.68

The 4 percent increase in operating costs was due to higher wages, material and service expense as well as the lower tonnage milled.

Employment and Management

The average number of employees was 219: 131 underground and 88 on surface. G. F. Greenacre was mine 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 Mines Limited. The officers and directors were: John D. Bryce, president and director; R. C. Stanley Jr., vice-president and director; Miss B. A. Argo, secretary-treasurer

and director; P. K. Hanley, J. C. L. Allen, P. A. Allen, and C. C. Huston, directors. 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 1966.

SHAFTS, RENABIE MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	SINKING 1966	TOTAL DEPTH BELOW SURFACE
				feet	feet
No. 1	S34314 (Leeson twp.)	Vertical	3	.....	281
No. 2	S34317 (Leeson twp.)	Vertical	3	208	3,514

The No. 2 shaft was sunk 208 feet to a total depth of 3,514 feet below the collar. The 3,375 loading pocket and 3,460 sump level were established at 3,381 and 3,466 feet respectively below the shaft collar. Development work during the year consisted of 1,505 feet of drifting, 1,060 feet of crosscutting, and 783 feet of raising. Total development footage to 31 December 1966 was as follows: 42,755 feet of drifts; 21,490 feet of crosscuts; 27,220 feet of raises. Diamond-drilling in 1966 consisted of 60 holes, totalling 13,357 feet from underground.

New construction in 1966 consisted of six new houses, 36 x 26 feet for employees, and a cookery 96 x 40 feet.

Added equipment included the following:

- 3 skips, aluminum, 4-ton capacity
- 1 trammer
- 1 rock drill

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

		1966	1965	1964
Gross recovery	\$	1,467,050	1,430,817	1,222,728
Milled	tons	162,580	165,018	171,830
Recovery per ton	\$	9.02	8.67	71.2

Milling

The average tons milled per day in 1966 was 445.4 compared to 452.1 in 1965. Bullion recovery comprised 38,387.39 ounces of gold, and 13,822.37 ounces of silver.

From the commencement of milling operations (July 1947), 3,151,665 tons of ore have been milled, from which has been recovered 658,428.48 ounces of gold and 208,251.03 ounces of silver, having a gross recovered value of \$23,973,793.22, equivalent to \$7.61 per ton milled, exclusive of cost aid.

There were no changes in the mill circuit during the year. The recovery at 93.8 percent remained the same as in 1965. The overall milling cost increased to \$2.36 per ton from \$2.08.

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Ore Reserves

The technical position of ore reserves at the year end after allowing for dilution and without including any ore below the 2,475-foot level was as follows:

	TONS	OUNCES PER TON	VALUE \$35.00 GOLD
Unbroken ore	190,442	0.23	8.05
Broken ore	82,149	0.24	8.40
Total	272,591	0.23	\$8.05

Costs

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

	1966		1965	
	TONS MILLED	OUNCES RECOVERED	TONS MILLED	OUNCES RECOVERED
	162,580	38,387.39	165,018	37,421.44
	PER TON	PER OUNCE	PER TON	PER OUNCE
Development and exploration	\$ 1.80	\$ 7.63	\$ 2.33	\$10.27
Mining	4.14	17.54	3.34	14.74
Milling	2.36	10.00	2.08	9.18
Undistributed operating charges including administration and head office	1.01	4.28	.82	3.60
Operating costs	\$ 9.31	\$39.45	\$ 8.57	\$37.79
Depreciation	.71	3.00	.60	2.62
Provision for taxes	.08	.31	.06	.27
	\$10.10	\$42.76	\$ 9.23	\$40.68

Employment and Management

The average number of employees was 185: 94 underground and 91 on surface. W. A. Moore was mine manager.

Sapawe Gold Mines Limited

Lindsay Explorations Limited was incorporated in February 1955; in January 1963 the name was changed to Sapawe Gold Mines Limited, with an authorized capitalization of 10,000,000 shares of \$1 par value, of which 8,292,376 shares have been issued. The directors and officers were: W. J. LaMorte, president and director; J. A. Moss, W. M. Zilbersher, T. V. Tozzi, S. W. Erickson and R. B. Krize, directors; Eileen McBain, secretary; W. H. Connolly, treasurer. The head office and mine address is Box 759, Atikokan.

The property comprises 52 claims in McCaul and Hutchinson townships, Fort Frances district, located about 15 miles east of Atikokan, and connected to the Atikokan highway by road.

Mining and milling continued throughout 1966.

The vertical, three compartment No. 1 shaft collared in claim FF3417 has a depth of 1,016 feet below the collar. Development footage in 1966 consisted of 2,070 feet of drifting, 53 feet of crosscutting, and 1,468 feet of raising. Total

development footage to 31 December 1966 was as follows: 3,877 feet of drifts; 2,198 feet of crosscuts; 2,724 feet of raises. Altogether, 119 diamond-drillholes totalling 4,333 feet were completed from underground in 1966.

Added equipment in 1966 was as follows:

- Cookery:
 - 1 refrigerator
 - 1 electric range
- Mill:
 - 3 pumps, various sizes
- Mine:
 - 1 pump
 - 1 locomotive battery
 - 2 mine telephones
 - 1 mine car
 - 2 water pressure reducers
- Assay Office:
 - 2 scales
 - 1 sample dryer
 - 1 slag pot
- Office:
 - 1 calculator
 - 1 air conditioner

A total of 13,957 tons of ore was hoisted; and a total of 14,600 tons was milled, at an average of 55 tons daily.

Employment and Management

The average number of employees was 42: 23 underground and 19 on surface. A. F. Heather, vice-president and mine manager was in charge.

Stairs Exploration & Mining Company Limited

Stairs Exploration and Mining Company Limited was incorporated in March 1962 with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 2,600,005 shares have been issued. The directors and officers were: I. C. Stairs, president and director; G. P. Stairs, vice-president and director; E. F. Stairs, director; Miss M. A. Calnan, secretary-treasurer. The head office is at P.O. Box 520, 920 Bridge Street, Bathurst, New Brunswick. The mine address is P.O. Box 189, Matachewan.

The property is a gold prospect consisting of 77 claims located in Midlothian township, District of Timiskaming.

The mine operated from 1 January to 30 April; the mill from 1 January to 15 May 1966.

SHAFTS, STAIRS MINE

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
No. 1 inclined adit	MR26662	-20°	1	feet Surface	feet 100
No. 2 shaft	MR26662	Vertical	3	Surface	683

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The following table gives the development footage in 1966, and the accumulated footage to the time of closure, 30 April 1966.

LEVEL	DRIFTS	CROSSCUTS		RAISES
	TOTAL	1966	TOTAL	TOTAL
	feet	feet	feet	feet
Service adit	.....	.....	149	.....
80	682	.....	952	136
200	695	.....	236	425
350	452	.....	237	152
500	782	88	1,126	237
650	580	.....	335	195
Total	3,191	88	3,035	1,145

Some 8 diamond-drillholes totalling 3,244 feet, were completed from underground in 1966.

Employment and Management

The average number of employees was 25: 15 underground and 10 on surface. R. J. Roach 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, of which 2,946,681 shares have been issued. The directors and officers were: W. D. Sutherland, president and director; V. J. Loveland, vice-president and director; W. D. Burden, chairman and director; C. H. M. Mortimer, secretary-treasurer and director; N. J. Coolidge, T. R. Coolidge, R. H. Poole and J. P. C. Traine, directors. The head office is at Suite 2200, Richmond-Adelaide Centre, Toronto 1. The mine address is P. O. Box 617, Wawa.

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

Operations progressed from 1 July to 31 December 1966. The vertical, three compartment No. 1 shaft, located in claim S.M.59662 was collared and sunk to a depth of 960 feet below the shaft collar. The 1st, 2nd, 3rd, 4th, 5th, 6th, and 7th levels were established at depths of 164, 290, 416, 542, 668, 794, and 920 feet respectively below the shaft collar. Three diamond-drillholes totalling 155 feet were completed from underground and two drillholes totalling 504 feet were completed from surface in 1966.

Major construction in 1966 included the following:

- 1 two-mile power line 33,000 V capacity with 750 kva substation.
- 1 90-foot steel headframe (No. 3 Algoma Ore Properties).
- 1 hoistroom and compressor house, 80 x 28 feet, concrete block.
- 1 mine office and dry, 78 x 24 feet, frame construction.
- 1 storage building, 25 x 15 feet, frame construction.

Major equipment installed included the following:

- 1 hoist, 53 x 36 ins. electric.
- 2 compressors, (one 1000 cfm; one 650 cfm).
- 2 pumps, (one 130 gpm, 450 foot head; one 150 gpm, 1100 foot head).

Employment and Management

The shaft sinking and lateral work was contracted by L. E. Robinson Developments Limited who employed some 25 men. C. A. McLeish was manager.

Teck Corporation Limited
 (Teck-Hughes Mining Division
 of Lamaque Mining Company Limited)

Teck-Hughes Gold Mines Limited was incorporated in March 1923; in July 1963 the consolidation of Teck-Hughes Gold Mines Limited, Lamaque Gold Mines Limited, Howey Consolidated Mines Limited and Canadian Devonian Petroleum Limited was completed. The name was changed to Teck Corporation Limited, having an authorized capitalization of 5,000,000 shares of no par value, of which 4,636,875 shares have been issued. The officers and directors were: N. B. Keevil, president, chairman of the board and director; J. H. Westell, executive vice-president, treasurer and director; J. B. Anderson, and N. B. Keevil Jr., vice-presidents and directors; Sir Michael Butler, Bt., secretary and director; R. P. Koenig, A. R. Keevil, L. N. Watt, G. L. Jennison, J. D. Leishman, D. A. Perigoe, and J. J. Rankin, directors; J. A. S. Gibson, and B. Middleton, assistant secretaries; D. S. Brown, assistant treasurer. The executive office is at Suite 1000, 11 Adelaide Street West, Toronto 1. The address of Teck-Hughes Mining Division of Lamaque Mining Company Limited is Kirkland Lake.

Teck-Hughes Gold Mines Limited acquired in 1960 the adjoining Kirkland Minerals Corporation Limited property. The Teck property now comprises 44 claims in Teck township, Kirkland Lake area, District of Timiskaming. The reported total development footage completed by Kirkland Minerals up to the time of mine closure, 27 August 1960, was transferred and are now included in Teck-Hughes totals.

Mining and milling continued throughout 1966.

SHAFTS, TECK-HUGHES MINING DIVISION

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
South shaft	16625	Vertical	4	Surface	3,690
South shaft extension	16625	Vertical	4	3,639	5,553
No. 3 winze	16625	60°	3	4,887	6,148
No. 4 winze	16625	Vertical	3	3,638	4,572
Central shaft	16626	Vertical	4	Surface	3,014
10th level winze	16626	Vertical	3 (inactive)	1,098	1,985
No. 2 winze	{16625 16626}	60°	3 (inactive)	3,639	4,900
Central shaft extension	16626	Vertical	3 (inactive)	2,997	3,631
No. 1 shaft	1238	Vertical	2 (inactive)	Surface	490
No. 1 winze		Vertical	2 (inactive)	475	1,129

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The south shaft extension is caved between the 33rd and 36th levels, and inactive between the 30th and 33rd levels at present. A double-drum air hoist was installed on the 36th level to service the levels to the bottom or 45th level.

During the year, 376 feet of drifting, 311 feet of crosscutting, and 645 feet of raising were completed. Total development footage to 31 December 1966 was as follows: 261,597 feet of drifts; 98,006 feet of crosscuts; 120,811 feet of raises. A total of 83,242 tons of ore was hoisted, the mill treated 83,545 tons, averaging 228.9 tons daily.

Company Annual Report

The following is taken from the company annual report for the year ending 30 September 1966.

Production

During the 1966 period 79,420 tons of ore were milled. Recovery of bullion amounted to 20,588.343 ounces of fine gold and 3,808.61 fine ounces of silver, valued at \$780,533 or \$9.83 per ton. Operating costs of \$994,520 or \$12.52 per ton, reduced by Emergency Gold Mining Assistance of \$211,403, resulted in a cost of \$783,117 or \$9.86 per ton and an operating loss of \$2,584.

General

Mining operations continue to retreat from the deep levels of the mine in preparation for an orderly closedown. Under present schedule all mining and salvage work will be completed before the end of the present fiscal year. Mining of the remaining upper level pillars offers the possibility of higher production and profits during the latter months of operation.

Employment and Management

The average number of employees was 166; 92 underground and 74 on surface. G. G. Gilchrist was mine manager.

Tegren Goldfields Limited

Tegren Goldfields Limited was incorporated in February 1965 with an authorized capitalization of 5,000,000 preferred shares of \$1 par value and 3,000,000 common shares of no par value of which 2,000,000 common shares have been issued. The officers and directors were: N. B. Keevil, president and director; Sir Michael Butler Bt., secretary and director; J. B. Anderson, vice-president and director; G. E. Parsons, J. T. Garrow and H. P. Oakes, directors; J. H. Westel, treasurer; D. S. Brown, assistant secretary and treasurer. The head office is at Suite 1000, 11 Adelaide Street West, Toronto 1. The mine address is Kirkland Lake.

The property consists of 782 acres in Teck township, Kirkland Lake area, District of Timiskaming. It is adjacent to the west boundary of Macassa Gold Mines Limited and Tegren Goldfields Limited is a subsidiary of Teck Corporation. Access to the Tegren property is through No. 1 shaft, No. 1 and No. 2 winzes on Macassa property.

The mine operated throughout 1966.

The 47.04, 50.04, 56.04, and 60.04 levels were established in 1965 at depths of 4,750, 5,025, 5,600, and 6,025 feet below the collar. Development work done by Macassa mine comprised 346 feet of drifting and 108 feet of crosscutting on the 56.04 level. Total development footage to 31 December 1966 was 3,717

feet of drifts and 118 feet of crosscuts. Diamond-drilling in 1966 consisted of 145 holes totalling 13,819 feet from underground, and 2 holes totalling 218 feet from surface.

All ore was hoisted and milled at Macassa Gold Mines Limited.

Management and Operation

C. M. Armstrong and G. E. Parsons, geologists, were in charge for Tegren at the property, and the operation was carried on by the Macassa organization.

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; E. S. Chard, assistant 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 1966.

SHAFTS, UPPER BEAVER MINE

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
No. 1	2586	Vertical	2	Surface	102
No. 3	2587	Vertical	2	Surface	549
Winze	2587	Vertical	2	500	1,290

Development work during the year consisted of 2,665 feet of drifting, 1,288 feet of crosscutting, and 244 feet of raising. Total development footage to 31 December 1966 was as follows: 20,166 feet of drifts; 14,176 feet of crosscuts; 461 feet of raises. Diamond-drilling in 1966 consisted of 145 holes, totalling 26,279 feet, from underground.

Major construction consisted of an addition to the dry, 24 x 16 feet, frame construction.

Equipment added in 1966 included a hoist, 36 x 24 inch with 75 hp. motor, 750 rpm., both at 500-foot winze.

See Upper Canada Mines Limited for further information contained in that company's annual report for the year ending 31 December 1966, which pertains to the Upper Beaver mine.

Employment and Management

The work has been carried out by employees of Upper Canada Mines Limited; J. H. Botsford was general manager.

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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; E. S. Chard, assistant secretary-treasurer. 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 1966.

SHAFTS, UPPER BEAVER 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, 5,997 feet of drifting, 1,391 feet of crosscutting, and 2,517 feet of raising was completed. Total development footage to 31 December 1966 was as follows: 161,220 feet of drifts; 38,847 feet of crosscuts; 44,779 feet of raises. Some 179 diamond-drillholes, totalling 26, 918 feet, were drilled from underground.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

The net value of metals produced from the Upper Canada and Upper Beaver mines was \$3,068,535. An additional \$490,000 was receivable from cost aid, making a total of \$3,558,535, compared with \$3,013,976 in the previous year.

A total of 208,033 tons was handled, 12,617 tons higher than in 1965. The Upper Canada mine produced 147,636 tons, grading \$12.34 in gold; the Upper Beaver mine produced 60,397 tons, grading \$11.61 in gold and 1.14 percent copper.

	GOLD OZ.	SILVER OZ.	COPPER LBS.
Upper Canada mine	47,723.79	13,598.92	.....
Upper Beaver mine	19,014.12	6,373.66	1,336,185
Total	66,737.91	19,972.58	1,336,185

Upper Canada Mine

The results of the deep drilling below the 1,750-foot level "C" zone have been confirmed by drifting on the 2,750-foot level, where 466 feet of ore averaging \$10.29 over 5.8 feet has been developed. Diamond-drilling to outline this zone above and below this level is now underway.

Drifting on the "L" zone on the 4,950-, 5,250-, and 5,550-foot levels was in average "L" zone ore. The first 500 feet of the main "L" zone tested on the 6,150-foot level was unproductive but considerable gold mineralization and some ore is now being encountered. This may indicate a flattening of the eastward plunge of the orebodies, a repetition of "L" zone structural conditions found on the 1,750-foot level. Some 2,000 feet of favourable ground to the east remains to be explored.

PRODUCTION

	TONS	GRADE	VALUE
Surface to 1,750-foot	.....	.....	.....
1,750-, to 2,750-foot	11,158	\$ 9.25	\$ 103,238.00
2,750-, to 3,625-foot	35,982	8.44	303,553.00
3,625-, to 4,800-foot	85,520	14.62	1,249,925.00
4,800-, to 6,150-foot	14,976	11.01	164,856.00
Total	147,636	\$12.34	\$1,821,572.00

Upper Beaver Mine

Intensive exploration of the levels above the 500-foot horizon has continued to find new orebodies. While many of these are small, the overall result is that developed ore reserves have been more than maintained.

A hoisting plant was installed on the internal shaft, the mine dewatered to the bottom, or 1,250-foot level, and exploration and development of the mine below the 500-foot level is now underway. First drifting results in the vicinity of the old stoping areas are encouraging.

In 1965 the mine was operated as a gold mine, with gold accounting for more than 70 percent of production. In 1966, due to rising copper prices and an increase in copper grade of ore developed, the mine was operated as a copper mine. The revenue per ton, \$20.88, without cost aid, was higher than in the previous year. This policy is continuing in 1967.

PRODUCTION

LEVEL	TONS	GRADE	
		GOLD	COPPER PERCENT
80-foot	19,291	\$14.62	1.23
200-foot	17,402	11.01	0.90
350-foot	11,353	10.31	0.83
500-foot	12,255	8.90	1.64
Bins	96	11.76	1.13
	60,397	\$11.61	1.14

Milling

The Upper Canada gold circuit averaged 404.5 tons per day with a recovery of 92.74 percent. Output of the Upper Beaver flotation circuit increased from 128.1 to 165.5 tons per day. It produced 2,636 dry tons of concentrate, grading 6.59 ounces per ton gold, 2.4 ounces per ton silver, and 25.34 percent copper. Cyanidation of the flotation tailing in the Upper Canada circuit yielded 1,652 ounces gold. The recovery was 96.55 percent of the gold and 96.84 percent of the copper.

Employment and Management

The average number of employees was 351: 232 underground and 119 on surface. J. H. Botsford was general manager.

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Wilmar Mines Limited

Wilmar Mines Limited was incorporated in September 1958 with an authorized capitalization of 3,000,000 shares of 95 cents par value, of which 2,578,923 shares have been issued. The directors and officers were: E. C. Cochenour, president and director; G. F. MacDonnell, vice-president and director; M. C. Mosher, J. B. McLellan, J. R. Mooney, and C. E. Mooney, directors; C. V. Maltby, secretary-treasurer. The head office is at Suite 1203, 2200 Yonge Street, Toronto 12, the mine address is Cochenour.

The property comprises 675 acres in Dome township, Red Lake area, District of Kenora, adjoining south of Cochenour Willans main property. Wilmar Mines Limited was formed to acquire the property from Martin-McNeeley Mines Limited. Development work on the property continues to be carried out by Cochenour Willans on agreement.

Development work continued throughout 1966.

The vertical, four compartment Wilmar winze collared 1,265 feet below Cochenour No. 1 shaft has a total depth of 816 feet below collar, or 2,081 feet below surface.

Development work in 1966 consisted of 1,683 feet of drifting, and 674 feet of raising. Total development footage to 31 December 1966 was as follows: 7,240 feet of drifts; 5,767 feet of crosscuts; 1,266 feet of raises. Some 134 diamond-drillholes, totalling 18,734 feet were completed in 1966, from underground.

Employment and Management

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

IRON ORE AND IRON

Total shipments of iron ore from mines in Ontario decreased 3.90 percent in quantity from 8,475,218 tons in 1965 to 8,144,289 tons in 1966; the value of shipments decreased 2.66 percent, from \$94,209,236 in 1965 to \$91,700,740 in 1966. The production, value, and general statistics for iron ore production by the nickel-copper mines appears in this Volume under "Nickel and Copper."

The industry paid \$4,697,638 to 572 salaried employees, and \$14,952,974 to 2,825 wage-earners; fuel and electricity cost \$5,319,059 and process supplies \$19,528,341.

Three companies with four plants in Ontario operated a total of 12 blast furnaces in 1966, treating 9,299,711 net tons of iron ore which included small amounts of mill scale and scrap, to produce 6,213,144 net tons of pig iron. In 1965 these three companies treated 9,623,136 net tons of iron ore to produce 6,112,514 net tons of pig iron. The companies include The Algoma Steel Corporation Limited with the Steelworks Division at Sault Ste. Marie, and the Canadian Furnace Division at Port Colborne; The Steel Company of Canada Limited and Dominion Foundries and Steel Limited, both located at Hamilton. Further details for each company is given in this section.

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 11,606,434 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; W. R. Binch, Sir Philip 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. A. Machum, vice-president (personnel) and 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, and the Goudreau Pyrite property. The mines (excluding the Goudreau Pyrite property) and the sintering plant, are at Wawa.

George W. MacLeod Mine

This property consists of 14 claims in ranges 23 and 24, Township 29, District of Algoma. Mining operations continued from 1 January to 31 December 1966.

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SHAFTS, GEORGE W. MACLEOD MINE

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	VERTICAL DEPTH FROM SURFACE
No. 4 (below 2nd level)	DJ22	Vertical	2 (inactive)	feet 1,778
No. 5	DJ24	Vertical	3	2,066
Ropeway	DJ24, 25, 30, 31	-22°	1	1,827

During 1966, a total of 17,782 feet of drifting, 5,422 feet of crosscutting, and 4,429 feet of raising was completed. Total development footage to 31 December 1966 was as follows: 137,197 feet of drifts; 42,397 feet of crosscuts; 51,573 feet of raises. Altogether, 94 diamond-drillholes, totalling 27,989 feet, were completed from underground, and four holes, totalling 8,545 feet, from surface.

New construction in 1966 included an extension to the compressor room, 40 x 40 feet and a scale house at the sinter plant, 16 x 14 feet.

Major added equipment included the following:

- 1 mucking machine, 24B
- 10 mine cars, various types
- 1 mobile crane, 14 ton
- 1 truck loading, dust collect system
- 2 traxcavators, model 966
- 2 steam boilers, 150 hp., 15 psi.
- 1 steam cleaner, 200 gph.
- 1 welding machine, electric
- 2 ore screens, 6 x 14 feet
- 100 sinter machine pallets
- 12 pager phones
- 134 sheet steel piling, 15 feet.

Sir James Mine

This property consists of two claims and two mining locations in range 24, Township 29, District of Algoma. A spur railway line was built from the Helen mine to provide service to the operation and for the transportation of ore to the treatment plant. A conveyor tunnel, 610 feet long, was driven at an angle of 14.5 degrees to house the conveyor carrying ore from the underground crusher to the railway loading point. The crusher room was cut at a point 124 feet vertically below surface. In 1966 a total of 1,001 feet of drifting was completed on the first level.

Major added equipment consisted of a front end loader, 5½-yard capacity, and a propane direct fired heating plant.

Mining operations continued from 1 January to 31 December 1966.

A total of 626,921 net tons of ore was hoisted and conveyed.

Goudreau Pyrite

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

There was no operation at the property in 1966.

The total ore production from the George W. MacLeod, and Sir James mines was 3,429,961 net tons. The siderite iron ore is concentrated, sintered

and screened before shipment to the steel plants. 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 340 days during 1966, producing 741,523 net tons of sinter. A new sinter machine was put on line early in the year; it is 100 feet long by 12 feet wide, and is one of the largest units in the country. It has replaced the older machines Nos. 1, 2, and 3 which have been scrapped. Hot sinter is trucked to the nearby screening plant and the in-line four loading bays have been hooded and vented with the result that dust conditions are vastly improved from the older installation. Ventilation on the sinter floor proper has also been improved.

EMPLOYMENT AND MANAGEMENT

The average number of employees at the mines was 909: 259 underground and 650 on surface and in the sintering plant. J. E. Worley was general superintendent.

STEELWORKS DIVISION

The blast furnace section of the Division is located at Sault Ste. Marie. Operations continued throughout 1966.

PRODUCTION OF IRON, STEELWORKS DIVISION

FURNACE	1965		1966	
	DAYS OF OPERATION	PRODUCTION	DAYS OF OPERATION	PRODUCTION
		net tons		net tons
No. 3	363	372,575	348	359,376
No. 4	362	260,987	293	217,833
No. 5	322	671,492	349	802,434
No. 6	362	748,346	351	626,577
Total		2,053,400		2,006,220

Number 4 blast furnace was relined and the hearth diameter increased from 15.75 feet to 17.25 feet, which increased the working volume from 14,843 cubic feet to 16,810 cubic feet. A Venturi washer having a capacity of 138,000 scfm. was installed in No. 4 blast furnace.

The blast furnaces treated a total of 3,209,222 net tons of ore at a daily average of 9,091 tons and produced 2,006,220 net tons of pig iron.

EMPLOYMENT AND MANAGEMENT

The average number of employees in the blast furnace was 478; W. P. Dowhaniuk was superintendent.

CANADIAN FURNACE DIVISION

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

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The blast furnace division operated at capacity continuously throughout 1966. Ore ratios in the burden were virtually unchanged, consisting mainly of sized hematitic ore, sinter from the Sault Ste. Marie division, and good grade pellets.

Results of the natural gas injection system installed November 1964 to supplement coke as a fuel has proven satisfactory and has been incorporated into the regular blast furnace practice.

The blast furnace operated from 1 January to 31 December 1966, a total of 365 days and produced 234,364 tons of pig iron from the treatment of 385,823 tons of ore at a daily average of 1,057 tons.

EMPLOYMENT AND MANAGEMENT

The average number of employees was 161. Rino Fabbro was general superintendent.

CORPORATION ANNUAL REPORT

The following is taken from the corporation's annual report for the year ending 31 December 1966.

Sales

Shipments of steel products amounted to 1.7 million tons and were approximately 3 percent lower than in 1965, with the decline entirely in shipments into the Canadian market in the last half of the year.

Following settlement of the main labour contract, it became evident that customers had increased inventories considerably earlier in the year. This accumulation, particularly in flat rolled products, was a hedge against a possible strike in the steel industry. Reduction of these inventories continued from September to the end of the year when it appeared to be almost complete. In addition, orders were affected by a slow start up to the 1967 model automobile year.

The tonnage of steel products exported to the United States was about the same as in 1965 and, including ingots, represented 14 percent of total shipments. Offshore shipments were negligible.

A series of additional light weight wide flange beams was successfully introduced and high strength NiCuTen steel products were marketed for the first time and received good customer acceptance. NiCuTen steel was developed by Algoma and is a low carbon, low manganese, alloy content steel which has high tensile strength, good forming and welding qualities and high resistance to atmospheric corrosion.

The average realization at Sault Ste. Marie from sales of steel products was \$124.55 per ton compared to \$121.88 in 1965, the increase resulting from product mix. Although higher prices for steel products were justifiable in 1966, none were initiated in view of suspension on 19 September, at the request of the Federal Minister of Finance, of increases announced by a competitor.

Shipments of pig iron were largely from the Canadian Furnace Division and declined almost 20 percent from 1965 to 276,000 tons. Most of the decline was in the tonnage exported to the United States.

Shipments of Algoma sinter to the United States amounted to 250,000 gross tons, an increase of 54,000 tons over 1965.

Orders for steel products, particularly plate, and hot and cold rolled sheet and strip, were lost because of the strike, but it is not possible to estimate the tonnage involved. As a consequence of the strike and decline in demand, the order backlog at the year end was lower than at the end of 1965.

Toward the end of the year an intensive management information system study was started having as its main objectives more rapid processing of customer orders, faster information with respect to inventories and customer order status, increased rolling yields and improved ability to give firm delivery date promises to customers and to live up to them. The study teams are manned by senior experienced employees and are guided by a consulting firm with extensive experience in this field. This study is expected to result in improved service to customers.

Operations

Lower production of Algoma sinter, coke, iron and raw steel was primarily attributable to the enforced shut down of operations at the Steelworks and Algoma Ore Divisions during the

strike. Production also had to be discontinued at the Algoma Ore Division, from 31 August to 6 September, during the national rail strike.

A record proportion of total raw steel, slightly over 63 percent, was produced in the L-D Oxygen Steel plant.

The maximum tonnages of sized Algoma sinter and of ore from the mine leased from Steep Rock Iron Mines Limited were used in the blast furnaces, and the combined tonnages of ores from the Corporation's mines represented an increased proportion of the total ores used. The pellet plant being constructed by Steep Rock will be completed in July 1967 and pellets from this plant, produced from ore from the mine leased by Algoma, will raise the average grade of materials used in the blast furnaces and further integrate iron ore mining and steelmaking operations.

Research was conducted to develop new high strength steel products with good results and successful production. In addition, research continued on the development of new steel products with low alloy additions, and alloyed rails were supplied to a railroad for use at locations subject to severe traffic conditions. Tests have indicated that high quality seamless tubes can be produced from continuous cast blooms.

At the Algoma Ore Division performance of the 12 feet wide sintering machine, brought into operation in February, was excellent and this machine assures additional sintering capacity when it is required. Research and industrial engineering studies have been undertaken with the objective of controlling and improving sinter grade.

Approximately 82 percent of the ore sintered was from the George W. MacLeod underground mine and the balance from the Sir James open pit mine; 84 percent of the sinter produced was used in Algoma's blast furnaces. Due to the areas being mined, a higher proportion of the ore required treatment before sintering than in 1965.

Improvements, Additions and Alterations

Relining and enlargement of one of the smaller (No. 4) blast furnaces which increased annual production capacity 100,000 tons, equipment of this furnace for fuel injection and higher top pressure operation and increasing the capacity of the hot blast stoves.

Dismantling an old small (No. 2) blast furnace, which had not been operated since 1957, to clear site for construction of the large (No. 7) blast furnace.

Installation of a new pig iron storage yard to clear site for the second L-D Oxygen Steel plant.

Construction of the new forge and fabricating shop building.

Purchase of two 25-ton diesel locomotives and additional steel and slag transportation equipment.

Major projects underway at the Steelworks at the end of the year included:

Construction of the battery of sixty large coke ovens and ancillary facilities.

Construction of the new building for the large blast furnace turbo blower which is expected to be in operation about mid 1967.

Installation of the continuous casting plant.

Construction of new buildings for diesel repair, central trades, metallurgical and research, and medical, training and employment.

Construction of a railway transfer yard to clear site for the new L-D Oxygen Steel plant.

At the Algoma Ore Division major expenditures, other than those on normal mine development, included:

Purchase of equipment for modified underground mining of the Sir James mine being undertaken at a comparatively low capital cost. Ore from this development and an extension at the open pit will extend the life of this mine at least four and one half years to 1972, at an annual mining rate of 500,000 tons.

Completion of installation of the new 12 feet wide sintering machine brought into production in February and dismantling the three old 5 feet wide sintering machines it replaced.

Additions and modifications to the sinter plant dust collection system to improve working conditions and reduce dust losses.

Caland Ore Company Limited

Caland Ore Company Limited was incorporated in November 1957, with an authorized capitalization of 100,000 shares of \$50 par value, all of which have been issued. It is a wholly owned subsidiary of the Inland Steel Company of Chicago. The directors and officers were: P. D. Block Jr., chairman and director; C. B. Jacobs, president and director; R. D. Satterley and H. M. Graff, vice-presidents and directors; W. H. Lowe, assistant treasurer, assistant secretary, and director; J. L. Block, L. B. Hunter, J. F. Smith Jr., F. G. Jaicks,

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R. S. Gentz, and G. A. Ranney Jr., directors; P. P. Ribotto, vice-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 operations continued throughout 1966; milling from 11 May to 26 November.

The Falls Point mine is serviced by the vertical, eight-compartment shaft, 1,333 feet deep, located on claim F.F. 3513.

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 cross-cuts; 976 feet of raises on the 800-, 1,000-, and 1,200-foot levels. Five diamond-drillholes totalling 1,690 feet were drilled from surface in 1966.

Major equipment in 1966 included the following:

- 1 dryer, 9½ x 120 ft., 200 tph. capacity, added to ore improvement plant.
- 2 tractors: 1 D-8; 1 D-9.
- 1 dozer, rubber-tired, 824B.

All production in 1966 was from the open pit and consisted of 1,902,593 tons, of which 1,736,035 tons was processed at a daily average of 11,600 tons.

Employment and Management

The average number of employees was 370: 109 in the open pit and 261 on surface. P. P. Ribotto, vice-president, was in charge at the property.

Cliffs of Canada Limited

Sherman Mine

Cliffs of Canada Limited was incorporated in March 1957, with an authorized capitalization of 20,000 shares of \$10 par value, of which 13,500 shares have been issued. The officers and directors were: H. S. Harrison, president and director; J. S. Wilbur, H. J. Leach, and J. S. Westwater, vice-presidents and directors; R. M. Kimmel, secretary; J. P. Long, treasurer; J. C. Vickery, comptroller. The head office is at Suite 2400, 25 King Street West, Toronto 1; the Sherman mine address is Box 217, Timagami.

The Sherman mine is a joint project of Dominion Foundries and Steel Limited of Hamilton who have a 90 percent interest, and Cleveland Cliffs Iron Company of Cleveland, Ohio, U.S.A., the remaining 10 percent through a wholly owned subsidiary, Tetapaga Mining Company. The Cleveland Cliffs organization is in charge of all mining and pelletizing operations. The initial plant capacity is scheduled for a million tons of 64 percent iron pellets with production to commence in 1968, all production to be delivered to the Hamilton plant of Dominion Foundries and Steel Limited.

The property comprising 112 claims, about 7,602 acres, is located in Strathy, Strathcona, Briggs, and Chambers townships, Timagami area, District of Nipissing.

In 1966 the work of stripping three orebodies, the North, West and South was commenced. The waste rock and material from stripping is being used in the construction of haulage roads and a tailings dam. Some surface trenching, to an average depth of 12 feet was completed over a length of 600 feet. Four diamond-drillholes, totalling 621 feet were completed from surface. The construction of a railroad spur was completed also the main office and service building, which was occupied in May 1966. Canadian Bechtel Limited was awarded a contract for construction of the concentrator; Canadian Allis-Chalmers will construct the pellet plant. The contractors employ approximately 650 men.

Employment and Management

Cliffs of Canada Limited had an average of 105 employees; B. H. Boyum was mine manager.

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; 15,397,003 common and 250,000 preferred shares have been issued. The officers of the company were: F. H. Sherman, president and managing director; R. R. Craig, executive vice-president (commercial); J. G. Sheppard, executive vice-president (financial) and secretary; D. F. Hassel, vice-president (industrial relations); D. O. Davis, vice-president (engineering); D. A. Lindsey, vice-president (purchasing); W. C. Hassel, vice-president (works manager); F. J. McMulkin, vice-president (research); W. R. Weir, vice-president. The head office and plant address is P.O. Box 460, Hamilton.

Operations progressed from 1 January to 31 December 1966.

PRODUCTION OF IRON, DOMINION FOUNDRIES AND STEEL

FURNACE	1966		1965	
	OPERATED	PRODUCTION	OPERATED	PRODUCTION
	days	Net tons	days	Net tons
No. 1	330	428,187	365	483,127
No. 2	365	563,163	365	538,724
No. 3	365	603,341	365	562,222
Total		1,594,691		1,584,073

The blast furnaces treated 2,334,158 net tons of ore, averaging 6,395 tons per operating day, to produce 1,594,691 net tons of pig iron.

The three blast furnaces operated throughout the year with the exception of No. 1 furnace which was off blast during August for relining. Principal modifications included the installation of external cooling plates to increase the working volume of the No. 1 furnace, and oxygen connections ahead of the

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snort valves of the cold blast mains to increase the driving rate of all furnaces. Pig iron production slightly exceeded the record established in 1965. The use of high quality coke and pellets made at Pointe Noire Plant from Wabush concentrates contributed to the favourable low coke consumption per ton of iron produced.

The new battery of 53 coke ovens was virtually completed. The extension of the high-line, ore-bridge tracks and the ore yard was consistent with the higher demand for handling more raw materials. The solid type burner valves, designed to prevent gas leakage at the stoves replaced existing units. Equipment and safe procedures were improved where process gas is potentially hazardous. An elaborate detector system and additional fully-equipped rescue stations were included.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Iron Ore Properties

Construction work at Sherman mine near Timagami in Northern Ontario in which the company has a 90 percent interest is progressing satisfactorily and the mine should be ready for production in 1968. The service building with offices was completed in the spring of 1966. The concentrator building is about finished and the pelletizing building is nearing completion. Most of the equipment has been ordered and installation has begun. Stripping and development of ore bodies are well under way.

Employment and Management

The average number of employees in the blast furnace division was 251. W. R. Rombough was general superintendent.

Ferrox Iron Limited

Ferrox Iron Limited, a subsidiary of Quebec Smelting and Refining Limited, has operated a research and pilot plant in Prescott, for the past three years. Work to date has been on Quebec Cartier hematite concentrate which is reduced from 64 to about 99 percent iron oxide. The plant produces high grade iron powder and various ferrites.

Employment and Management

The average number of employees was 24; W. J. D. Stone was managing director and P. D. Maltby was plant manager.

**Geo-Met Reactors Limited
and
Masterloy Products Limited**

These two associated companies, under the same management, were formed in 1961, Geo-Met for metallurgical research and Masterloy for the production of high-cost ferro-alloys of columbium, molybdenum, tungsten, vanadium, manganese, titanium, chromium and nickel-columbium. These alloys were formerly imported from Britain and the United States but now the company not only supplies the Canadian market but also exports 70 percent of its strategic ferro-alloys.

At first both companies operated from a plant in South Ottawa, but in 1966 Masterloy moved to a new plant five miles south of the Ottawa city limits. This new plant with eight furnaces has a rated capacity of 40,000 pounds per day. Masterloy produces all its ferro-alloys using the aluminothermic reduction technique whereby the oxides are reduced to the metal, using aluminum primarily as the reducing agent.

Total production in 1966 was valued at close to one million dollars.

Executive, Management, Employees

W. S. Morgan is president and managing director, and S. J. Pettigrew, secretary-treasurer and general manager. The two companies have 26 employees.

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; H. J. Haughton, treasurer; E. C. Ford, secretary. The head office is at 3 Gateway Center, Pittsburgh, Pennsylvania 15230, U.S.A. The address of the Adams mine is Box 547, Kirkland Lake.

The property, known as the Adams mine, comprises 135 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 1966.

Altogether, 27 diamond-drillholes, totalling 9,445 feet, were completed from surface.

Added equipment included 7 magnetic cobbbers, installed in the concentrator and seven ½-ton trucks from various manufacturers.

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During 1966 a total of 3,994,657 tons of ore was mined in the open pit, 656,255 tons were rejected by the coarse cobber; 3,338,780 tons were milled at a daily average of 10,304 tons. Some 2,084,044 tons of waste rock was removed.

Employment and Management

The average number of employees was 370: 120 in the open pit and 250 on surface. R. E. Durocher was division superintendent.

Marmoraton Mining Company Limited

Marmoraton Mining Company Limited is a wholly-owned subsidiary of Bethlehem Steel Corporation. It was incorporated in the State of Delaware in November 1950. The authorized capitalization is 205,000 shares of \$100 each, of which 200,500 have been issued. The directors and officers were: E. P. Leach, president and director; A. M. Reed, vice-president, comptroller and director; R. D. Broeker, I. D. Sims and L. W. Foy, vice-presidents and directors; G. C. Vary and S. J. Shale, vice-presidents. R. C. Sonneman, secretary; H. Olsen, manager; E. W. Morris, treasurer. The head office and mine offices are at Marmora. The executive office is at Wilmington, Delaware, U.S.A.

The company owns an iron property in Marmora and Rawdon townships, County of Hastings, a short distance east of Marmora.

Mining and milling continued throughout 1966.

Major construction in 1966 consisted of a steam cleaning building, 49 x 46 feet, with steel frame and masonry block construction.

Six diamond-drillholes, totalling 2,227 feet, were completed from surface. The ten year pit enlargement program progressed very favourably with the removal of about another 3.5 million tons of waste.

A total of 1,353,960 tons was mined in the open pit; the mill treated 902,928 tons of ore averaging 2,690 tons per working day and produced 536,548 tons of pellets.

Employment and Management

The average number of employees was 332: 83 in the open pit and 249 on surface. C. A. Lorensen, vice-president and general superintendent 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; S. L. Engel, secretary; R. E. Beal, treasurer. The head office is at 100 Erieview Plaza, Cleveland, Ohio, U.S.A. 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. Production continued throughout the year from Nos. 2, 3, and 10 open pits. The magnetite ore is concentrated, then pelletized with production of pellets to average 1,750 tons daily to meet a yearly quota of 625,000 tons. The pellets are transported by Canadian National Railways from the property to Depot Harbour 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 1966.

Altogether, 10 diamond-drillholes, totalling 3,306 feet were drilled from surface.

Major added equipment consisted of caterpillar wheel tractor, with 6 cylinder 275 hp. diesel engine, 24 volt direct electric starting.

A total of 1,567,830 tons of ore was removed from the open pits; 1,395,405 tons were milled at a daily average of 3,823 tons. Some 694,400 gross tons of iron concentrates were treated in two pelletizing units each operating for 365 days to produce 715,903 net tons of iron pellets.

Employment and Management

The average number of employees was 290: 91 in the open pit, 199 on surface, in the concentrator and pelletizing plant. D. K. Nelson was superintendent.

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 to 28,000,000 shares of no par value, of which 24,139,052 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, Frederick Johnson, R. A. Laidlaw, W. H. Browne, J. R. Gordon, H. Greville Smith, D. R. McMaster, L. G. Rolland, H. S. Foley and J. D. Campbell, directors; R. B. Taylor, vice-president and treasurer; N. J. Brown, vice-president and comptroller; H. J. Clawson, A. D. Fisher and J. P. Gordon, vice-presidents; J. W. Younger, secretary. The head office is at Wilcox Street, Hamilton.

THE GRIFFITH MINE

The property comprises 63 patented claims, and four licences of occupation which includes some 500 acres, leased from Iron Bay Mines Limited and located in the Patricia Portion of the 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.

The mine is planned for production in early 1968 at a rate of 1,500,000 tons of pellets annually. The pellets produced will be shipped over a 68 mile railway, now under construction, to the Canadian National Railway main line at Amesdale, and thence to the company's steel plant at Hamilton. A natural gas

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line running from the Trans-Canada pipe line at Vermillion Bay will supply fuel for the pelletizing process.

Operations progressed from 1 June to 31 December 1966.

Major construction in 1966 included a concentrator building, 349 x 297 feet, a crusher building, 110 x 47 feet, a service building, 291 x 257 feet, and a truck storage garage, 120 x 80 feet, all with steel frames and insulated metal siding.

Major equipment added was as follows:

- 3 electric shovels, 6 cu. yd. capacity
- 1 rotary drill, 40-R., 9 in. diam. hole
- 9 haulage trucks, Euclid R-45, 45 ton capacity
- 1 shovel, diesel, 2½ cu. yd.
- 5 crawler tractors, 4 T.D. 25; 1 C-6
- 2 front end loaders, H-120
- 1 mobile crane, 25T
- 1 Payloader shovel, 400

Employment and Management

The contractors, Canadian Bechtel Limited employed about 600 men and Pickands Mather and Company employed about 90 men during the period of operation. The Griffith mine employed an average of 55 men on surface; F. P. Morawski was manager of operations.

HILTON WORKS

Blast Furnace Division

The plant address is Wilcox Street, Hamilton.

The blast furnace treated 3,370,808 net tons of ore, averaging 9,487 tons per working day, to produce 2,377,869 net tons of pig iron.

The sinter plant operated at capacity during 1966 and supplied about 20 percent of the beneficiated material in the form of self fluxing sinter to the blast furnaces.

The new No. 5 blast furnace with its ancillary equipment and the extensive new battery of coke ovens were more than half completed. The furnace is scheduled to be on blast during the summer of 1967. The design, size and rated capacity of the furnace surpasses any other existing in the world.

Emphasis was directed toward continuing the improvement in safe practices generally, and in particular, in areas where breathing apparatus is used and stored.

PRODUCTION, THE STEEL COMPANY OF CANADA, 1965 AND 1966

FURNACE	1966		1965	
	OPERATED	PIG IRON PRODUCED	OPERATED	PIG IRON PRODUCED
	days	tons	days	tons
A	358	153,426	365	157,746
B	354	540,057	331	393,031
C	354	722,416	365	731,064
D	355	961,970	365	957,476
Total		2,377,869		2,239,317

Employment and Management

The average number of employees was 515. C. M. Birkett was works manager; J. A. Peart was superintendent in the blast furnace division.

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: Cyrus S. Eaton, chairman of the board and director; M. S. Fotheringham, president, general manager and director; Neil Edmonstone, vice-president, secretary-treasurer and director; W. J. Huston, vice-president (operations); W. R. Daley, J. G. Cross, G. E. Allen, Mark McKee, John Paterson, F. H. Black, Hon. W. M. Benidickson, and Hon. C. J. Burchell, directors. The head office and mine offices are at Steep Rock Lake.

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

Operations continued throughout 1966. The amount of ore mined during the year is shown in the following table.

	1965	1966
	tons	tons
B orebody (Errington underground)	268,497	100,603
G orebody (Roberts open pit)	2,142,888	1,596,811
Total	2,411,385	1,697,414

A total of 1,236,453 tons of ore was sold in 1966, a slight decrease over the 1,264,176 tons sold in 1965.

A (Hogarth) Orebody

Open-pit mining was completed on 16 March 1962. Preparations for underground mining of the Hogarth orebody had continued to 31 August 1961.

SHAFTS, A (HOGARTH) OREBODY

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	DEPTH FROM SURFACE
				feet
No. A-1	FF3183	Vertical	3 (inactive)	845
No. A-2	FF3660	Vertical	4	1,480

Total development footage when underground operations were discontinued was as follows: drifts, 1,477 feet; crosscuts, 5,169 feet; raises, 1,040 feet.

The mine was inactive during 1966.

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B (Errington) Orebody

Underground mining on the B (Errington) orebody continued throughout 1966.

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 1966 consisted of 2,245 feet of drifting, 465 feet of crosscutting, and 20 feet of raising. Total development footage to 31 December 1966 was as follows: 44,822 feet of drifts; 14,090 feet of crosscuts; 10,591 feet of raises. A total of 100,603 tons of ore was hoisted.

Roberts Open Pit Mine

The dredging of the "G" ore zone was completed in 1961. A total of 1,768,448 cubic yards of material had been removed from this portion of the "G" ore zone, which is now an open pit operation called the Roberts mine.

Mining operations continued throughout 1966; and milling operations commenced on 16 April and continued to 1 November.

Diamond-drilling in 1966 consisted of three holes, totalling 1,474 feet from surface.

The construction of a crushing, screening and pelletizing plant designed to produce 1,350,000 tons of iron pellets was commenced in 1966.

New equipment consisted of the following:

- 3 bulldozers, D-8
- 1 loader
- 6 trucks, 85-ton capacity

A total of 1,596,811 tons of ore was mined in the open pit, of which 1,107,436 tons was milled in 1966.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966:

Ore Reserves

The Steep Rock Range is amply endowed with ore reserves. The proven, probable and inferred reserves of the mines operated by the company, projected to the depth of the deepest drillhole, 1,700 feet below existing surface, are estimated to be 337,100,000 tons. This represents 259,300,000 tons of pellets.

On the property leased to Caland, a similar projection would add 190,400,000 tons to the proven reserves there and bring reserves on the Range to 527,500,000 tons equivalent to 405,800,000 tons of pellets.

In addition, there are 272,800,000 tons of lean ore, averaging 30 percent iron. This could augment the pellet potential by an estimated 82,000,000 tons.

Over and above these extensive tonnages, the company's Lake St. Joseph property, which is fully engineered, contains the largest known open pit reserves of iron ore in the Province of Ontario, with an estimated capability of providing up to 160,000,000 tons of pellets down to a depth of only 500 feet.

Since commencement of operations, Steep Rock and Caland have produced 43,300,000 tons of high grade iron ore. Of Steep Rock's direct production and sale of 31,000,000 tons, the open pits have supplied 28,900,000 tons and the underground operations 2,100,000 tons. Approximately 35,000,000 tons are still contained within Steep Rock's present open pit design. An additional 19,000,000 tons could be available for deep pit mining if future deep pit costs prove more favorable than underground costs. The remaining reserves will be recovered by underground mining methods.

Of further significance, the large scale underground experimental program, conducted over the past several years, has determined that the company's large reserves of underground ore can be recovered at attractive costs. This conclusion has been confirmed recently in a detailed report by an independent engineering firm.

Review and Outlook

Steel remained in strong demand in both Canada and the United States during 1966. The outlook for this year may be somewhat less vigorous, but the intermediate and long term trend is strongly upward.

While pressure on North American markets for direct shipping iron ore continues, this is not true with respect to pellets, which are in increasing demand.

The company has now consolidated its position in the field of pellet production, and nearly 50 percent of 1967's output is expected to be in this profitable category. In 1968 long term contracts for production and shipment of 1,350,000 tons of pellets annually will be in force. Since maximum utilization of the ore as mined is accomplished by the pelletizing process, the margin of profit is substantially better for pellets than from direct shipping ores.

Caland is stepping up its operations to its objective of 2,300,000 tons annually, of which 1,000,000 tons will be pellets and 1,300,000 tons coarse ore.

Employment and Management

The average number of employees was 575; 43 underground and 532 on surface and in the open pit. M. S. Fotheringham was president and general manager.

Strategic-Udy Metallurgy Limited

The head office and plant is at 3527 Stanley Avenue, Niagara Falls.

The research and development facilities were virtually inoperative during 1966. A stand-by crew confined their efforts to the melting of stainless steel grindings in one of the small electric furnaces, and returning the ingots to a plant in Welland.

Normally, selective and direct reduction processes are developed here to beneficiate standard and low-grade ores, and to produce such metals as iron, manganese, nickel and chromium.

R. O. Denman, vice-president, was in charge.

LEAD AND ZINC

The production of lead increased 2.14 percent in quantity from 3,887,218 pounds in 1965 to 3,970,467 pounds in 1966; the value decreased 1.55 percent from \$602,518 in 1965 to \$593,188 in 1966.

The production of zinc increased 35.79 percent in quantity from 121,349,121 pounds in 1965 to 164,789,837 pounds in 1966; the value increased 35.80 percent from \$18,323,817 in 1965 to \$24,883,265 in 1966. There was some lead recovered in 1966 from the silver-cobalt ores of the Cobalt-Gowganda area; the major portion of the lead, and the major portion of the zinc production came from the Thunder Bay district; the balance of the zinc came from Canadian Jamieson, Kam-Kotia and Texas Gulf in the Porcupine area.

The mines of the Thunder Bay district paid \$1,420,561 to 197 salaried employees and \$4,738,967 to 757 wage-earners; fuel and electricity cost \$670,449 and process supplies \$6,484,809.

The operations report for Noranda (Geco Division), Willecho and Willroy appears under "Nickel and Copper."

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, secretary-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 (Ontario).

During 1966 the company completed the installation of a concentrate unloading and mixing system, designed to prepare an ore mixture prior to pelletizing.

A new pellet dryer was installed to improve the quality of pellet drying and working conditions in the pelletizing operations. The installation has improved both the quality of the pellet feed to the fluid column roaster and the throughput.

A third track was installed in the ore-thawing shed to provide enough thawed ore in the minimum time possible for process requirements.

The company unloaded its first ore shipment by boat during the year.

Continued development work on the recovery of selenium from zinc concentrates has been maintained. The development work has thus far been successful and the recovery is now dependent on the economical justification.

A new record for production of sulphuric acid and the processing of zinc concentrates was set for the year.

Major construction in 1966 included an acid pump house, 12 x 9 feet; ore storage bins and mixing station housing, one 100 x 30 x 60 feet; one 50 x 45 feet high.

Major added equipment was as follows:

- 1 calcine dryer, capacity 25 tph.
- 1 lathe
- 2 electric motors, 50 hp.
- 1 set, hot gas fans

A total of 82,598 tons of zinc sulphide concentrate was treated, at a daily average of 236 tons, to produce 64,340 tons of zinc oxide (calcine) in 1966.

Employment and Management

The average number of employees was 74; R. K. Thoman was works manager.

Zenmac Metal Mines Limited

Zemac 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, treasurer and director; E. R. Heald, Patrick Harrison, and Wm. McKee, directors; J. L. Noble, secretary. The head office is at Suite 505, 80 Richmond Street West, Toronto 1; the mine address is P.O. Box 189, Schreiber.

Zenmac's Zenith mine property, comprises 69 claims located in the Pays Plat Lake area, Schreiber district, about 10 miles north of Lake Superior.

Mining operations progressed from 1 January to 31 December, milling from 1 February to 31 December 1966.

The vertical, three compartment Main shaft, collared in claim TB42277, has a depth of 425 feet below the collar. Development footage in 1966 consisted of 1,400 feet of drifting, 128 feet of crosscutting, and 840 feet of raising. Total development footage to 31 December 1966 was as follows: 3,149 feet of drifts; 470 feet of crosscuts; 965 feet of raises. Some 182 diamond-drillholes, totalling 16,191 feet were completed from underground and 6 holes, totalling 2,312 feet, were completed from surface.

Major construction in 1966 included the following: a waste bin 16 x 14 x 14 feet, and a loading bay 26 x 16 feet, both timber construction, plywood clad; a high explosive magazine 8 x 8 feet, a blasting agent magazine 16 x 12 feet, both plywood clad with sand-filled walls; and a detonator storage 8 x 8 feet, plywood clad.

A total of 29,405 tons of ore was hoisted; 31,972 tons were milled at a daily average of 106 tons.

Employment and Management

The average number of employees was 78: 38 underground and 40 on surface; P. S. Broadhurst was general manager.

MAGNESIUM AND CALCIUM

These metals are produced in the Renfrew area of Ontario by Dominion Magnesium Limited. The production of magnesium decreased 33.49 percent in quantity from 20,216,369 pounds in 1965 to 13,445,701 pounds in 1966; the value of production decreased 31.17 percent from \$6,067,057 in 1965 to \$4,175,743 in 1966. The production of calcium increased 56.29 percent in quantity from 159,434 pounds in 1965 to 249,179 pounds in 1966; the value of production increased 60.37 percent from \$152,848 in 1965 to \$245,125 in 1966. The company paid \$403,611 to 66 salaried employees, \$1,361,968 to 419 wage-earners; fuel and electricity cost \$679,869 and process supplies \$2,224,419.

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: H. J. Fraser, president and director; John Thomson, vice-president, general manager and director; J. G. Weir, L. M. Pidgeon, F. H. Jowsey, G. T. N. Woodrooffe, P. N. Pitcher and J. M. Mortimer, 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. Operations were suspended for a period of almost four months in 1966, due to strike action at the company's quarry and plant about 3 miles from Haley, comprising 383 acres in concessions V and V1, Ross township, Renfrew county.

A 21 percent magnesium dolomite is mined in two quarries in the plant area, at the rate of about 300 tons daily, as the source of both magnesium and calcium. Only the coarse clean rock, screened ahead of the primary crusher, is used in the magnesium-calcium process. The finer materials are further crushed, dried, and screened to produce special concrete aggregate, flux for the glass industries, and the fines for asphalt and other fillers.

Production of metals for 1966 and 1965 was as follows:

		1965	1966
Calcium crowns	lbs.	238,013	300,399
Magnesium, crowns	lbs.	22,431,474	15,343,465
Thorium	lbs.	7,275	175
Titanium	lbs.	19,311	3,015
Barium	lbs.	275	228
Strontium	lbs.	112	126
Zirconium	lbs.	15,658	2,657

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

As a result of a strike, almost four months of primary magnesium production time was lost which resulted in a reduction of income.

Production of magnesium crowns amounted to 15,343,465 pounds as compared to 22,431,474 pounds last year. Had there been no interruption, the rate of production would have resulted in the highest crown production in the company's history. The company also produced 6,670 pounds of zirconium magnesium master alloy, 228 pounds of barium and 125 pounds of strontium. During the strike shutdown, considerable vital maintenance repair was achieved on furnaces, main transformers, measuring and recording instruments, kilns and conveyance equipment; this work, which was carried out by staff employees, should reduce future shutdown time for repairs. The extrusion plant was operated on a reduced scale by staff employees until 21 October when striking employees returned to work. On 19 October the company and union reached agreement, thereby ending the strike that started on 14 July. The new labour contract expires 18 October 1968.

The company program was temporarily disrupted due to the strike but is now continuing with respect to improved furnace design, metal condensation, product improvement, die casting alloys and process efficiency. Efforts are being concentrated on the development of reduction furnace charging and discharging devices.

In 1966 the world demand for magnesium was strong. There was a release of 15,000 tons from the United States Government stockpile. The company continues to hold its share of the world magnesium market. It is anticipated that calcium sales to the U.S.A. will increase in 1967, due mainly to the Vietnam war demands.

Employment and Management

The average number of employees at the plant and quarry was 400. D. J. McPhail was plant manager.

MOLYBDENUM

Michigan Mining and Milling Company Limited

The company began operations on a molybdenum property in the Searchmount area early in 1966. Searchmount is off Highway 17, about 30 miles northeast of Sault Ste. Marie.

Six claims, located 5 miles east of the village, were leased from the Algoma Central Railway. The present company did some breaking from two surface exposures and a small stockpile was built up at the mill site.

One half mile north of Searchmount, a Butler-type mill building was erected and some equipment was installed.

All operations ceased in July.

Employment and Management

Gordon Trehaar was in charge and an average of 10 men were employed.

Pax International Mines Limited

Pax International Mines Limited was incorporated in October 1949; the capitalization was increased to 6,000,000 shares of \$1 par value of which 5,463,320 shares have been issued. The company is a consolidation of International Molybdenum Mines and Pax Athabasca Uranium Mines Limited. The directors and officers were: W. A. Page, president and director; D. A. Pettigrew, treasurer and director; J. B. Goad, Maxwell Bruce, A. K. Stuart, A. J. Montminy, H. G. Hughes, W. A. Morgan, and J. E. Hayes, directors; Miss Margaret Smith, secretary. The head office is at 1725 Bank Street, Ottawa; the mine address is Matachewan.

Pax International Mines Limited leased the property of Min-Ore Mines Limited, the name having been changed from New Ryan Lake Mines in October 1955. The copper-molybdenum prospect comprises approximately 39 claims in Powell township, District of Timiskaming, near the town of Matachewan.

There is a vertical two-compartment No. 1 shaft located in claim MR12548 some 459 feet deep, from which four levels had been established.

There was no development work completed at the property in 1966. Total development footage to 31 December 1966 was as follows: 6,777 feet of drifts; 2,593 feet of crosscuts; 3,603 feet of raises. One diamond-drillhole, totalling 900 feet was completed from surface, and 11 drillholes totalling 2,035 feet were completed from underground in 1966.

No development work was completed underground during the year although the workings were kept dewatered. Cominco had a field crew and surface drilling crew on the property during the summer and fall months. Since October the mill was leased to Ethel Copper Mines Limited, milling about 100 tons of ore per day from that property.

NICKEL AND COPPER

The production of nickel in Ontario decreased 16.24 percent in quantity, from 382,566,712 pounds in 1965 to 320,428,750 pounds in 1966; the value of production decreased 14.81 percent from \$316,332,366 in 1965 to \$269,461,584 in 1966. The mines with predominant nickel production include: Falconbridge Nickel Mines Limited, The International Nickel Company of Canada Limited, and Kidd Copper Mines Limited, in the Sudbury area; and, the Gordon Lake Division of Metal Mines Limited in the Werner Lake area of the Kenora District. These mines paid \$28,962,169 to 3,356 salaried employees and \$109,990,967 to 19,913 wage-earners; fuel and electricity cost \$24,251,493, and process supplies cost \$75,970,863. Some nickel production resulted from the refining of the silver-cobalt ores of the Cobalt-Gowganda area which is given in this Volume under "Silver and Cobalt".

The production of copper in Ontario decreased 6.14 percent in quantity, from 432,544,119 pounds in 1965 to 405,951,287 in 1966. The value of production increased 12.19 percent from \$161,665,138 in 1965 to \$181,375,552 in 1966. In addition to the copper production of the predominantly nickel-producing mines, there is also some copper production from the silver-cobalt and gold mines. The Manitowadge area mines, Noranda (Geco Division), Willecho and Willroy are important producers of cadmium, copper, gold, lead, silver and zinc; the general statistics for these operations and Zenmac Metal Mines in the Schreiber area is given under "Lead and Zinc". The balance of the copper production comes from the following predominantly copper-producing mines: Canadian Jamieson, Copperfields, Ethel Copper, Kam-Kotia,

NICKEL AND COPPER MINING AND SMELTING

	1962	1963	1964	1965	1966
	tons	tons	tons	tons	tons
Ore treated	15,724,683	16,699,767	19,936,712	19,493,142	17,182,443
Nickel produced in Ontario	91,222	73,818*	97,290	111,788	84,452
Copper produced in Ontario	172,407	164,834	184,181	143,960	124,140
Matte exported	121,901	118,372	106,020	131,673	127,778
Nickel content of matte exported	77,227	75,271	64,804	79,487	75,737
Copper content of matte exported	16,678	14,126	13,736	17,298	16,285

*Note: Correction of 1963 reported figure

PRECIOUS METALS RECOVERED

	1962	1963	1964	1965	1966
Platinum metals	oz. 470,782	357,649	376,238	463,127	395,952
	\$ 28,848,262	22,585,055	25,404,117	36,109,799	32,363,556
Gold	oz. 55,922	52,557	47,226	54,271	51,605
	\$ 2,092,042	1,983,946	1,771,379	2,047,591	1,946,025
Silver	oz. 1,757,848	1,373,044	1,459,455	1,766,248	1,639,566
	\$ 2,047,893	1,900,662	2,043,237	2,472,747	2,293,753
Total Value	<u>\$32,988,197</u>	<u>\$26,469,663</u>	<u>\$29,218,733</u>	<u>\$40,630,137</u>	<u>\$36,603,334</u>

STATISTICAL SYNOPSIS OF THE NICKEL-COPPER MINES IN ONTARIO

YEAR	NUMBER OF PRODUCING COMPANIES	DIVIDENDS PAID	NUMBER OF PLANTS IN ONTARIO	SALARIED EMPLOYEES			WAGE EARNERS		SELLING VALUE OF PRODUCTS		
				NUMBER	SALARIES	NUMBER	WAGES	KIND	VALUE		
1962	4	\$ 70,979,901	{ 18 mines* 3 smelters 2 refineries }	1,105 1,199 429	\$ 8,573,659 8,213,374 3,047,569	9,904 5,773 2,355	\$52,125,497 28,209,681 11,223,002	Nickel in matte Metallic nickel Nickel oxide and salts Copper in matte Converter copper Gold Silver Platinum metals Selenium and tellurium Cobalt Iron ore Sulphur	\$122,084,245 134,169,676 17,955,541 9,455,058 76,285,695 2,092,042 2,047,893 28,848,262 883,827 4,707,066 4,505,093 952,877		
Total		\$ 70,979,901		2,733	\$19,834,602	18,032	\$91,558,180				
1963	3	\$ 79,057,256	{ 15 mines* 3 smelters 2 refineries }	2,680	\$19,497,580	16,798	\$85,300,244	Nickel in matte Metallic nickel Nickel oxide and salts Copper in matte Converter copper Gold Silver Platinum metals Selenium and tellurium Cobalt Iron ore Sulphur	\$121,838,817 96,777,996 27,635,675 8,842,887 68,689,585 1,801,670 1,900,662 22,585,055 511,317 4,295,732 7,982,796 1,397,959		
Total		\$ 79,057,256		2,680	\$19,497,580	16,798	\$85,300,244				
1964	3	\$101,726,177	{ 20 mines* 3 smelters 2 refineries }	1,145 1,154 451	\$ 9,410,512 8,622,000 3,224,000	8,282 5,277 2,081	\$49,765,140 27,035,559 10,132,000	Nickel in matte Metallic nickel Nickel oxide and salts Copper in matte Converter copper Gold Silver Platinum metals Selenium and tellurium Cobalt Iron ore Sulphur	\$ 97,886,844 106,011,487 63,859,817 7,595,310 87,143,571 1,771,379 2,043,237 25,404,117 560,139 4,121,535 12,180,732 1,676,727		
Total		\$101,726,177		2,750	\$21,256,512	15,640	\$86,932,699				

1965	3	\$115,042,256	(22 mines* 3 smelters 2 refineries)	1,260 1,311 480	\$10,005,531 10,046,263 3,560,000	11,046 6,076 2,556	\$61,153,116 33,794,589 13,074,000)	Nickel in matte Metallic nickel Nickel oxide and salts Copper in matte Converter copper Gold Silver Platinum metals Selenium and tellurium Cobalt Iron ore Sulphur	121,505,416 122,960,643 71,844,829 11,862,805 108,432,215 2,047,591 2,472,747 36,109,799 657,947 5,398,260 14,816,973 1,143,170 \$499,252,395
Total		\$115,042,256	3,051	\$23,611,694	19,678	\$108,021,705			
1966	4	\$106,651,500	(24 mines* 3 smelters 2 refineries)	1,458 1,403 495	\$13,197,149 11,827,020 3,938,000	11,248 6,132 2,533	\$63,610,810 33,576,157 12,804,000)	Nickel in matte Metallic nickel Nickel oxide and salts Copper in matte Converter copper Gold Silver Platinum metals Selenium and tellurium Cobalt Iron ore Sulphur	117,918,783 94,857,296 56,643,002 13,496,895 111,708,200 1,946,025 2,293,753 32,363,556 596,850 4,988,414 12,663,520 1,281,869 \$450,758,163
Total		\$106,651,500	3,356	\$28,962,169	19,913	\$109,990,967			

*The figures for "mines" include the following that were active but non-producing:
 1962—Copper Cliff North, Crean Hill (International Nickel), Strathcona (Falconbridge).
 1963—Copper Cliff North, Coleman (International Nickel), Strathcona (Falconbridge).
 1964—Levack West, Coleman, MacLennan, and Totten (International Nickel), North mine (Falconbridge).
 1965—Coleman, Kirkwood, Levack West, Little Stobie, and Totten (International Nickel).
 1966—Coleman, Kirkwood, Levack West, Little Stobie and Shebandwan (International Nickel), Longuack South (Falconbridge Nickel).

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North Coldstream, Rio-Algom (Pater), Sheridan Geophysics (Coppercorp Property), and Texas Gulf Sulphur; these mines paid \$1,194,149 to 158 salaried employees and \$5,474,144 to 904 wage-earners; fuel and electricity cost \$980,421, and process supplies cost \$6,523,100.

The nickel-copper mines in the Sudbury area milled 16,971,215 tons, or 78.88 percent of the total of 21,513,645 tons of nickel and copper ores milled. In addition to the significant production of nickel and copper, they account for the province's entire production of platinum metals (selenium and tellurium), the major portion of the cobalt production, also significant production of gold, silver, iron ore and sulphur. The accompanying statistical synopsis of the nickel-copper mines, giving the complete production by year for a five-year period, includes the production of Metal Mines Limited (Gordon Lake Division), and the three producers of the Sudbury area: Falconbridge Nickel Mines Limited, The International Nickel Company of Canada Limited, and Kidd Copper Mines Limited.

Canadian Jamieson Mines Limited

Canadian Jamieson Mines Limited was incorporated in April 1964, with an authorized capitalization of 5,000,000 of \$1 par value, of which 2,513,087 shares have been issued. The directors and officers were: A. T. Griffis, president and director; G. J. Killeen, vice-president and director; R. D. Lawrence, J. J. Parisi and D. H. Wigston, directors; R. H. Pope, treasurer; R. C. Bragagnolo, secretary. The executive office is at 251 Third Avenue, Timmins; the mine address is Box 1050, Timmins.

The property comprises 13 claims in Godfrey and Jamieson townships, District of Cochrane, readily accessible by road from Timmins.

The vertical three compartment No.1 shaft in lot 9, concession 6, Godfrey township, was sunk 121 feet in 1966 to a depth of 760 feet below collar. The 5th level was established at a depth of 705 feet below the collar. Development footage completed in 1966 consisted of 1,897 feet of drifting, 730 feet of cross-cutting and 1,847 feet of raising. Total development footage to 31 December 1966 consisted of 2,870 feet of drifting; 1,877 feet of crosscutting and 2,483 feet of raising. Altogether 69 diamond-drillholes totalling 5,329 feet, were completed from underground.

Canadian Jamieson has purchased the complete plant of H. G. Young Mines Limited which it is moving and re-establishing a 450tpd copper zinc plant on the company property in Godfrey township. Major construction in 1966 included: addition to office, 24 x 12 feet; gate house, 10 x 8 feet; water storage tank, 20-foot diameter, 75 feet high; pump house, 10 x 8 feet; core shack; engineering office; conveyors.

Major equipment installed included the following:

- 1 hoist motor and controls to 200 feet.
- 1 air compressor, 1,000 cfm.
- 1 underground pump, 5 stage, 5 levels.
- 1 jaw crusher, 36 x 24 in.
- 1 cone crusher, short head cone 4 ft.
- 1 ball mill, 9 x 9 ft.
- 1 regrind mill, 5 x 8 ft.
- 1 Ross feeder, 48 in.
- 1 vibrating feeder, 72 x 48 in.
- 1 rod deck screen, 8 x 4 ft.
- 4 cyclones, 10 in.
- 2 disc filters; one 5 x 5 ft.; one 5 x 3 ft.
- 2 thickeners, 30 ft.
- 2 vacuum pumps
- 58 flotation cells; 38 No.24; 16 No.18; four 48 in.
- 2 dryers; one 34 x 5 ft.; one 16 x 5 ft.
- 3 conditioner tanks, plus ore and concentrate bins, reagent and tailings pumps, launders, electrical substations etc.

A total of 89,816 tons of ore was hoisted, 92,585 tons were milled at a daily average of 350 tons during the period of mill operation from 11 April to 31 December 1966.

Employment and Management

The average number of employees was 118: 39 underground and 79 on surface. H. R. Fowlie 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; Sir Michael Butler, Bt., secretary and director; J. H. Westell, treasurer and director; Hon. J. B. Aird, J. B. Goad, D. A. Perigoe and R. J. Wright, directors; N. B. Keevil Jr., vice-president exploration; J. B. Anderson, operations manager; D. S. Brown, assistant treasurer. The head office is at Suite 1000, 11 Adelaide Street West, Toronto 1. The mine address is 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, in the Timagami area, District of Nipissing.

Mining and milling operations continued throughout 1966.

The vertical four-compartment No.1 shaft located in Phyllis township on mining lease No.11446 has a depth of 1,672 feet below the collar.

Development footage in 1966 consisted of 7,990 feet of drifting, 909 feet of crosscutting and 1,318 feet of raising. Total development footage to 31 December 1966 was as follows: 39, 925 feet of drifts; 5,717 feet of crosscuts; 8,345 feet of raises. Diamond-drilling in 1966 consisted of 509 holes, totalling 83,077 feet from underground.

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Added equipment in 1966 included the following:

- 1 truck for hauling concentrate, 6-ton capacity.
- 2 scrapers, model 2A, 26 ins.
- 1 crawler tractor, series 1010
- 1 mucking machine, model 12B
- 1 high pressure fire pump
- 2 stoper rock drills
- 2 slushers; one 5 ph.; one double drum 7.5 hp.

A total of 52,635 tons of ore was hoisted; the mill treated 52,486 tons averaging 188 tons daily.

Company Annual Report

The following is taken from the company annual report for the year ending 30 June 1966.

Ore Reserves

	TONS	PERCENT COPPER
Ore in place	54,500	6.74
Broken ore	43,384	6.72
Total	97,884	6.73

An additional 16,600 tons of inferred ore grading 3.74 percent copper is also in place.

Milling

The mill treated 54,357 tons of ore grading 6.34 percent copper and 98.75 percent of the copper was recovered. The metals contained in the 11,492 tons of concentrate produced were as follows:

Copper	lb.	6,806,694
Gold	oz.	1,077.5
Silver	oz.	17,438

Copper Concentrate Production

	DRY TONS	PERCENT COPPER	OZ./TON GOLD	OZ./TON SILVER
Year ended 30 June 1966	11,492	29.62	0.094	1.52
Total to date	83,493	29.29	0.086	1.72

Employment and Management

The average number of employees was 107: 55 underground and 52 on surface. M. F. Leavens was mine manager.

Crownbridge Copper Mines Limited

Crownbridge Copper Mines Limited was incorporated in October 1963 with an authorized capitalization of 5,000,000 shares of \$1 par value of which 2,218,505 shares have been issued. The directors and officers were: L. J. Moreaux, president and director; R. Stewart, vice-president and director;

David Martin, Wm. Hull, A. J. Gravelle and J. E. Smith, directors; C. R. Schultz, secretary-treasurer. The head office and mine office is at Box 250, Iron Bridge.

The property comprises 101 claims in Township 168, District of Algoma, on Highway 546, 25 miles north of Iron Bridge. The mine is reached by an access road in an easterly direction some 3.5 miles long.

The vertical three compartment shaft in claim SSM53834 was collared and sunk to a depth of 28 feet below the collar. A 72-foot headframe had been partially erected.

Major construction in 1966 comprised the following: a mill 120 feet long, 56 feet wide at one end, 25 feet at the other; a machine shop and generator room, 74 x 42 feet; a pumphouse, 18 x 10 feet, all concrete block construction; a warehouse, dry and hoistroom T-shaped building, 86 x 35 x 24 feet; a core shack, 10 x 10 feet; a scale house, 16 x 8 feet; a powder magazine, 12 x 10 feet, all frame construction.

Major equipment installed included the following:

- 1 jaw crusher, 18 x 24 ins., 800 tons per day
- 1 cone crusher, 3 ft., 400 tons per day
- 1 screen, 8 x 4 ft., 800 tons per day
- 1 ball mill, 6 x 9 ft., 200 ton capacity
- 12 flotation cells, 200 ton capacity
- 1 thickener, 6 x 16 ft.
- 1 drum filter, 6 x 6 ft., 400 ton capacity
- 3 diesels (two 187 hp.; one 240 hp.), 575kva.

Copper Concentrators Limited

Copper Concentrators Limited, a private company, was incorporated in February 1966 with an authorized capitalization of 200,000 shares of no par value of which all shares have been issued. This company has an agreement with Crownbridge to truck ore from the Cheney and other satellite properties to the mill, and to produce copper concentrates from the 200 tpd. concentrator.

Cheney Property

The Cheney property comprises 17 claims in Gould township, District of Algoma. The Cheney Copper Mines Limited did a small amount of work on the property then known as McDonald Copper in 1917. The property came under the control of Sudbury Basin Mines Limited in 1928 and considerable development work was completed (see Ontario Department of Mines Annual Report 1928, Volume 38, Part 7, pages 10 to 15), including diamond-drilling, a 150-foot shaft, 450 feet of drifting, and 150 feet of crosscutting.

Major construction in 1966 included the erection of a 25-foot headframe, and a dry, 26 x 16 feet, both frame construction.

Equipment installed consisted of a hoist, size 7 x 6 in., an electric generator, and a compressor.

Employment and Management

The average number of employees at all operations was 5: 1 underground and 4 on surface. C. W. Miller was manager.

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Ethel Copper Mines Limited

Ethel Copper Mines Limited was incorporated in November 1952, with an authorized capitalization of 3,000,000 shares of \$1 par value, of which 2,956,520 shares have been issued. The directors and officers were: G. W. Carnegie, president and director; V. N. Harbison, vice-president and director; R. Darling, H. A. Campbell and G. S. Welsh, directors; Mrs. K. J. Anderson, secretary-treasurer. The head office is at Suite 607, 80 Richmond Street West, Toronto 1. The mine address is Elk Lake.

The company's holdings comprise 18 claims in James and Tudhope townships, District of Timiskaming, some three miles east of Elk Lake.

The property, inactive since 1961, was re-opened on a salvage basis in July, shipping copper ore to the milling plant of Pax International Mines. The first shipment of copper concentrate was made in October; present milling rate was approximately 100 tons per day. The ore is opened up on one level at the 150-foot horizon reached from surface through a minus-20-degree incline, about 359 feet long, located in claim MR10316. Lateral development was underway to the east and west consisting of 376 feet of drifting, 35 feet of crosscutting, and 137 feet of raising. Total development footage completed to 31 December 1966 was: 876 feet of drifts; 60 feet of crosscuts; and 137 feet of raises. Altogether 10 diamond-drillholes, totalling 865 feet were completed in 1966 from underground.

Major construction in 1966 included: a mine dry, 24 x 20 feet; and two ramps, one 80 x 6 x 8 feet, the other 60 x 12 x 10 feet, both frame construction with mill plastic covering.

Mining progressed from 1 September to 31 December and milling from 2 September to 31 December 1966.

A total of 10,485 tons of ore was hoisted, the mill treated 7,118 tons averaging 70 tons daily during the period of operation.

Employment and Management

The average number of employees was 12: 7 underground and 5 on surface. F. T. O'Connor was manager.

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 4,894,607 shares have been issued. The directors and officers were: H. J. Fraser, president and managing director; R. Campbell, executive vice-president and director; C. F. H. Carson, O. D. Cowan, W. F. James, Thayer Lindsley, J. D. Barrington, James Stewart, L. J. McGowan, S. M. Wedd and R. B. West, directors; R. C. Mott, vice-president (operations); G. S. Jewett, vice-president (corporate affairs); G. T. N. Woodrooffe, vice-president (finance) and secretary; W. G. Dahl, vice-president (marketing); E. L. Healy, vice-president (nickel division); P. N. Pitcher, vice-president (minerals division); G. P. Mitchell, director of exploration and geology; F. R. Archibald, director of metallurgy and research, A. W. Coome, controller; J. T. McWhirter, treasurer; J. L. Matthews,

assistant secretary; D. R. Lochhead, manager (nickel division, Sudbury operations); J. H. Fraser, general superintendent (Falconbridge area); A. R. Baker, general superintendent (Onaping area). 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.

Employment and Management

The company employed in Ontario in 1966, excluding employees of contractors doing work for the company, a total of 3,316 employees; 2,022 at the mines (1,409 underground and 613 on surface); 1,294 in the smelter, pyrrhotite plant and research laboratories operated by the company. Seven mines were operated since the Hardy, Boundary and Onaping operations were combined; total ore production was 2,102,750 tons; a total of 2,004 feet of shaft sinking was completed in 1966.

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

MINE	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING 1966	VERTICAL DEPTH FROM SURFACE
				feet	feet	feet
Falconbridge						
No. 1	3035 SES	Vertical	3	Surface	.....	2,848
No. 5	3040 SES	Vertical	6	Surface	.....	4,347
No. 7	3040 SES	Vertical	3 (inactive)	2,631	.....	4,323
No. 9	3040 SES	Vertical	6	4,023	.....	6,562
East Mine						
No. 1	3036 SES	Vertical	3	Surface	.....	3,942
No. 2	.....	Vertical	3	3,872	771	5,558
Hardy-Boundary-Onaping						
Hardy	5822	Vertical	3	Surface	.....	1,427
1125 Incline	.....	36½°	1 (inactive)	986	.....	1,138
Boundary	5821	Vertical	3	998	.....	1,951
Onaping	S.E.¼ S½, Lot 8, Con. 1, Levack tpw.	Vertical	5	Surface	.....	3,148
Fecunis Lake						
No. 1	N.W.¼ N½, Lot 5, Con. 2, Levack tpw.	Vertical	6	Surface	.....	4,183
No. 2	"	Vertical	4	Surface	.....	3,243
Strathcona						
No. 1	S.½, Lot 4, Con. 4, Levack tpw.	Vertical	4	Surface	.....	3,205
No. 2	"	Vertical	5	Surface	1,184	3,144
Longvack South	N.½, Lot 3, Con. 4, Levack tpw.	Vertical	3	Surface	49	49

FALCONBRIDGE MINE

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

Operations progressed from 1 January to 31 December 1966.

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A total of 7,049 feet of drifting, 245 feet of crosscutting, and 1,936 feet of raising was completed. Total development footage to 31 December 1966 was as follows: 224,471 feet of drifts; 47,084 feet of crosscuts; 110,408 feet of raises. A total of 663 diamond-drillholes totalling 62,328 feet were completed in 1966 from underground.

Production continued from the No. 5 shaft area. Stoping commenced in the No.9 internal shaft area on four levels. A raise borer is being used in the No.9 shaft area for driving ventilation and escapement raises. Portland cement is added to hydraulic tailings fill as required to provide concrete for stope floors, or consolidated fill for special fillings.

Major construction consisted of facilities for the addition of alluvial sand at the tailings and fill plant, 31.5 x 8 x 9 foot building extension with concrete foundation, steel frame, tile walls, "T" deck roof with built up roofing.

New equipment added was as follows:

- 1 battery locomotive, 8½ ton
- 2 loaders, model 12B-55
- 10 mine cars, Granby, 93 cu. ft.
- 1 scooptram, S.T. 1½

A total of 781,551 tons of ore was hoisted and milled.

Employment and Management

The average number of employees was 879; 675 underground and 204 on surface. A. G. Slade was mine superintendent.

EAST MINE

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

Operations progressed from 1 January to 31 December 1966.

The vertical three compartment No.2 internal shaft, collared on the 4,025-foot level 3,872 feet below surface, was sunk a further 771 feet in 1966 to a vertical depth of 1,686 feet below the collar or 4,787 feet below surface. The 4,525-, 4,700-, 4,875-, 5,025-, 5,200-, 5,375-, 5,525- and 5,700-foot levels were established at depths of 512, 680, 847, 1,014, 1,182, 1,349, 1,517 and 1,685 feet respectively below shaft collar.

During the year 64 feet of drifting, 231 feet of crosscutting, and 72 feet of raising were completed. Total development footage to 31 December 1966 was as follows: 39,922 feet of drifts; 7,684 feet of crosscuts; 15,968 feet of raises. Some 84 diamond-drillholes totalling 5,329 feet, were drilled from underground in 1966. The ore was trammed over to Falconbridge mine orepass on three levels. The stoping method in use is overhand slice-and-fill using mill tailing.

Major construction in 1966 consisted of an extension to the tailings and fill plant, 27 x 16 x 27 feet with concrete foundation, steel frame, tile walls, "T" deck roof with built up roofing to provide facilities for the addition of cement.

A total of 298,942 tons of ore was hoisted and milled.

Employment and Management

The average number of employees was 156; 145 underground and 11 on surface. W. W. Bolton 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, Sudbury district. The mine address is Onaping.

Operations progressed from 1 January to 31 December 1966.

Development footage in 1966 comprised the following: 51 feet of drifting, 49 feet of crosscutting, and 136 feet of raising at the Hardy property; 730 feet of drifting, 63 feet of crosscutting, and 409 feet of raising at the Boundary property; 1,820 feet of drifting, and 118 feet of crosscutting at the Onaping property. Total development footage at the three properties to 31 December 1966 was as follows: 14,944 feet of drifts, 18,582 feet of crosscuts, and 13,048 feet of raises on the Hardy property; 12,143 feet of drifts, 3,979 feet of crosscuts, and 3,468 feet of raises on the Boundary property; 11,023 feet of drifts, 10,326 feet of crosscuts, and 6,707 feet of raises on the Onaping property; the accumulated total on the three properties was 38,110 feet of drifts, 32,887 feet of crosscuts, and 23,223 feet of raises. Diamond-drilling in 1966 consisted of 129 holes, totalling 45,648 feet from underground, and seven holes totalling 338 feet from surface.

Construction

Major construction in 1966 included the following:

HARDY MINE

Extension to services building 42 x 14 x 12.5 feet, concrete foundation, concrete block walls, "T" deck roof with built up roofing. Area fuse and capping house 32 x 30 x 11 feet, concrete foundation frame construction, sand filled walls and ceiling, wood roof and asbestos board sheathing.

ONAPING MINE

A dry and office building 92 x 46.6 x 22.5 feet with 73.5 x 12.7 x 12.5 foot lean-to and passage, concrete foundation steel frame, tile walls, precast roof with built up roofing.

HARDY-BOUNDARY-ONAPING AREA

A gate-house 18 x 11 x 8 feet, concrete pad, frame construction, wood roof and asbestos shingle siding.

Equipment

Added equipment at the Boundary mine consisted of the following:

- 2 electric slusher hoists, 3 drum, 30 hp.
- 2 air slusher hoists, 2 drum, 15 hp.

Underground Operations

Pillar recovery is continuing at the Hardy mine using undercut and fill methods. Boundary-Onaping continue overhand cut and fill stoping. The addition of Portland cement to the tailings fill has been a successful innovation.

A total of 491,975 tons of ore was hoisted and milled.

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Employment and Management

The average number of employees at the Hardy, Boundary and Onaping properties was 545: 260 underground and 285 on surface. P. W. MacMillan was mine superintendent.

FECUNIS LAKE MINE

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

Operations progressed from 1 January to 31 December 1966.

During the year 1,197 feet of drifting, and 291 feet of raising were completed. Total development footage to 31 December 1966 was as follows: 18,702 feet of drifts; 13,776 feet of crosscuts; 14,292 feet of raises. Some 27 diamond-drillholes totalling 22,037 feet, were drilled from underground in 1966.

A total of 333,172 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.

Employment and Management

The average number of employees was 249: 176 underground and 73 on surface. E. N. Gilje was mine superintendent.

STRATHCONA MINE

The property comprises five claims located in Levack township, Sudbury district. The mine address is Onaping.

Operations proceeded from 1 January to 31 December 1966.

The vertical, five compartment No.2 shaft located in the S.½ lot 4, concession 4, Levack township was sunk 1,184 feet in 1966 to a depth of 3,144 feet below the collar. The 2,000-, 2,125-, 2,250-, 2,375-, 2,500-, 2,625-, 2,750-, 2,900-, 3,025-, and 3,150-foot levels were established at vertical depths of 1,992, 2,119.9, 2,247.7, 2,375.6, 2,503.6, 2,631.4, 2,759.3, 2,887.2, 3,015.3, and 3,144 feet respectively, below the collar.

Development work consisted of 7,871 feet of drifting, 6,524 feet of cross-cutting, and 14,524 feet of raising. Total development footage to 31 December 1966 consisted of 33,271 feet of drifts, 27,712 feet of crosscuts, 21,996 feet of raises. Diamond-drilling consisted of 100 holes totalling 21,624 feet from underground.

The sinking of No.2 shaft was completed and the cage friction hoist was put in operation. Stope preparation and excavation of ore handling facilities and ventilation raises had commenced.

Major new construction of the crushing plant and concentrator continued throughout the year and consisted of No.2 shaft shafthouse, the south section, 40 x 30 x 22 feet, and the east section, 74 x 53 x 22 feet, both on concrete foundations, steel frame and tile walls; a water storage tank, 250,000 imp. gals., 48 ft. diam., 24 feet high wood stave construction on concrete base; two pumphouses, No. 1, 16 x 16 x 11.5 ft., No. 2, 20 x 20 x 11.5 ft., both on concrete foundations with tile walls.

New equipment installed included the following:

- 1 cage hoist, 9 ft. Asca friction winder
- 1 shunt wound motor, 735 hp., type LC 1805
- 1 M.G. set, 800 hp., type GA 109
- 20 Grangesburg mine cars, 250 cu. ft. bottom dump
- 2 trolley locomotives, 20 ton, type LME
- 4 raise climbers, Alimak, type STH-5
- 2 loaders, Eimco 24B
- 2 battery locomotives, Clayton 4.5 tons
- 1 true gun, model SFM

A total of 47,818 tons of ore was hoisted.

Employment and Management

The average number of employees was 193: 153 underground and 40 on surface. K. A. Baillie was mine superintendent.

NORTH MINE

The mine is located in the N.¼ of lot 5, concession II, of Levack township 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 1966.

Development work consisted of 1,933 feet of drifting, 579 feet of raising. The total to 31 December 1966 was 5,484 feet of drifts, 2,342 feet of crosscuts, 1,360 feet of raises completed from the 3,450-, 3,600-, and 3,775-foot levels of Fecunis Lake mine. Some 107 diamond-drillholes totalling 42,458 feet were completed from underground.

New added equipment in 1966 consisted of an electric slusher hoist, Joy type D, 3 drum, 30 hp.

A total of 149,292 tons of ore was hoisted.

Employment and Management

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

LONGVACK SOUTH MINE

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

Operations progressed from 16 May to 31 December 1966. The vertical, three compartment Longvack South shaft was collared in the N.½ lot 3, concession 4 Levack township and sunk to a depth of 49 feet below the collar.

Major construction in 1966 comprised the following:

- 1 timber headframe, 88 x 38 x 120 feet, concrete foundation, wood roof with asbestos sheathing and roofing.
- 1 shafthouse, 51 x 37 x 24 feet, frame construction, tripanel sheathing 1½-inch, 2 inch T. & G. roof, trafford tile roofing.
- 1 bin, 31 x 17 x 34 feet with structural steel supports.
- 1 hoist house, 60 x 14 x 16 feet, Butler building, insulated, concrete foundation.

Added equipment included a used mine hoist, double drum, 120 x 56 ins., C.I.R., class PE-1; two electric motors, 400 hp., 600 rpm. C.G.E. type M; two sheave wheels Dodge bicycle type, 10 ft. diameter.

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Some 33 diamond-drillholes totalling 5,389 feet were completed from surface.

Management

The work progressed under the direction of G. M. Proudfoot, mine projects superintendent and A. R. Baker, superintendent, Onaping area.

Outside Exploration

Outside exploration completed in 1966 on Sudbury Basin properties required some 711 feet of drifting on the 2,650-foot level of International Nickel's Levack mine to complete exploratory diamond-drilling to the Fecunis Lake, Longvack and North mine properties; the footage drilled was included in the total for these mines.

Management

The work was carried out under the direction of A. M. Clarke, chief geologist for Falconbridge.

CONCENTRATORS

FALCONBRIDGE MILL

The plant address is Falconbridge.

Operations progressed from 1 January to 31 December 1966.

During the year a total of 1,078,352 tons of ore was milled, at an average of 3,072 tons daily.

EMPLOYMENT AND MANAGEMENT

W. R. Lyford was superintendent of plants. The employees were included in the smelter total.

HARDY-BOUNDARY-ONAPING MILL

The plant address is Onaping.

Operations proceeded from 1 January to 31 December 1966.

New construction consisted of a pellet hardening plant, 55 x 42 x 47.5 feet, concrete foundation, steel frame, tile walls, precast concrete roof.

Added equipment was as follows:

- 1 X-ray Quantimeter for process control, type PCXQ with computer interface console (Baush & Lomb)
- 1 shaft drier
- 1 conveyor system, 18 conveyors; twenty-four 30 in. wide, seven 170 feet long.
- 2 natural frequency feeders; one 24 ins., one 18 ins.

During the year a total of 446,350 tons of ore was milled, at an average of 1,531 tons daily and 95,165 tons of nickel-copper concentrate was produced.

EMPLOYMENT AND MANAGEMENT

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

FECUNIS MILL

The plant address is Onaping.

Operations progressed from 1 January to 31 December 1966.

During 270 days of operation in the year a total of 569,200 tons of ore was milled, at a daily average of 2,108 tons, producing 105,060 tons of nickel-copper concentrate.

EMPLOYMENT AND MANAGEMENT

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

STRATHCONA MILL

The plant address is Onaping.

Construction of the crushing plant and concentrator continued throughout the year and consisted of the following:

- 1 concentrator building, lower section 398 x 206 x 43.5 feet, mid section, 65 x 250 x 76, upper section 58 x 250 x 114 feet, concrete foundation, steel frame, three walls tile, one asbestos.
- 1 tailings fill plant, 180 x 90 x 86, concrete foundation, steel frame, tile walls.
- 1 service tunnel concentrator to tailings fill plant, 7 x 7 x 115.7 feet long, reinforced concrete construction.

SMELTER AND PYRRHOTITE PLANT

The smelter and plants address is Falconbridge.

Operations proceeded from 1 January to 31 December 1966.

New construction in 1966 consisted of the concrete foundation, 60 x 34 feet for an extension for the new smelter building.

New equipment added included the following:

- 1 lightning mixer, Greey 40 hp. for the pyrrhotite plant
- 1 converter, Pierce Smith type, 13 x 30 feet.

The smelter treated concentrates from the Falconbridge, Hardy and Fecunis mills and produced 65,814 tons of nickel-copper matte. The pyrrhotite plant treated pyrrhotite concentrate and produced 92,644 short tons of iron ore.

Employment and Management

The average number of employees was 1,188 in the smelter and pyrrhotite plant. W. R. Lyford superintendent of plants was in charge.

FALCONBRIDGE RESEARCH LABORATORY

The metallurgical laboratories of Falconbridge Nickel Mines Limited, are located 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.

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Employment and Management

C. L. Lewis is the manager. There are 79 persons employed.

LAKEFIELD RESEARCH OF CANADA LIMITED

Lakefield Research, a subsidiary of Falconbridge Nickel Mines Limited, is located at Lakefield, seven miles north of Peterborough. Since the company was incorporated in 1941, it has been in the business of serving mineral and metal producers through mineral processing, research, and flowsheet development. During 1966 the company investigated processes for the beneficiation of all types of ores, metallic and non-metallic.

Employment and Management

A. G. Scobie is manager and there are 27 persons employed.

COMPANY ANNUAL REPORT

The following is taken from the company annual report for the year ending 31 December 1966.

Metal Deliveries

	1966	1965
	pounds	pounds
Nickel	78,963,000	72,984,000
Copper	32,872,000	33,813,000

The upward trend in nickel consumption continued for a fourth straight year. Nickel deliveries from production were augmented by purchased nickel from the United States Government stockpile. This enabled the company to increase nickel deliveries to the highest level in its history.

Copper production and deliveries were somewhat lower than in the preceding year.

Metal Prices

Free world nickel prices were raised late in 1966. The base price for electrolytic nickel was increased by U.S. 7½ cents per pound, from 77¾ cents to 85¼ cents. The increase was made effective by the company as from 1 December 1966. Suspension of the import duty of 1¼ cents per pound of refined nickel, announced by the United States Government . . . in September 1965, continued throughout 1966.

Copper prices fluctuated during the year in response to changing market conditions. Until May 1966, the "producers' price", at which most copper sales were made stood at U.S. 42 cents per pound. The successive establishment of several different levels of substantially higher prices by individual companies or countries produced a chaotic situation in the wake of disrupted copper supplies from Chile and Africa.

Mines

	1966	1965
Ore delivered to treatment plants from company mines	tons 2,101,000	2,344,000

Production of ores from company mines was down in 1966 from 1965 by slightly over 10 per cent, but as a result of higher quantities of nickel in feed from other sources, primarily in concentrates from Marbridge Mines Limited, the smelter production of nickel in matte was down by less than 4 percent.

A very heavy program of development work was carried on at the Strathcona mine toward preparing it for production. Over 14,000 feet each of drifting and of raising were completed in the year. The No. 2 shaft was completed at a depth of 3,144 feet below collar, and the cage hoist

was put in service in December. At the Longvack South mine, a surface plant was constructed and the collar was completed ready for sinking.

Development work also continued in the producing mines. Drifting was carried on from the No. 9 internal shaft at the Falconbridge mine on various levels between the 4,700-, and 5,875-foot levels. East mine No. 2 shaft was deepened to the 5,600 horizon towards its objective at the 6,050-foot level.

Treatment Plants and Refinery

The smelter, pyrrhotite plant and the three mills operated without interruption except for the curtailment of feed created by a shortage of skilled miners and labour unrest in the latter half of the year.

Refined nickel production was slightly higher than in the previous record year of 1961. Production at the refinery was limited by the supply of feed, and inventories of unfinished nickel were somewhat reduced. Stable operating conditions existed throughout the year.

Ore Reserves

After extracting 2,101,000 tons for treatment, the ore reserves were increased in both tons and metal content. Development programs in the mines, especially at Falconbridge and Strathcona, and completion of the drilling program at Lockerby, accounted for the gain in reserves.

Proven ore reserves at year end were calculated at 55,717,500 tons with a combined nickel-copper content of 1,172,000 tons as compared with 55,260,000 containing 1,162,000 tons at the end of 1965. Estimates of the company's reserves of probable ore also increased in the year from 17,900,000 tons of ore containing 304,000 tons of nickel-copper metal to 19,143,200 tons of ore containing 326,411 tons of metal.

Great Lakes Nickel Corporation Limited

Nautilus Uranium Mines Corporation Limited was incorporated in 1955; in December 1964 the name was changed to Great Lakes Nickel Corporation Limited, with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 1,500,000 shares, including 910,000 pooled shares have been issued. The directors and officers were as follows: J. A. McCuaig, president and director; I. C. Christopher, vice-president and director; H. R. Hogan and W. H. Hood, directors; J. A. Murphy, secretary-treasurer. The head office is at 360 St. James Street West, Montreal, P.Q. The mine address is Box 367, Fort William.

The property comprises 29 claims in Pardee township, District of Thunder Bay. Some work had been previously completed on the property including a tunnel some 80 feet long.

Mining operations proceeded from July to December 1966.

A diamond-drill, model P38, was purchased and some 17 holes, totalling 810 feet were completed from underground and 14 holes, totalling 16,955 feet were completed from surface.

Major construction included a cookhouse and bunkhouse, both of 20 man capacity.

Added equipment included an air compressor, 600 cfm; a Ford Bronco and a Bombardier muskeg tractor.

About 460 tons of ore was removed and stockpiled.

Employment and Management

A. W. Grant was manager; H. Monette, T. Salman and J. H. Riemers were consulting engineers and several men were employed during the period of operation.

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Irvington Mining Company Limited

Genex Mines Limited was incorporated in March 1949; in October 1966 the name was changed to Irvington Mining Company Limited having an authorized capitalization of 5,000,000 shares of no par value, of which 1,092,500 shares have been issued. The directors and officers were: I. M. Harrington, president and director; A. T. Griffis, vice-president and director; E. D. Hinch and B. E. W. Gransden, directors; A. B. Whitelaw, secretary; T. Henerofsky, treasurer. The head office is at Suite 1100, 365 Bay Street, Toronto 1; the mine address is Box 877, Timmins.

The property comprises 7 claims in Godfrey township, District of Cochrane, in the Timmins area.

Mining operations progressed with sporadic mill operation from June to November 1966.

The vertical two-compartment No.1 shaft located in claim P.27215 has a depth of 277 feet below the collar. The first and second levels had been established at depths of 125 and 250 feet below the collar. Development footage in 1966 consisted of 1,025 feet of drifting and 692 feet of raising. Total development footage to 31 December 1966 consisted of 2,647 feet of drifts, 310 feet of crosscuts, and 692 feet of raises. Some 47 diamond-drillholes totalling 5,656 feet were completed from underground. Major construction in 1966 consisted of a mine dry.

The company went into intermittent production but difficulties of all sorts were encountered throughout the summer and fall. Finally the plant was closed, and the shaft capped on 1 December; future plans are not known.

Employment and Management

The average number of employees was 42: 17 underground and 25 on surface. J. A. Bates was managing director, R. McDonald was manager.

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 of no par value, of which 29,678,245 shares have been issued.

The officers of the company in 1966 were as follows: H. S. Wingate, chairman and chief officer; J. R. Gordon, president; J. C. Parlee, executive vice-president; T. M. Gaetz, assistant vice-president; W. A. McCadden, comptroller; W. F. Kennedy, secretary; F. M. A. Noblet, treasurer; J. A. Pigott, division general manager (Ontario); Alex Godfrey, W. Curlook, N. H. Wadge, D. A. Fraser and G. O. Machum, assistants to Division general manager (Ontario); J. McCreedy, manager of mines; R. R. Saddington, manager of reduction plants; G. A. Dick, manager (copper refining division, Sudbury); W. R. Koth, manager (nickel

SHAFTS, INTERNATIONAL NICKEL COMPANY'S MINES, SUDBURY AREA

	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING IN 1966	VERTICAL DEPTH FROM SURFACE
			feet	feet	feet
Coleman					
No. 1	Vertical	5	Surface	537	592
Crean Hill					
No. 1	(57° to 305 ft.) (71° to bottom)	3 (inactive)	Surface	.....	797
No. 2	Vertical	5	Surface	.....	2,115
Creighton					
No. 2.0	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	2,249	2,337
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	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	Surface	1,056	1,100
Garson					
No. 1	Vertical	3 (inactive)	Surface	.....	1,457
No. 2	Vertical	5	Surface	.....	4,242
No. 3	Vertical	2	4,000	.....	5,126
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
Maclennan					
No. 1	Vertical	3	Surface	165	1,091
Kirkwood					
No. 1	Vertical	3	Surface	1,601	1,650
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
Victor					
No. 1	Vertical	3	Surface	.....	362
Clarabelle C.C. North					
No. 1	Vertical	5	Surface	.....	4,134
No. 2	Vertical	3	Surface	930	937
Totten					
No. 1	Vertical	3	Surface	.....	824
No. 2	Vertical	3	Surface	1,335	1,383
Little Stobie					
No. 1	Vertical		Surface	777	777
No. 2	Vertical		Surface	1,230	1,230
Shebandowan					
No. 1	Vertical		Surface	577	577

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refining division, Port Colborne); E. G. Stoneman, manager (iron ore recovery plant, Copper Cliff).

The executive office is at 67 Wall Street, New York 5, N.Y., U.S.A., and the general offices are at Copper Cliff. The Toronto office is at 55 Yonge Street, Toronto 1.

The company and its subsidiary companies operate hydro-electric plants; nickel-copper mines in the Sudbury district; a smelter, refinery, and iron ore recovery plant at Copper Cliff; a refinery at Port Colborne. 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.

Employment

The International Nickel Company of Canada Limited employed for its Ontario operations, excluding work completed by contractors for the company, an average of 19,862 employees: there were 10,457 employed in the mines (7,562 underground and 2,895 on surface); 18 were employed in one quarry; 7,046 were employed in the smelters and iron ore recovery plant; 3,036 were employed in two refineries. Ten mines and open pit, two of which did not operate for the full year, supplied a total of 15,716,929 tons of ore of which 14,961,308 tons was processed. A total of 28 days were lost by all operations in 1966 due to strike action.

CREAN HILL MINE

Normal operations continued.

The vertical five-compartment No.2 shaft some 2,115 feet in depth was used to service the mine. The No.1 inclined shaft was abandoned for hoisting purposes.

Development footage in 1966 consisted of 3,404 feet of drifting and cross-cutting and 1,411 feet of raising. Total development footage to 31 December 1966 was: 55,346 feet of drifts and crosscuts; 14,779 feet of raises. Some 48 diamond-drillholes, totalling 16,473 feet, were completed from underground and 13 holes totalling 2,929 feet were completed from surface.

Added equipment in 1966 consisted of the following:

- 5 batteries, 66 D-8 cells
- 5 stoper drills, RB-83
- 10 mine cars, Granby, 110 cu. ft. 36 in.
- 4 slusher hoists, 2 drum AF-212
- 1 ore loader, LM56-H
- 2 locomotives, 9 ton, 36 in. gauge
- 1 pump, model M-14
- 2 scrapers, 60 in.
- 3 rectifiers, battery charging, model SL-150D-150M
- 1 car dumper

A total of 692,154 tons of ore was hoisted, 693,157 tons were shipped at an average of 3,067 tons per working day, 28 days were lost due to strike action.

Employment and Management

The average number of employees was 296: 217 underground and 79 on surface. R. H. Brown was superintendent.

CREIGHTON MINE

Normal operations continued.

The vertical, six-compartment No.9 shaft was sunk some 2,249 feet and had reached a depth of 2,337 feet below surface at year end; the planned depth is 7,150 feet.

Development work in 1966 consisted of 12,239 feet of drifting and cross-cutting; 5,715 feet of raising. Total development footage to 31 December 1966 was as follows: 487,296 feet of drifts and crosscuts; 224,645 feet of raises. A total of 271 diamond-drillholes totalling 98,866 feet were completed from underground.

Major construction in 1966 included a hoisthouse (223 x 123 x 54 feet).

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

- 3 batteries, 66 D-8 cells
- 1 crane, underhung type, 25 ton
- 9 ore car dumpers with 2-10 in. lift cylinders
- 1 hoist, parallel double drum, 18 ft. diam.
- 11 slusher hoists, K5MM-26
- 7 slusher hoists, 125 NN5T MK1V
- 5 slusher hoists, 2 drum AF-212
- 5 slusher hoists, 3 drum AF-312
- 1 axivane fan, 66-26½-1150 series 1000
- 2 air intake fans, size 66D types
- 2 ore loaders, LM-56H
- 1 scooptram, diesel powered, model ST-4A
- 1 gun, all machine, true 24-36 in.
- 1 silicon rectifier, model SL-150D-150M
- 6 pumps, M-14
- 6 locomotives, 9 ton, 24 in. gauge
- 1 oil and gas burner, RC1G4NA, natural draft
- 2 heaters, Drago, model 150 GM
- 7 transformers, various sizes
- 3 hot water tanks, 5 x 12 feet
- 1 skip, bottom dump, 15 ton
- 3 diamond drills, VEG-O; plus 3 pumps, model B-B-4-7
- 1 jumbo drill, self propelled
- 2 transformers for temporary substations
 - 1—2000 kva 13,800/4160V; 1—1500 kva 13,800/575V
- 3 transformers for permanent substations
 - 2—10,000 kva, 69,000/13,800V; 1—1500 kva, 13,800/575V

A total of 4,278,703 tons of ore, averaging 18,042 tons daily, was hoisted and shipped for treatment.

Employment and Management

The average number of employees was 2,311: 1,770 underground and 541 on surface. E. E. Mumford was superintendent.

FROOD STOBIE MINE

Normal operations continued.

The vertical, three compartment No.9 shaft was sunk 1,056 feet to a depth of 1,100 feet below surface. The 600-and 1,000-foot levels were established at depths of 578 and 977 feet below the collar. This 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.

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Development work consisted of 35,230 feet of drifting and crosscutting; 6,094 feet of raising. Total development footage to 31 December 1966 was as follows: 607,058 feet of drifts and crosscuts, 227,127 feet of raises. Some 75 diamond-drillholes, totalling 7,196 feet were drilled from underground.

Considerable new and replacement equipment similar to additions at Creighton mine was installed both underground and on surface at Frod Stobie mine.

A total of 4,964,399 tons of ore at a daily average of 21,105 tons was hoisted and shipped for further treatment.

Employment and Management

The average number of employees was 2,974: 2,310 underground and 664 on surface. S. J. Sheehan was superintendent.

GARSON MINE

Normal operations continued.

Development work consisted of 6,540 feet of drifting and crosscutting; 3,348 feet of raising. Total development footage to 31 December 1966 was as follows: 250,864 feet of drifts and crosscuts; 113,728 feet of raises. Some 86 diamond-drillholes, totalling 48,738 feet, were drilled from underground.

Added equipment included a wood stave tank, 40 ft. diam. x 14 feet, 124,667 U.S.G.; 2 mixing tanks, 9 ft. diam. x 8 feet, 2,755 imp. gals.; 2 agitators, open type and 1 cable reel, vertical axis, all for the sand fill plant.

A total of 978,177 tons of ore, at a daily average of 4,189 tons was hoisted and shipped for further treatment.

Employment and Management

The average number of employees was 1,108: 907 underground and 201 on surface. B. T. King was superintendent.

LEVACK MINE

Normal operations continued.

Development work in 1966 consisted of 1,608 feet of drifting and crosscutting; 2,074 feet of raising. Total development footage to 31 December 1966 was as follows: 259,468 feet of drifts and crosscuts after 1,324 feet had been transferred to the Levack West mine; 86,906 feet of raises. Some 47 diamond-drillholes, totalling 41,030 feet were drilled from underground. Some drilling was done for Falconbridge, and some was done jointly with Falconbridge.

New and replacement equipment added in 1966 included mine car dumpers, batteries, fans, slusher hoists, loaders, scooptram, weighers, rotor for 1,200 hp. motor, man cage, and air receivers.

A total of 1,483,888 tons of ore was hoisted and shipped at an average of 6,382 tons per working day.

Employment and Management

The average number of employees was 2,161: 1,718 underground and 443 on surface. D. Lennie was superintendent.

LEVACK WEST MINE

A limited amount of development work was carried out at the Levack West mine by Falconbridge for International Nickel. Some 843 feet of drifting and crosscutting and 83 feet of raising was completed in 1966; 1,324 feet of drifts and crosscuts was transferred from the Levack mine footages, resulting in a total of 3,026 feet of drifts and crosscuts and 115 feet of raises for the Levack West mine to 31 December 1966. Some 17 diamond-drillholes, totalling 15,702 feet were completed from underground, also by Falconbridge for International Nickel.

Management

The work was under the direction of J. McCreedy, manager of mines.

MURRAY MINE

Normal operations continued.

Development work in 1966 included 12,664 feet of drifting and crosscutting; 1,749 feet of raising. Total development footage to 31 December 1966 was as follows: 196,232 feet of drifts and crosscuts; 42,787 feet of raises. Some 24 diamond-drillholes, totalling 25,226 feet were completed from underground.

Added equipment consisted of two compressors, three ore loaders, two slusher hoists and three ore car dumpers.

A total of 1,324,122 tons of ore at a daily average of 5,659 tons was hoisted and shipped for further treatment.

Employment and Management

The average number of employees was 673: 538 underground and 135 on surface. H. W. Smith was superintendent.

CLARABELLE-COPPER CLIFF NORTH MINE

These two operations, formerly reported separately, are now combined since the 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 vertical three-compartment No.2 shaft was collared and sunk 930 feet to a depth of 937 feet below the collar. The 400-, 600-, and 800-foot levels were established at depths of 420, 623, and 819 feet below the collar, the 4,100-foot level was established in No.1 shaft some 4,124 feet below the collar.

Development footage in 1966 consisted of 21,602 feet of drifting and crosscutting, and 4,964 feet of raising. Total development footage to 31 December 1966 was as follows: 50,521 feet of drifts and crosscuts; 11,749 feet of raises. Some 137 diamond-drillholes, totalling 100,006 feet, were completed from underground and 13 holes totalling 7,659 feet from surface. Some 1,779 rotary drill-blastholes, totalling 90,667 feet were completed in the open pit.

Major construction consisted of a truck warming shed, 120 x 40 x 16 feet.

Added equipment comprised three 4 ton locomotives, 23 batteries, 6 silicon rectifiers, eighty-five 140-cu.ft. mine cars, 2 electric motors 600 hp., 12 winches,

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16 ore car dumpers, 24 fans, 1 air compressor, 1 longhole drill, and 8 Haulpack trucks of 35 ton capacity.

A total of 1,359,733 tons of ore was mined and trucked to the rockhouse at an average of 5,654 tons daily.

Employment and Management

The average number of employees 239: 102 underground and 137 on surface. N. A. Creet was superintendent.

MACLENNAN MINE

Operations progressed with open pit mining completed 22 June.

The vertical three-compartment No.1 shaft was sunk 165 feet to a depth of 1,091 feet below the collar by MacIsaac Mining and Tunnelling Company on contract. A total of 4,831 feet of drifting and crosscutting and 2,092 feet of raising was completed. Total development footage to 31 December 1966 was as follows: 5,200 feet of drifts and crosscuts, 2,092 feet of raises. Some 63 diamond-drillholes, totalling 10,177 feet were completed from underground.

A total of 178,819 tons of ore was hoisted, 178,715 tons were delivered at a daily rate of 709 tons during the operating period, by Carman Construction on contract.

Management

J. McCreedy, manager of mines for International Nickel, was in charge.

KIRKWOOD MINE

Operations continued under Dravo of Canada Limited contract at the Kirkwood property located in Garson township.

The vertical three-compartment No.1 shaft was sunk 1,601 feet to a depth of 1,650 feet below the collar. The 200-, 400-, 600-, 800-, 1,200-, 1,400-, and 1,600-foot levels were established at depths of 211, 400, 610, 799, 1,009, 1,219, 1,408, and 1,618 feet respectively below the collar. Development footage in 1966 consisted of 673 feet of drifting and crosscutting and 197 feet of raising which is also the total to date.

Major equipment installed consisted of the following:

- 3 compressors
- 2 stage with 500hp. motors
- 3 horizontal air receivers (60 x 192 ins.)
- 3 after cooler assemblies
- 2 chlorinators
- 1 fan size 50
- 4 pumps vertical turbine 6 stage
- 2 transformers (one—1000 kva, 44,000/2,300V; one—600 kva, 2,300/500V temporary substations)

Management

J. McCreedy, manger of mines for International Nickel, was in charge.

COLEMAN MINE

The contract for sinking the vertical, five compartment No.1 shaft commenced in 1965; sinking in 1966 comprised a further 537 feet to a depth of 592 feet below the collar.

Falconbridge Nickel Mines Limited completed 452 feet of drifting and crosscutting and 40 feet of raising for International Nickel at the Coleman mine. Total development footage to 31 December 1966 consisted of 3,729 feet of drifts and crosscuts and 51 feet of raises. Some 19 diamond-drillholes, totalling 13,986 feet were completed from underground by Falconbridge and 11 holes totalling 2,580 feet were completed from surface by International Nickel.

Major construction consisted of a steel building 60 x 28 x 14 feet Amsco pre-engineered and erected by Neil Smith Construction Limited of Sudbury.

Added equipment included the following:

- 1 air compressor, 1080 cfm, 19½ x 12 x 10 x VHE-2
- 3 air compressors, various types
- 50 mine cars, Granby 110 cu. ft., 24 in.
- 1 fan, Woods 2 stage, 24 in. diam., 1500 cfm.
- 1 transformer, 2000 kva, 44,000/4160V
- 1 transformer, 1500 kva, 4,160/575V

Management

J. McCreedy, manager of mines for International Nickel was in charge. The work was completed by Dravo of Canada Limited and R. F. Fry and Associates Limited under contract.

ELLEN OPEN PIT

Operations in the Ellen open pit were continued from 1 January to 7 November on the Pioneer Construction contract.

About 213,836 tons of ore was produced and shipped from the Crean Hill rockhouse at an average of 999 tons daily.

Management

The work was under the direction of J. McCreedy, manager of mines for International Nickel.

TOTTEN MINE

Shaft sinking continued at the Totten mine, in Drury township.

The collaring and sinking of the vertical three-compartment No.2 shaft was commenced in 1965 and was sunk 43 feet to a depth of 48 feet below the collar. In 1966 a further 1,335 feet was sunk to a depth of 1,383 feet below the collar. The 250-, 450-, 650-, 850-, and 1,050-, 1,250-foot levels were established at depths of 252, 448, 651, 847, 1,050, and 1,253 feet respectively below the collar.

A total of 3,870 feet of drifts and crosscuts, and 932 feet of raises had been completed. Total development footage to 31 December 1966 consisted of 6,465 feet of drifts and crosscuts and 2,208 feet of raises. Some 23 diamond-drillholes, totalling 25,568 feet were completed from underground.

Major construction included a head frame, 67 x 46 x 120 feet high, a collar house 47.7 x 32.3 x 20 feet and a steal ore bin 17.5 feet diam. 19.5 feet high.

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Added equipment comprised the following:

- 3 compressors, 2 stage vertical with 500 hp. motors
- 3 horizontal air receivers 60 x 192 ins.
- 3 after cooler assemblies
- 1 resistor
- 1 mine transit
- 1 transformer, 750 kva. 44,000/550V—temporary substation.

A total of 242,199 tons of ore was hoisted and shipped at a daily average of 850 tons.

Management

The work was completed by MacIsaac Mining & Tunnelling Company under the direction of J. McCreedy, manager of mines.

LITTLE STOBIE MINE

The properties are located in Blezard township.

The sinking of two vertical shafts was commenced in 1966. No.1 shaft was sunk to a depth of 777 feet below the collar; the 400- and 600-foot levels were established at depths of 453 and 652 feet below the collar. No.2 shaft was sunk to a depth of 1,230 feet below the collar; the 200-, 400-, 600-, 800-, 1,000-, and 1,223-foot levels were established at depths of 231, 427, 628, 826, 1,025, and 1,223 feet respectively below the collar. Development footage consisted of 497 feet of drifting and crosscutting and 177 feet of raising which is also the total to 31 December 1966. About 90 diamond-drillholes totalling 85,834 feet were completed from surface.

Major equipment installed comprised 4 transformers (two 1500 kva, 3 phase 50 cy.; two 600 kva, 3 phase 60 cy.); 2 Aerofoil fans, 24 in. diam.; 1 mine transit and 1 transformer, 2000 kva 44,000/2,300V in the temporary substation.

Management

The work was completed by MacIsaac Mining and Tunnelling Company under contract. J. McCreedy, manager of mines for International Nickel was in charge.

SHEBANDOWAN MINE

The property is located in Hagey township.

The No.1 vertical shaft was collared and sunk 577 feet; the 200- and 400-foot levels were established at depths of 273 and 462 feet below the collar in 1966. Some 84 feet of drifting and crosscutting was also completed. A total of 34 diamond-drillholes, totalling 44,732 feet was completed from surface.

Equipment installed consisted of the following:

- 4 transformers, 333 kva, 63.5 KV, 2,200V 1 phase, 60 cy.
- 1 flush deck barge, 40 x 15.2 x 5.2 ft.
- 2 outboard motors, 60 hp.
- 2 transmission towers, double legs, 88 ft.

Management

The work was completed by Patrick Harrison and Company Limited under the direction of J. McCreedy, manager of mines for International Nickel.

CREIGHTON MILL (CONCENTRATOR)

Normal operations continued.

The Creighton mill treated 3,814,721 tons of ore, averaging 11,421 tons per working day to produce concentrates, which were pumped to the Copper Cliff smelter.

Employment and Management

The employees are included in Creighton mine total. E. McMullen was superintendent.

COPPER CLIFF CONCENTRATOR

Normal operations continued.

Added equipment included 6 pumps, 4 electric motors, 3 reagent feeders, 4 oil circuit breakers, 1 transformer (1500 kva, 3 hp., 50 cy.), and a platform filter, 3 ft. diam., 1 ft. face.

The Copper Cliff concentrator treated 9,367,687 tons of ore, averaging 28,047 tons daily, to produce concentrates.

Employment and Management

The employees are included in Copper Cliff smelter totals; J. Lee was superintendent.

LEVACK MILL

Normal operations continued.

Added equipment consisted of a disc filter 8 ft. 10 ins. diam., 4 disc.

A total of 1,778,900 tons of ore was milled at an average of 5,326 tons per working day.

Employment and Management

The employees are included in Levack mine totals. G. H. Morrison was superintendent.

FROOD-STOBIE MILL

Construction of the Frood-Stobie mill was progressing in 1966.

Major construction included the following:

A mill building 326.5 x 309 x 107 feet high to high roof, 68 feet to low roof, reinforced concrete foundation, concrete block and brick walls, structural steel frame, precast roof slabs.

A crusher building 213.2 x 79.7 x 90.3 feet high of similar construction to the mill.

Added equipment included the following:

- 2 cranes, 5 ton, 36.3 foot span
- 3 electric hoists, one 2.5 ton, one 3.3 ton, one 5.5 ton capacity
- 6 electric motors, 300 hp., 439 rpm, 550/3/60
- 1 flow meter, 2 in., max. flow 800 tons per day
- 8 controllers, 300 hp.
- 15 transformers, 1500 kva. 3 ph. 60 cy.
- 6 flotation machines, 6 cell #30 L.H.
- 12 fans, various sizes
- 11 heaters, 1 Dravo counterflo, 10 natural gas various capacity

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Employment and Management

The employees are included in Froid-Stobie mine total. R. G. Regimbal, superintendent of mills was in charge.

SMELTERS

CONISTON SMELTER

Normal operations continued.

Added equipment consisted of one cast steel slag pot, one nickel cadmium battery and four fans, 60 inch diameter.

The Coniston smelter treated 511,839 tons of concentrate averaging 1,532 tons per working day and produced 43,317 tons of bessemer matte, shipped to Copper Cliff for further processing.

EMPLOYMENT AND MANAGEMENT

The average number of employees was 524. R. L. Snitch was superintendent.

COPPER CLIFF SMELTER

Normal operations continued.

Major construction in 1966 consisted of a one storey computer building 119.3 x 110.3 x 14.5 feet with reinforced concrete foundation, concrete block and brick walls, concrete slab roof with tar and gravel.

Considerable new and replacement equipment was added.

The smelter treated 315,222 tons of concentrate averaging 944 tons per working day and 144,901 tons of nickel matte were shipped; 33,781 tons of nickel oxide sinter, and 141,234 tons of converter copper were produced.

EMPLOYMENT AND MANAGEMENT

The average number of employees at the Copper Cliff concentrator and smelter was 5,782; J. R. Feick was superintendent of smelters.

IRON ORE RECOVERY PLANT

Normal operations continued at the plant located in Waters township.

Major construction in 1966 included two additions to the Kelley Lake pumphouse, one 11 x 9 x 10 feet; one 17 x 11 x 10 feet, with reinforced concrete foundations, concrete block walls, precast Haydite slab roof.

Considerable new and replacement equipment was added as follows:

- 6 conveyors
- 17 pumps, various types
- 1 filter, 8 ft. diam. x 10 ft. face
- 1 Holoflute dryer
- 1 magnetic separator
- 1 empty barrel handling system
- 1 air merge blending system
- 1 screen, 3 ft. wide
- 1 scale, 1,000 lb. capacity
- 1 complete Turbo mixer
- 1 spray lubrication system
- 1 transformer, 1500 kva. 6900/575V
- 1 electric motor, 300 hp., 1800 rpm. 550V 3 phase 60 cy.

The iron ore recovery plant produced 695,056 gross tons of iron ore and 7,249 net tons of nickel oxide.

Employment and Management

The average number of employees was 740; E. G. Stoneman was manager.

REFINERIES

COPPER CLIFF REFINERY

Normal operations continued.

The Copper Cliff refinery produces copper cathodes and shapes, nickel sulphate, gold, silver, tellerium, selenium, and semi-refined platinum metals.

Major equipment added consisted of a radio crane control on a 15 ton crane to commence modernization of plant cranes; one 2½-ton lift truck; one two minute oxygen analyser; and one 20-inch American lathe.

A total of 141,234 tons of converter copper, 8,949 tons of scrap secondary copper was refined at an average of 446 tons per working day; 136,382 tons of refined copper was produced from the primary converter copper and 8,126 tons from the secondary scrap copper. No.1 furnace was in operation for 308 days, No.2 furnace for 318 days.

EMPLOYMENT AND MANAGEMENT

The average number of employees was 934. G. A. Dick was manager.

PORT COLBORNE REFINERY

Operations continued throughout the year.

The Port Colborne refinery produces nickel metal, cobalt metal, and elemental sulphur.

At the research and pilot plant stations, significant success was achieved in new process development for the economic recovery of nickel from oxide nickel ores.

Major construction consisted of an extension to the shipping and shearing warehouse, 100 x 48 x 33 feet, structural steel with brick and tile construction.

Added equipment included a Harperizer with a capacity of 20,000 lbs. per hr. for deburring nickel cathodes in the shipping and shearing warehouse, and a rotary kiln, 5-foot diameter 40 feet long having a capacity of 5 ton/day located in No.2 research station.

Production at the nickel refinery included 125,436,272 pounds of electrolytic nickel, 10,092,670 pounds of nickel shot and ingots and 1,108,816 pounds of cobalt.

EMPLOYMENT AND MANAGEMENT

The average number of employees was 2,102. W. R. Koth was manager.

COMPANY ANNUAL REPORT

The following is taken from the company annual report for the year ending 31 December 1966.

Annual Report for 1966

Deliveries of Metals

		1966	1965	1964	1963
Nickel					
Primary nickel*	lbs.	431,560,000	433,190,000	393,980,000	303,070,000
Nickel in rolling mill products	lbs.	68,640,000	59,770,000	50,210,000	47,660,000
Total nickel	lbs.	500,200,000	492,960,000	444,190,000	350,730,000
Copper	lbs.	293,000,000	275,880,000	286,530,000	253,550,000
Cobalt	lbs.	2,000,000	2,020,000	2,750,000	2,150,000
Platinum-Group Metals and gold	oz.	500,900	510,800	544,800	439,400
Silver	oz.	1,513,000	1,581,000	1,493,000	1,403,000
Iron ore	long ton	673,000	889,000	734,000	458,000

*Including salts and chemicals, and rolled bars for electroplating

Mines

Although Ontario operations were seriously affected by slowdowns and strikes, total ore production from the Ontario and Manitoba mines amounted to 17,550,000 short tons, second only to the record of 19,750,000 tons in 1965 and comparing with the 16,439,000 tons mined in 1964.

The broad program of mine development in the Sudbury District of Ontario was carried forward during the year. The sinking of the 7,150-foot No. 9 production shaft at the Creighton mine was continued, reaching a depth of 2,337 feet at year end. At the Frood-Stobie mine, sinking of the 2,400-foot No. 9 shaft, to handle increased production, reached a depth of 1,100 feet. At year end, three new shafts were being sunk at company operating mines in Ontario.

New Mine Development

In 1966 International Nickel enlarged the major mine expansion program announced in 1965. In the Sudbury district, the company opened the Totten mine, and began underground operations at a second small mine, the MacLennan, following completion of open pit operations.

The company is developing seven new mines in Canada while continuing development work in Guatemala and the United States. Additionally, the sinking of an exploration shaft was started on the Shebandowan property in western Ontario. Also, sinking of an exploration shaft will start early in 1967 to determine the feasibility of developing large low-grade deposits lying northwest of Garson, Ontario. Level development and underground construction were continued at the Copper Cliff North mine, with ore production scheduled for early 1967. At the other new mines—(Kirkwood, which is expected to be in production in 1968, and Little Stobie and Coleman, in 1969), shaft sinking was started and proceeded throughout the year.

Plant Improvements and Process Research

In the Sudbury district, surface plant expansion was underway to allow for increased production. Construction of the 22,500-ton per day Frood-Stobie mill was started and continued through the year. The mill, which is scheduled for completion late in 1967, will concentrate lower grade ores for pipeline transmission to the Copper Cliff smelter. A first step was taken at the Copper Cliff smelter to replace multi-hearth equipment with modern fluid bed roasters. Revisions in matte separation operations were also started which will permit improvements in the quality of sinter for the nickel refineries.

The company's new J. Roy Gordon Research Laboratory at Sheridan Park, Ontario, began to operate by year end. It will be principally concerned with extractive metallurgy and the development of improved methods for processing metallurgically complex ores. Geophysical and geological research, as well as product research, will also be carried on. The name of the new facility, as announced by the Chairman in May, recognizes the significant contributions to metallurgical research and the more than 30 years of service to the company of J. Roy Gordon, Chairman of the Executive Committee and a Director of the company, who retired as President of the company in January 1967.

During the year the company intensified its research on processes for the treatment of lateritic ores of nickel. Construction proceeded also on Research Station No. 3 at Port Colborne. With the completion of this station, there will be concentrated in one location broad-purpose pyrometallurgical, hydrometallurgical and vapometallurgical pilot facilities for developing extraction and refining processes for both sulphide and oxide ores of nickel.

Ore Reserves

The proven ore reserves of the company's Sudbury district and Manitoba mines were 324,870,000 short tons at 31 December 1966, with a nickel-copper content of 9,480,000 short tons. At the end of 1965, the proven ore reserves were 306,203,000 short tons, with a nickel-copper content of 9,274,000 short tons.

Highlights 1966

Nickel consumption in the free world in 1966 reached a new high estimated at 830,000,000 pounds, an increase of 70,000,000 pounds over the record established in 1965. Demand for nickel exceeded the available supply.

International Nickel delivered a record 500,200,000 pounds of nickel. These deliveries included sizable amounts of United States government surplus nickel released from the national stockpile and delivered to United States consumers, on which there was no profit to the company.

On 1 November for the first time since 1961, the company increased its price of nickel primarily to allow a start on new projects for the development of low-grade ores to meet the mounting long-term demand for nickel, and to partially offset cost increases which have been incurred.

The company's program of new mine development was expanded during the year. Plans were announced for the development of the Pipe mine in Manitoba, which with related facilities will cost an estimated \$100,000,000.

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 4,247,500 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; A. W. McDonald, B. Willemborg, J. Geddes, 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 10 claims in Robb township, Porcupine area, District of Cochrane, about 12 miles northwest of Timmins.

Mining and milling continued throughout 1966.

The vertical four-compartment No.1 shaft collared on claim P12341, was sunk 941 feet to a depth of 1,974 feet below surface. The 6th, 7th, 8th, 9th, and 10th levels were established at depths of 1,058, 1,260, 1,436, 1,611, and 1,877 feet respectively below the collar.

Development footage completed in 1966 consisted of 5,499 feet of drifting, 980 feet of crosscutting, and 2,081 feet of raising. Total development footage to 31 December 1966 was as follows: 31,849 feet of drifts; 3,416 feet of crosscuts; 12,058 feet of raises. Diamond-drilling consisted of 586 holes, totalling 85,303 feet, from underground and 49 holes, totalling 15,050 feet from surface.

Major construction in 1966 consisted of an addition to the warehouse, 40 x 20 feet, steel frame with plywood sheathing.

Major added equipment included the following:

- 1 propane heater, 2,500,000 B.T.U.
- 2 trucks, ½-ton pickup
- 1 loading pocket, 85-ton capacity
- 2 welding machines, 400 amps.
- 1 jaw crusher, 48 x 36 ins.
- 4 loaders, model 21
- 3 locomotives; one 4.5-ton, two 1½-ton.
- 10 mine cars, 50 cu. ft.
- 1 tubemill, 6 x 8 ft., 150 hp.

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A total of 507,631 tons of ore was hoisted, 566,722 tons were milled at a daily average of 1,533 tons. The mill also treated ore from the Texas Gulf's Kidd Creek mine.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production and Milling

Milling was carried out continuously through the year at maximum capacity with the company's ores being milled for 264 days and Texas Gulf's Kidd Creek mine ores for 101 days. Operating time was about 96.5 percent of available time with balance being spent on maintenance and repairs. Daily treatment rate for Kam-Kotia ores was 1,765 tons. All mill feed was supplied from underground operations and millheads ranged from 1.5 to 2.0 percent copper and 1.65 to 2.55 percent zinc. The zinc circuit operated continuously and performance was improved over 1965.

There were no major changes made in the mill circuit during the year. Studies and tests were initiated late in the year to investigate the effect of finer grinding on metal recoveries, assess requirements for a 10 to 15 percent increase in mill capacity, and reduce grinding costs. An additional cone crusher has been ordered to provide 3 stage crushing and make finer mill feed, and this machine will be installed in the summer of 1967.

Production Data

		1966
Milled	tons	464,726
Average per day	tons	1,765.0
Millheads, copper	percent	1.67
Copper concentrate produced	tons	33,592.7
Grade of copper concentrate	percent	19.91
Returnable copper	pound	12,706,672
Copper recovery in milling	percent	86.0
Smelter settlements outstanding at 31 December 1966—		
	copper pound	4,345,581.2
Zinc millheads	percent	1.965
Zinc concentrate	tons	10,453.0
Zinc concentrate grade	percent	49.20
Zinc recovery in milling	percent	59.20
Gold	oz.	672.0
Silver	oz.	78,077

Milling Data

	LB. PER TON MILLED
GRINDING STEEL CONSUMPTION	
Balls and rods	3.57
REAGENT CONSUMPTION	
Hydrated lime	5.055
Zanthates	0.421
Sodium cyanide	0.048
Frothers	0.059
Zinc sulphate	0.642
Copper sulphate	0.396

Mine Production

Tonnage hoisted during the year was 507,631 tons of ore and 73,879 tons of waste. The bulk of production came from blast hole stopes with minor tonnage from shrinkage stopes and development work. Stope development expense was heavy during the year, and, at the end of the year, most of the known reserves above the 5th level were developed for mining. Broken and drilled off tonnage was 177,000 tons. Production grades closely confirmed drill indicated grades.

Ore Reserves

Ore reserves at 31 December 1966, were as follows, including dilution factor.

POSITIVE AND BROKEN ORE	
2,169,000 tons grading	1.55 percent Cu and 1.93 percent Zn
380,000 tons grading	0.34 percent Cu and 4.15 percent Zn
PROBABLE ORE	
612,000 tons grading	1.54 percent Cu and 1.90 percent Zn.
POSSIBLE ORE (drill indicated only)	
1,200,000 tons @	1.60 percent Cu and 1.50 percent Zn
TOTAL ALL CATEGORIES AS ABOVE: 4,361,000 tons.	

Employment and Management

The average number of employees was 259: 139 underground and 120 on surface. G. W. Walkey was general manager and director.

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 2,100,009 shares have been issued. The directors and officers were: J. P. Sheridan, president and director; C. S. Espeler, M. Juby, and J. Bruce, directors; B. M. Young, secretary-treasurer. The executive office is at Suite 1606, 4 King Street West, Toronto 1. The mine address is Worthington.

The property comprises 538 acres in Denison township, District of Sudbury, formerly operated by Denison Nickel Mines Limited. In 1955 Pacolund 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.

Mining operations progressed from September to December and milling from November to 31 December 1966.

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. 111, Denison twp.	Vertical	3	985
No. 2	S.W. ¼ of S. ½ lot 12, con. 111, Denison twp.	Vertical	3	1,078

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Development work in 1966 consisted of 32 feet of drifting, 52 feet of cross-cutting and 45 feet of raising. Total development footage completed on the property to 31 December 1966 was as follows: 8,939 feet of drifts; 2,071 feet of crosscuts; 3,344 feet of raises. Some 43 diamond-drillholes totalling 4,437 feet were completed from underground.

Major equipment added in 1966 included a hoist; a jaw crusher, 36 x 54 inches; a secondary cone crusher, 4½ feet; a short head crusher, 4 feet; a rod mill; two ball mills; classifiers; flotation cells; a disc filter; a standby compressor; 10 conveyors, of various sizes; and an ore skip.

A total of 11,732 tons of ore was hoisted, 11,047 tons was milled at a daily average of 828 tons during the period of mill operation.

Employment and Management

The average number of employees was 40; 30 underground and 10 on surface. W. Griffin was manager.

Metal Mines 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. The authorized capitalization is 8,500,000 shares of \$1 par value, of which 7,215,700 shares have been issued. The directors and officers were: A. W. Johnston, president and director; H. B. Hicks, vice-president (operations), and director; D. L. Marcus, vice-president (finance) and director; L. E. Wetmore, secretary and director; W. C. Campbell, Eliot Janeway, John Beattie, G. P. Robertson, and A. B. Whitelaw, directors; W. M. O'Shaughnessy, treasurer. The head office is at Suite 914, 1155 Dorchester Blvd. West, Montreal 2, Quebec. The executive office is at Suite 1600, 100 Adelaide Street West, Toronto 1. The mine address of the Metal Mines Limited, Bancroft Division, (formerly Faraday Uranium Mines Limited) is R.R. No. 3, Bancroft. The mine address of Metal Mines Limited, Werner Lake Division (formerly Gordon Lake Division) is Werner Lake, Ontario.

The Werner Lake Division property comprises 128 claims, approximately 5,010 acres, in the Werner Lake area, District of Kenora.

Mining and milling continued throughout 1966.

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 1966 consisted of 2,156 feet of drifting, 150 feet of crosscutting, and 939 feet of raising. Total footage to 31 December 1966 was as follows: 24,026 feet of drifts; 10,353 feet of crosscuts; 15,805 feet of raises. Diamond-drilling consisted of 189 holes, totalling 21,784 feet, from underground, and 21 holes, totalling 1,363 feet, from surface.

Added equipment consisted of:

- 1 rotary concentrate dryer, 60 ins. by 25 ft.
- 1 aerofoil electric fan, 12 ins.
- 1 oil fired boiler, 150 psi.
- 3 trucks, ½-ton capacity
- 2 scrapers, 26 in.
- 3 rock drills
- 3 single drum tuggers
- 24 head lamps, No. 282N
- 1 battery charger, 20 cell
- 1 air hydraulic jacking unit, 100-ton capacity
- 1 car spotter, link belt No. 100

A total of 209,888 tons of ore was hoisted; 211,228 tons were milled at a daily average of 665 tons.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Metal Mines has concluded an agreement with Federal Resources Corporation of Salt Lake City, Utah, under which Federal has undertaken to expend up to \$1,300,000 in underground exploration and development at the former uranium producer near Bancroft, Ontario, within the next three years. Should this work prove successful, Federal has the option of placing the property back in production. A new corporation would then be formed in which Federal would hold 51 percent and Metal Mines 49 percent. Metal Mines would receive in addition \$1,000,000 out of future profits. Preliminary work, leading to dewatering of the mine workings, is underway. Federal already operates a producing uranium mine in the United States and has a number of other mining interests.

The Werner Lake nickel-copper mine operated throughout the year. Tonnage treated was greater by 14.5 percent than in 1965, but this was partly offset by a lowering of grade, both of these factors being attributable to a higher proportion of mining being carried out by blast-hole methods. This policy has been adopted with a view to reducing manpower requirements as the availability of satisfactory underground labour continues to be critical.

The new "D" zone, some 1,200 feet east of the main shaft on the 1,200- and 1,350-foot levels was prepared for mining during the year and will be in full production throughout 1967. A search for new ore is currently underway, including driving of a 2,000-foot heading eastward on the bottom or 1,650-foot level. During the coming summer, surface exploration on the company's large property will also be continued.

Employment and Management

The average number of employees was 218: 113 underground and 105 on surface. C. P. Moore was mine manager.

Munro Copper Mines Limited

Centre Hill Mines Limited was incorporated in February 1953; the capitalization was increased in January 1965; in 1966 the name was changed to Munro Copper Mines Limited with an authorized capitalization of 5,000,000 shares of \$1 par value; 3,276,640 shares have been issued. The directors and officers were: R. S. Potter, president and director; Patrick Harrison, vice-president and

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director; J. E. Wallington and Steve Gabon, directors; G. E. Smith, managing director; R. A. Cranston, secretary; J. Balazovic, treasurer. The head office is at 285 Richmond Street East, Toronto 2; the mine address is Box 604, Matheson.

The property comprising 24 claims, about 1,120 acres, in Munro township, District of Cochrane, is some 22 miles east of Matheson.

Mining operations progressed from 1 January to 31 December 1966.

The vertical three-compartment No.1 shaft located in the northeast quarter of the south half of lot 7, concession 5 (claim P53954) was sunk 336 feet in 1966 to a depth of 970 feet below collar. The 1st, 5th, and 6th levels were established at depths of 200, 725, and 850 feet below the collar.

Development footage completed in 1966 comprised 1,208 feet of drifting, 433 feet of crosscutting, and 898 feet of raising. Total development footage to 31 December 1966 consisted of 2,937 feet of drifts; 1,045 feet of crosscuts; 898 feet of raises. Some 36 diamond-drillholes, totalling 2,049 feet were completed from underground.

Major construction in 1966 included raising the headframe from 65 to 100 feet, and sheeting with 12 gauge aluminum; mill building, 500 tpd., 245 x 60 feet with "L" to North 90 x 50 feet; crushed building, 100 x 30 feet; 2 transfer houses, one 25 x 16 feet, one 21 x 16 feet; 4 conveyor ways; fire resistant all metal building, 120 x 40 feet; water tank; 2 bunkhouses, one 100 x 22 feet, one 70 x 24 feet; addition to cookery, 40 x 20 feet; office and warehouse, 60 x 30 feet, single storey; coarse ore bin, 500 to 700 ton capacity; fine ore bin, 1,500 ton capacity.

Construction of the crushing, milling and concentrating plant to handle 500 to 700 tons per day was almost completed with production to commence in early 1967. The mine access road was renovated, and the power line extended from the Munro property of Canadian Johns-Manville Limited to the property by Ontario Hydro.

Major added equipment included the following:

- 1 jaw crusher, 40 x 20 ins.
 - 1 short head crusher, 5½ ft.
 - 1 ball mill, 8 x 15 ft.
 - 1 rod mill, 8 x 12 ft.
 - 7 cyclones
 - 1 aerator
 - 28 flotation cells; 16 No. 24, 12 No. 30
 - 2 thickeners; one 40 ft. diam., one 30 ft. diam.
 - 1 disc filter, 8 x 6 x 6 ft.
 - 1 dryer
 - 1 vibrating feeder, 80 x 24 ins.
 - 1 hoist, double drum, 78 x 60 ins.
 - 3 compressors; one 2,500 cfm., one 1,000 cfm., one 750 cfm.
 - 2 boilers; one 1,000 hp., one 750 hp.
 - 1 substation with one 2,400 kva. transformer, 27,500/2,290 V.
three 600 kva. transformer, 2,200/550 V.
- plus all electrical panels for mill and plant.

Employment and Management

The average number of employees was 17: 7 underground and 10 on surface. D. Sykes 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 is 15,000,000 shares of no par value, of which 11,931,514 shares have been issued. The directors and officers were: J. R. Bradfield, chairman of the board and chief executive officer; R. V. Porritt, president and director; W. S. Row, executive vice-president and director; A. Powis, vice-president and director; A. O. Dufresne, Hon. G. B. Foster, L. G. Lumbers, Hon. Jean Raymond, J. D. Simpson, Andre Monast, W. P. Wilder and L. H. Timmins, directors; C. H. Windeler, secretary; E. K. Cork, treasurer. The head office is at Suite 1700, 44 King Street West, Toronto 1. The Geco Division mine address is Manitouwadge.

The property comprises 79 claims in the Manitouwadge Lake area, Port Arthur Mining Division, District of Thunder Bay.

Mining and milling continued throughout 1966.

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 2,650-, 2,850-, and 3,050-foot levels were established at depths of 2,890.5, 3,085.5 and 3,280.5 feet respectively below the collar.

The following development work was done during the year: drifting and crosscutting, 23,652 feet; raising 7,743 feet. The total development footage to 31 December 1966 was as follows: 239,384 feet of drifts and crosscuts; 78,323 feet of raises. Diamond-drilling consisted of 418 holes, totalling 75,253 feet from underground, and 2 holes, totalling 1,207 feet from surface.

New added equipment was as follows:

- 1 crane, double girder under running, 15-ton capacity
- 3 dust collectors, model 126D
- 1 transfer car, complete
- 1 car dumper with twin 10-in. cylinders
- 2 tanks; one 15,000 gals., one 8,394 gals.
- 1 rotary printing calculator
- 1 taper shank grinder, 3 phase, 60 cycle, 550 V.
- 2 electric slusher hoists with 30 hp. motor
- 1 loader, LM 56H
- 4 stoper drills, RB83
- 8 rock drills, BBC25W
- 3 tuggers, MHG-41
- 2 electric motors, 125 hp.
- 2 pumps, 2 CNT-6
- 1 conveyor belting, 2,116 ft. 36 ins. wide 5 ply.
- 1 fan, Aerofoil, 19-in. diam.
- 1 set, automatic sprinklers, dry pipe system
- 12 mine cars, heavy duty Granby, 110 cu. ft.

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A total of 1,459,586 tons of ore was hoisted and milled at an average daily milling rate of 3,999 tons.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Ore production averaged 4,000 tons per day, a 10 percent increase over the preceding year. The grade of ore treated averaged 1.95 percent copper, 4.15 percent zinc and 2.03 ounces of silver per ton. New ore proven more than offset the tonnage mined and ore reserves were increased by 1,102,000 tons.

Development to the west of the No.4 shaft was well advanced as were all facilities to handle ore through this shaft to the concentrator.

Production

		1966	1965	1964	TOTAL 1927 TO DATE
Ore treated in concentrator	tons	1,459,600	1,326,400	1,299,300	12,142,000
Metal content of concentrates produced:					
Copper	tons	26,770	24,790	25,620	226,680
Zinc	tons	46,120	42,880	56,640	371,860
Lead	tons	840	1,060	1,740	6,600
Silver	oz.	2,203,500	2,214,600	2,468,800	17,608,600
Gold	oz.	4,650	4,430	4,300	46,680

Employment and Management

The average number of employees was 602: 238 underground and 364 on surface. J. A. Graham was mine manager.

North Coldstream Mines Limited

Coldstream Copper Mines Limited was incorporated in November 1951; in August 1959, the name was changed to North Coldstream Mines Limited on a one for four share basis; the authorized capitalization is 7,000,000 shares of no par value, of which 5,438,696 shares have been issued. The directors and officers were: G. D. Pattison, president and director; P. S. Cross, vice-president and director; R. D. Bell, secretary-treasurer and director; E. T. Donaldson, L. J. Moreaux, A. B. Lash, K. A. Davis, directors. The head office is at Suite 509, 25 Adelaide Street West, Toronto 1. The mine address is Burchell Lake.

The property, comprising 106 claims, includes the old Tip Top mine. It is in the area east of Moss township and south of Ames township, District of Thunder Bay, about 90 miles west of Fort William, and about 8½ miles by road south of Kashabowie Station on the Canadian National Railway.

Mining and milling operations continued throughout 1966.

SHAFTS, NORTH COLDSTREAM MINE

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	TOTAL DEPTH FROM SURFACE
				feet
No. 1	K65	80°	2 (inactive)	200
No. 2	K65	Vertical	1 (inactive)	50
No. 3	K65	Vertical	1 (inactive)	20
No. 4	K65	Vertical	3	1,596

Development footage in 1966 consisted of 243 feet of drifting, 339 feet of crosscutting, and 975 feet of raising. Total development footage to 31 December 1966 was as follows: 17,607 feet of drifts; 11,099 feet of crosscuts; 19,926 feet of raises. Diamond-drilling consisted of 9 holes, totalling 608 feet, from underground, and 9 holes, totalling 1,560 feet, from surface.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Summary of Production

		1966	1965
Milled	tons	343,835	365,082
Average milled daily	tons	942	1,000
Average grade, copper	percent	1.67	1.86
Copper recovery	percent	95.29	95.27
Operating time	percent	94.35	96.61
Concentrate grade			
Copper	percent	26.69	26.44
Gold	oz. per ton	0.111	0.125
Silver	oz. per ton	2.21	2.31
Concentrate shipped	tons	20,550.06	24,605.93
Content of concentrate shipped			
Copper	lb.	10,951,137	13,014,279
Gold	oz.	2,317.97	3,104.90
Silver	oz.	44,728	56,738

The average daily tonnage milled decreased from 1,000 tons per day to 942 tons per day. This reduction was mainly due to a shut down of 10 days in February to permit the repair of cracks which developed in the shell of the primary grinding mill. The mill has operated at a slightly lower rate since that time.

Development and Mining

Development and stope preparation during 1966 was confined to the preparation for mining of several small orebodies. Ore broken during development, stope preparation, and stoping totalled 327,360 tons and 346,980 tons of ore were trammed. It is expected that the mining of all currently known ore will be completed in April. Low grade wall rock caving into the open stope areas will, however, prolong operations beyond this date.

Exploration

No further exploration was carried out underground during 1966 as this program had been completed during 1964. Surface exploration continued throughout the year. Reconnaissance work was carried out in areas adjacent to the mine. Seven properties which were brought to

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attention by local prospectors were also inspected. None of this work warranted more than routine preliminary geophysical surveying. Three electromagnetic anomalies discovered during 1965 were tested by diamond-drilling which revealed that they were produced by schisted graphites containing varying amounts of pyrite and pyrrhotite.

Ore Reserves

Ore reserves at 31 December 1966, after allowing for dilution, were estimated to be 103,000 tons having an average grade of 1.95 percent copper; this includes 56,690 tons of broken ore having an average grade of 1.79 percent copper.

Employment and Management

The average number of employees was 149: 71 underground and 78 on surface. G. H. Montgomery was manager.

Rio Algom Mines Limited

Pronto Division, Pater Mine

In June 1960, Pronto Uranium Mines Limited, which comprised the Pater mine, was amalgamated under the name of Rio Algom Mines Limited. Further details are given in the Uranium section of this Volume under Rio Algom Mines Limited.

PATER MINE

The property consists of approximately 1,576 acres known as the McFadden Option, in Spragge township, District of Algoma. 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, was raised 119 feet in preparation for sinking. During 1966 it was sunk 423 feet, three compartments from 2,705 to 3,505 feet and 4 compartments from 3,505 to the bottom at 3,934 feet, some 6,639 feet below surface. The 19th, 20th, and 21st levels were established at depths of 3,505, 3,705, and 3,892 feet respectively below the collar.

Hydraulic tailings obtained from the Pronto mill, some 3.5 miles from the mine, are used for stope backfill. A 6-inch concrete floor is laid on the fill, then rubber-tired two-machine jumbos are used for drilling; the broken ore is transported to circular steel millholes by auto-loaders.

Development work in 1966 consisted of 2,637 feet of drifting, 539 feet of crosscutting, and 2,535 feet of raising. Total development footage to 31 December 1966 was as follows: 28,168 feet of drifts; 7,492 feet of crosscuts; 36,012 feet of raises. Diamond-drilling consisted of 55 holes, totalling 3,857 feet, from underground and one hole, totalling 538 feet from surface.

New added equipment included the following:

- 1 skip cage combination and 1 skip, 60 cu. ft., No. 2 shaft
- 3 cables; one mine shaft cable, 4,000 ft.; one 600 V cable, 2,000 ft.; one 2,300 V, service cable, 2,000 ft.
- 1 loading pocket, 60 to 80 cu. ft. capacity
- 1 raise climber, model STH-3
- 1 pump, 9 stage, 260 gpm. at 1,050 ft. head with 125 hp. motor
- 2 pumps, model RVH.
- 5 small substations, at 16th, 17th, 18th, 19th, 20th levels
- 1 fan, 54 in. with 30 hp. motor
- 4 flotation cells, No. 24
- 1 disconnect switch, 400 amp., 2,300 V.

A total of 240,280 tons of ore was hoisted, 240,828 tons were milled at a daily average of 696 tons.

Company Annual Report

The following, pertaining to the Pater operation, was taken from the Rio Algom annual report for the year ending 31 December 1966.

The mine produced copper concentrate containing 8,965,097 pounds of payable copper during 1966. A total of 240,828 tons of ore was milled with a millhead grade averaging 2 percent and a mill recovery of 96.4 percent. Although the total tonnage of ore milled was virtually unchanged from the previous year, the maintenance of mill recovery at 96.4 percent and an increase in millhead grade from 1.83 to 2 percent resulted in an increase in production of 716,441 pounds of payable copper.

The increase in head grade was achieved by implementation of the hydraulic cut and fill mining method. This method improves dilution control and has been an economically sound method for this mine.

The shaft deepening program and the development of four new levels was completed in December. This provides economically mineable reserves for about a three-year period. Further drilling will be done to decide whether the mine should be deepened further.

The effect of increased labour rates and other cost increases was modified by the improved recovery grade but resulted in a net increase in production costs per pound.

Employment and Management

The average number of employees was 209: 106 underground and 103 on surface. W. P. Arnold was vice-president and general manager, mining division; P. E. Young was mine manager.

Sheridan Geophysics 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.

Mining and milling operations progressed from 1 January to 31 December 1966.

The vertical three-compartment No.1 Ryan township shaft, was sunk 74 feet to a depth of 624 feet below collar. Development work in 1966 consisted of 2,010 feet of drifting, and 1,606 feet of raising. Total development footage completed to 31 December 1966 was as follows: 10,344 feet of drifts; 2,686 feet of crosscuts; and 3,586 feet of raises. Some 141 diamond-drillholes totalling 15,444 feet from underground, and 37 holes totalling 13,663 feet from surface were completed in 1966.

Major construction in 1966 included a mobile aluminum bunkhouse, and nine house trailers of various sizes.

Major equipment added consisted of three 4-ton battery locomotives.

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Early in the year the stockpile was exhausted and mill feed was obtained mainly from stopes on "C" and "D" zones on the 250-, 375-, and 500-foot levels, and a drive to the parallel "SB" zone from the 375-foot level south is underway.

The Silver Creek zone, opened up on the 500-foot level by the earlier operators, and located some 1,700 feet north and west of the shaft, is being prepared for stoping. An adit from the west side of the property will connect with the underground workings and will serve as an escapeway, for ventilation and also it will hold a portion of the main water supply from Lake Superior.

During the year the shaft was deepened to permit the installation of loading pockets, bins, and ore and waste passes. All muck can now be skip-hoisted from the 500-foot level.

A total of 118,848 tons of ore was hoisted; 149,691 tons were milled at a daily average of 488 tons producing 4,108,297 pounds of copper concentrates.

Employment and Management

The average number of employees was 127: 94 underground and 33 on surface. George Elbre was manager.

Texas Gulf Sulphur Company

Kidd Creek Mine

Texas Gulf Sulphur Company was incorporated in December 1909 with an authorized capitalization of 15,000,000 shares of no par value of which 11,520,000 shares have been issued. The company officers were: C. O. Stephens, president; D. M. Crawford, secretary and manager of public and government relations; G. N. McKee Jr., treasurer; W. F. Meyer, comptroller. The head office is at 200 Park Avenue, New York, N.Y. 10017, U.S.A.; the mine address is 155 Pine Street South, Timmins.

The property comprises about 6,000 acres in Kidd township where the Kidd Creek mine is located and 2,800 acres in Hoyle township where the Hoyle concentrator is located; both properties in the Porcupine area, District of Cochrane.

Construction and development of the Kidd Creek mine and the Hoyle concentrator proceeded steadily throughout the year. Despite a large number of work stoppages by various trades working for the Ralph M. Parsons Construction Company of Canada Limited, the general contractor, the first of three parallel circuits in the mill went into operation on 16 November 1966, exactly 31 months after the first announcement of the finding of the Kidd Creek orebody on 16 April 1964. The first five railway cars of concentrate were shipped on 21 November 1966, to the Noranda smelter. The second circuit was scheduled to go on stream in the second week in January and the third one late in February or early March 1967.

Several of the usual milling problems associated with hydro-metallurgy and separation and concentration of the copper-zinc-lead-silver-sulphur minerals were worked out during the months of test work performed in the mills of the Kam-Kotia and Broulan Reef mines. Consequently the normal tune-up time

of the big 9,000-ton-per-day concentrator should be shortened. Full production is envisaged about 1 April 1967.

By the time the spring break-up halted stripping of overburden operations, enough had been removed to permit some ore production and the removal of an appreciable amount of rock from around the orebody which measures 2,300 feet by 500 feet. The 17-mile railroad connecting the mine and concentrator went into operation late in the fall. Three diesel-electric locomotives, each capable of hauling 16 one-hundred ton special ore cars, can make a complete round trip in two hours. The whole complex is expected to be in full production in the first half of the new year.

Major construction commenced in 1966 included the following: concentrator and auxiliaries, 360,000 sq. ft.; primary crusher, 4,000 sq. ft.; two coarse ore bins, 6,000 tons capacity each; garage, shop, and auxiliaries, 68,000 sq. ft.

Major equipment added included:

- 1 primary crusher, 54-74 in.
- 1 traprock crusher, Telsmith 48S
- 17 secondary hydrocones
- 5 tertiary hydrocones
- 1 rodmill, 10.6 x 16 ft.
- 3 grinding circuits
- 2 regrind mills, 8 x 12 ft.
- 2 primary and secondary ball mills, 12 x 18 ft.

The concentrator commenced operations on 16 November, and 113,899 tons of ore were treated to 31 December 1966 at a daily average of 456 tons. Kam Kotia and Broulan Reef mills treated an additional 193,540 tons of Texas Gulf ore.

Employment and Management

The average number of employees was 216: 97 in the open pit and 119 on surface; F. R. Jones was manager.

Thunder Bay Nickel Mining Corporation Limited

Thunder Bay Nickel Mining Corporation Limited was incorporated in 1965 with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 1,250,005 shares, including 750,000 pooled, have been issued. The directors and officers were: W. H. Wood, president and director; J. A. McCuaig, vice-president and director; J. B. Frosst and R. S. Lamb, directors; J. A. Murphy, secretary-treasurer. The head office is at 360 St. James Street West, Montreal, P. Q. The mine address is Box 367, Fort William.

The property comprises 21 claims in Pardee township, District of Thunder Bay.

In 1966 a diamond drill, type P 38, was purchased and four diamond-drillholes, totalling 7,888 feet were completed from surface.

Employment and Management

A. W. Grant was manager; H. Monette, T. Salman, and J. H. Riemers were consulting engineers, and several men were employed during the period of operation.

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Tribag Mining Company Limited

Tribag Mining Company Limited was incorporated in December 1926, the authorized capitalization was increased to 7,500,000 shares of \$1 par value of which 3,677,000 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; C. H. Franklin and E. R. Heald, directors; J. B. Anderson, vice-president (mining operations); N. B. Keevil, Jr., vice-president (exploration); J. H. Westell, treasurer; James Gibson, secretary. The head office is at Suite 1000, 11 Adelaide Street West, Toronto 1. The mine address is Batchawana Bay.

The property comprises 135 claims in Townships 27 and 28, Range 13, District of Algoma, in the Batchawana area, about 50 miles north of Sault Ste. Marie, and 18 miles east of Highway 17.

Mining operations continued throughout the year.

The three-compartment vertical No.1 shaft on claim SSM35137 has a depth of 1,251 feet below collar.

Development footage completed in 1966 consisted of 3,219 feet of drifting, 145 feet of crosscutting, and 324 feet of raising. Total development footage to 31 December 1966 consisted of 8,890 feet of drifts; 1,953 feet of crosscuts; and 931 feet of raises. Some 179 diamond-drillholes, totalling 24,928 feet, were completed from underground and 8 holes, totalling 2,020 feet, were completed from surface.

The mill and ancillary equipment from the Pickle Crow property is being moved to Tribag. An escapeway is being driven and a limited amount of stoping has progressed during mill construction. Hydro-electric power has been installed and a stockpile of copper ore will be available for the commencement of milling. The construction of a 400 tpd. concentrator is progressing.

A townsite of mobile homes is being established on Batchawana Bay for the personnel transferred from Pickle Crow. The mine access road has been repaired and relocated where necessary.

Major construction in 1966 included the following: office, 60 x 32 feet; pumphouse, 15 x 15 feet; dry building, 65 x 40 feet; hoist, compressor and switchhouse, 60 x 40 feet; blacksmith shop, 18 x 18 feet; garage and dry building, 48 x 32 feet.

A total of 3,720 tons of ore was hoisted and stockpiled.

Employment and Management

The average number of employees was 54: 15 underground and 39 on surface. G. A. Vary was manager.

Welsh Mines

(Bornite Property)

This copper prospect, located in James township, District of Timiskaming, about two miles east of Elk Lake, is owned by G. S. Welsh of Matachewan.

A shaft about 40 feet deep was sunk some years ago. During the summer months a 40-foot crosscut was driven to intersect the ore, and a carload (39 tons) of bornite ore was mined and shipped to Noranda.

Employment and Management

There were two employees and Mr. G. S. Welsh was in charge.

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 directors and officers were: R. C. Stanley Jr., president and director; P. K. Hanley, vice-president and director; R. S. Haffidson, managing director; D. M. Giachino, secretary; Miss B. A. Argo, assistant-secretary. The head office is at 112 King Street West, Toronto 1; the mine address is Manitouwadge. 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.

The property comprises 50 claims in Mapledoram township, Manitouwadge area, District of Thunder Bay.

The vertical three-compartment No. 1 shaft in claim TB47378 is 1,361 feet deep, below the collar.

Mining and milling operations continued throughout 1966.

Development work consisted of 3,228 feet of drifting, 93 feet of crosscutting and 6,051 feet of raising. Total development footage to 31 December 1966 was as follows: 6,332 feet of drifts, 2,081 feet of crosscuts, and 14,799 feet of raises. About 371 diamond-drillholes totalling 50,118 feet were completed from underground and 34 holes, totalling 27,187 feet were completed from surface.

New construction consisted of a water tank and tower, and a service building.

Major added equipment was as follows:

- 1 set compressor control equipment
- 2 pick-up trucks
- 3 rock drills, AL-47
- 2 electric hoists, double drum; one 60 hp., one 50 hp.
- 2 scrapers, 60 in., ventilation equipment, power distribution, underground and chute fabrication.

Production was gradually increased and this ore was trucked to the Willroy concentrator for treatment.

Company Annual Report

The following is taken from the combined Willroy and Willecho annual report for the year ending 31 December 1966.

Production

The year's operation produced a total of 325,738 tons of ore grading 0.63 percent copper, 3.89 percent zinc, 0.22 percent lead and 1.79 ounces silver. The above production represents the combined ore mined from four operating levels during the year. Over 50 percent of this was obtained from stopes above the 400 level horizon.

The ore was treated at the Willroy mill and the resulting concentrates had the following metal content:

Zinc	lb.	22,078,863
Copper	lb.	3,541,349
Lead	lb.	1,271,554
Silver	oz.	391,567
Gold	oz.	648

Annual Report for 1966

The concentrates were valued at \$5,071,400 from which was obtained a net smelter return of \$3,431,364 or an equivalent of \$10.53 per ton of ore produced.

Production and operating costs were adversely affected by a shortage of skilled miners and higher wage rates. However, these were counterbalanced by new techniques and efficiencies, resulting in reduced operating costs as compared to the previous year.

	1966	1965
Exploration and development	\$0.36	\$0.51
Mining	3.60	3.91
Milling	1.32	1.20
Administration and general	1.04	1.11
	<u>\$6.32</u>	<u>\$6.73</u>

Exploration and Ore Reserves

The program of deep drilling on the Slimlake-Willecho boundary to test the continuity of the Willecho ore zone to depth was completed. Four holes drilled during the year intersected economic sulphides. The best intersection was 10 feet averaging 0.45 percent copper, 0.87 percent zinc, and 1.71 ounces silver at a depth of 2,120 feet and 8,500 feet down plunge from the surface outcrop.

Three additional surface holes were drilled across the No. 3 ore zone 6,000 feet down plunge from the outcrop. Two of these intersected ore grade material. The best section averaged 1.32 percent copper, 2.01 percent zinc, 0.31 percent lead, and 1.91 ounces silver over 12.2 feet at a vertical depth of 1,553 feet.

Surface drilling on No. 1 and No. 2 zones indicate that mineable ore grade and thicknesses occur in these zones to a vertical depth of 725 feet and 625 feet respectively. Further testing will be done by underground exploration.

On the 1,000 level an exploration crosscut to the east, parallel to the plunge line of ore, was driven to facilitate detailed drilling of the No. 3 zone below this level. Together with other level developments and diamond-drilling new ore has been added to the existing ore reserves. At year end the total proven and indicated ore reserves in No. 3 zone down to 1,350 feet horizon stood at 2,280,000 tons grading 0.48 percent copper, 4.29 percent zinc, 0.18 percent lead, and 1.84 ounces silver.

Employment and Management

The operation continued under Willroy supervision and labour; Willecho supplied a further three employees. J. Toivanen 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 4,279,244 shares have been issued. The directors and officers were: J. C. L. Allen, president and director; R. C. Stanley Jr., and R. S. Hafidson, vice-presidents and directors; Miss B. A. Argo, secretary and director; J. D. Bryce, P. A. Allen, P. K. Hanley, directors; B. E. Martin, assistant-secretary; D. M. Lorimer, comptroller. The head office is at Suite 400, 112 King Street West, Toronto 1. The mine address is Manitouwadge.

The property consists of 36 claims in Gemmell and Mapledoram townships, Manitouwadge Lake area, District of Thunder Bay, in the Port Arthur Mining Division adjoining the west boundary of the Geco property.

Operations continued throughout 1966.

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 done during the year: drifting, 1,639 feet; crosscutting, 334 feet; raising, 2,291 feet. The total development footage to 31 December 1966 was as follows: 38,621 feet of drifts, 14,050 feet of crosscuts, 30,166 feet of raises. Diamond-drilling consisted of 131 holes totalling 11,323 feet from underground.

Major construction in 1966 consisted of extensions to the office and crushing plant; assay office; conveyor gallery, tailings dam, surface cover over open stope, two pump houses at No. 2 well, Manitouwadge Lake.

New added equipment was as follows:

- 1 road sander and 1 station wagon
- 2 mill pumps, centriseal
- 2 rock drills
- 1 drill jumbo, ZAX-202
- 1 diamond drill, model H-25
- 1 ore bin, 1,500 ton
- 2 ore feeders, 60 x 36 in.
- 2 conveyor belts, 30 in.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

Tonnage treated was down slightly from the previous year, the total being 545,138 tons for an average milling rate of 1,494 tons per calendar day. Of this amount, 325,738 tons or nearly 60 percent, were milled for Willecho Mines Limited on a custom basis. The major part of the remainder was obtained from the Willroy No. 1 and No. 2 zones which accounted for the decrease in grade particularly as to zinc content. Development and stope preparation were in progress in the No. 3 zone to obtain production from the remnant stopes on the hangingwall of the plunge by year-end.

The grade of the Willroy tonnage milled ran 0.60 percent copper, 2.80 percent zinc, 0.22 percent lead and 2.03 ounces of silver. Concentrate production amounted to 225 cars made up of 65 cars of copper, 144 cars of zinc and 16 cars of lead. This yielded a gross value of \$2,917,141 and a net smelter return of \$2,081,665.

Contained metals, along with the returned values, are shown:

	METAL PRODUCTION		NET SMELTER RETURN
Zinc	lb.	10,696,766	\$ 684,737
Copper	lb.	2,250,136	942,928
Lead	lb.	852,574	57,729
Silver	oz.	311,003	382,720
Gold	oz.	429	13,551
			<u>\$2,081,665</u>
			(\$9.49 per ton milled)

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Costs

Both unit and total operating costs increased during the year reflecting higher labour and material costs, more difficult mining of remnant reserves and the lower tonnage divisor of Willroy production. A comparison of operating costs for the years 1965 and 1966 follows:

	COST PER TON MILLED	
	1966	1965
Exploration and development	\$0.27	\$0.21
Mining	3.89	3.03
Milling	1.21	1.09
Administration and general	0.88	0.85
	<u>\$6.25</u>	<u>\$5.18</u>

Big Nama Creek Property

The 10-1 west drift was advanced 16 feet to traverse the Big Nama Creek boundary thereby fulfilling the exploration and development phase of the option with Big Nama Creek.

In preparation for the mining of the Big Nama Creek orebody, 2,200 feet of right-of-way was cleared for an access road to the proposed mining site. By the year end, 1,600 feet of road had been constructed with waste rock.

Ore Reserves

As of 1 January 1967 the total of broken, proven and indicated reserves at Willroy mine stood at 566,170 tons distributed as follows:

ZONE	TOTAL ORE	COPPER	ZINC	LEAD	SILVER
	tons	percent	percent	percent	ounce
1	188,211	1.39	0.45	trace	0.42
3	258,255	1.05	4.33	0.08	0.98
6	119,704	2.61	1.25	trace	0.89
Total and average	<u>566,170</u>	<u>1.49</u>	<u>2.38</u>	<u>0.04</u>	<u>0.77</u>
Nama Creek option	<u>828,000</u>	<u>0.79</u>	<u>3.25</u>	.....	<u>0.75</u>
Grand total	<u>1,394,170</u>	<u>1.07</u>	<u>2.90</u>	.....	<u>0.76</u>

Employment and Management

The average number of employees was 272: 138 underground and 134 on surface; J. I. Jarvis was mine manager.

PLATINUM METALS—see NICKEL AND COPPER

SELENIUM—see NICKEL AND COPPER

SILVER AND COBALT

In 1966 the mines of the Cobalt and Gowganda area shipped 4,181 tons of concentrates to Noranda Mines Limited; 1,819 tons to the Cobalt Refinery Limited and 278 tons to refineries in foreign countries. From the total of 6,269 tons of concentrates and 9 tons of bullion shipments, 5,579,284 ounces of silver was recovered. The refining of concentrates from the various groups of mines resulted in the following silver recovery: from the base metal mines, 3,367,928 ounces; from the nickel-copper mines, 1,639,566 ounces; from the gold mines, 313,426 ounces. The total silver production of 10,900,204 ounces in 1966 resulted in an increase in quantity of 0.72 percent over 1965 production of 10,822,213 ounces; the value of production increased 0.65 percent from \$15,151,098 in 1965 to \$15,249,385 in 1966. The average price of silver in 1965 was \$1.40 per ounce; in 1966 it was \$1.399.

The mines of the Cobalt and Gowganda area reported the recovery of 282,379 pounds of cobalt from ores and concentrates shipped; the refining of nickel-copper ores produced 2,401,856 pounds of cobalt. The total of 2,684,235 pounds of cobalt shows an increase of 2.42 percent from 1965 production of 2,620,810 pounds; the value of production decreased 0.85 percent from \$5,511,436 in 1965 to \$5,464,495 in 1966.

The mines of the Cobalt and Gowganda area paid \$562,554 to 88 salaried employees and \$2,121,679 to 472 wage-earners. Fuel and electricity cost \$271,985 and process supplies cost \$1,324,945.

(See also tables on page 140.)

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; B. Kraft, secretary-treasurer and director; J. Osheroff, and Milton Klyman, directors. 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.

AGAUNICO PROPERTY

The Agaunico property is located in Bucke township, District of Timiskaming.

In 1966 two diamond-drillholes totalling 1,220 feet were completed from surface.

SILVER PRODUCTION

SOURCE	1962		1963		1964		1965		1966	
	oz.	\$	oz.	\$	oz.	\$	oz.	\$	oz.	\$
Sales of bullion by the reduction companies, smelters, and mines. Contained in silver-cobalt concentrates exported from Canada. Estimated as recovered from concentrates treated in other provinces.	4,707,590	5,053,534	5,310,506	5,800,234	5,310,506	5,800,234	5,310,506	5,800,234	5,310,506	5,800,234
In crude gold bullion	397,200	344,867	365,856	370,153	365,856	370,153	365,856	370,153	365,856	370,153
Recovery for nickel-copper refineries	462,738	477,296	512,197	518,214	512,197	518,214	512,197	518,214	512,197	518,214
Base metal mines	1,757,848	1,320,777	1,459,455	1,766,248	1,459,455	1,766,248	1,459,455	1,766,248	1,459,455	1,766,248
	2,047,893	1,827,955	2,043,237	2,472,747	2,043,237	2,472,747	2,043,237	2,472,747	2,043,237	2,472,747
	2,520,807	2,882,443	2,794,041	2,885,578	2,794,041	2,885,578	2,794,041	2,885,578	2,794,041	2,885,578
	2,936,740	3,989,301	3,911,657	4,039,809	3,911,657	4,039,809	3,911,657	4,039,809	3,911,657	4,039,809
Total Production	9,383,445	9,601,621	9,929,858	10,822,213	9,929,858	10,822,213	9,929,858	10,822,213	9,929,858	10,822,213
Total Value	10,931,713	13,288,643	13,901,801	15,151,098	13,901,801	15,151,098	13,901,801	15,151,098	13,901,801	15,151,098

SHIPMENTS FROM SILVER MINES, COBALT-GOWGANDA AREA

	ARSENIC	COPPER	COBALT	LEAD	NICKEL	BISMUTH	SILVER	TOTAL
1904-1961	tons \$ 88,091	2,075	22,183	610	8,234	354,000	499,067,672	\$378,529,180
	7,250,883	979,456	52,170,512	73,260	4,076,185	416,066	313,562,818	\$ 5,584,149
1962	tons \$ 80	38	20	.....	6	.....	4,707,590	\$ 5,584,342
	6,832	23,740	58,742	.....	10,493	.....	5,484,342	\$ 7,178,136
1963	tons \$ 94	63	28	.....	14	65	5,053,534	\$ 7,643,104
	7,498	39,268	113,530	.....	23,603	146	6,994,091	\$ 8,316,265
1964	tons \$ 162	71	40	1	4	541	5,310,506	\$ 8,420,432
	16,195	47,655	137,680	270	5,891	703	7,434,710	\$ 8,420,432
1965	tons \$ 202	50	29	2	13	3,883	5,800,234	\$ 8,316,265
	13,150	37,870	113,176	663	21,478	9,600	8,120,328	\$ 8,316,265
1966	tons \$ 351	49	141	3	26	6,312	5,579,284	\$ 8,420,432
	35,610	44,098	476,081	841	42,503	15,881	7,805,418	\$ 8,420,432
Total	tons \$ 88,980	2,346	22,441	616	8,297	364,801	525,518,820	\$415,671,266
	\$7,330,168	\$1,172,087	\$53,069,721	\$75,034	\$4,180,153	\$442,396	\$349,401,707	\$415,671,266

CART LAKE PROPERTY

The Cart Lake property comprises claim RL406, approximately 151 acres, and claim RL404, 168 acres in Coleman township, District of Timiskaming.

Operations progressed from January to December 1966. The vertical, two compartment Gould No. 2 shaft some 200 feet deep was rehabilitated to the 100-foot level. Development work in 1966 consisted of 573 feet of drifting, and 375 feet of raising. Total development footage to 31 December 1966 on the 100- and 185-foot levels was as follows: 1,359 feet of drifts; 250 feet of crosscuts; and 531 feet of raises. Some 9 diamond-drillholes, totalling 2,552 feet, were completed from surface, and 33 holes, totalling 6,341 feet, were completed from underground.

Some 6,096 tons of ore was hoisted and treated in the Penn mill.

LODE AND CHRISTOPHER PROPERTIES

The Christopher mine adjoins the south boundary of the Cobalt Lode mine, in lot 2, concession III, Coleman township; the properties comprise claims 106, 1970, 9, 535 and 1523.

Operations progressed from January to April 1966.

SHAFTS, CHRISTOPHER AND LODE MINES

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
Christopher					
No. 1 shaft	9	Vertical	2	.....	295
No. 2 shaft	106	Vertical	2	.....	415
650 winze	.....	Vertical	2	556	622
Lode					
No. 1 shaft	9	Vertical	2	Surface	624
No. 2 shaft	535	Vertical	2	Surface	200
No. 3 shaft	1,523	Vertical	2	Surface	100
401 winze	535	Vertical	2	200	300

The Cobalt Lode and Christopher shafts are connected on the 400-foot level and the nearby Brady Lake No. 4 shaft, leased from Silver-Miller, connects with the Cobalt Lode shaft on the 600-foot level. Mining operations in 1966 were on the Christopher property.

There was no development work completed in 1966. Total development footage to 31 December 1966 was as follows: 16,242 feet of drifts, 5,054 feet of crosscuts, 14,932 feet of raises on the Christopher property; 10,255 feet of drifts, 4,955 feet of crosscuts, 6,183 feet of raises on the Lode property.

A total of 2,953 tons of ore was hoisted from the Christopher property and trucked to the mill.

O'BRIEN PROPERTY

Nipissing-O'Brien Mines Limited was incorporated in January 1952. The company acquired the properties of M. J. O'Brien Limited, and Nipissing Mines Company Limited in concessions V and VI, Coleman township, District of Timiskaming.

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Nipissing-O'Brien Mines Limited operated the property until June 1958, when claim RL403 comprising 152.6 acres was purchased by Agnico Mines Limited. Mining operations continued at the O'Brien mine from January to July 1966.

SHAFTS, O'BRIEN MINE

	LOCATION	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	DEPTH FROM SURFACE
Main shaft	RL403	Vertical	3	feet	feet
No. 2 shaft	RL403	Vertical	2	.....	345
No. 6 shaft	RL403	Vertical	2	.....	250
No. 14 shaft	RL403	Vertical	2	.....	300
No. 615 winze	.....	Vertical	2	340	176
					456

Operations were carried on through the main shaft.

Development work in 1966 consisted of 121 feet of drifting, 90 feet of sub-drifting, and 180 feet of raising. Total development footage to 31 December 1966 was as follows: 11,241 feet of drifts; 5,738 feet of sub-drifts; 2,314 feet of crosscuts; 12,118 feet of raises. Some 48 diamond-drillholes totalling 6,853 feet were completed from underground.

A total of 5,258 tons of ore was hoisted and milled.

NIPISSING 407 PROPERTY

The property comprises claims RL407, RL408, RL92 and RL110 located in Coleman township, where the vertical, two compartment 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 throughout 1966.

Development footage in 1966 consisted of 1,755 feet of drifting, 830 feet of subdrifting, 860 feet of crosscutting and 730 feet of raising. Total development footage to 31 December 1966 was as follows: 4,899 feet of drifts; 948 feet of subdrifts; 6,573 feet of crosscuts; 2,288 feet of raises. Some 264 diamond-drillholes, totalling 18,754 feet were completed from underground in 1966.

Some 29,946 tons of ore was hoisted and milled.

FOSTER PROPERTY

The Foster property comprises claim No.66 located in Coleman township, District of Timiskaming.

Exploratory work in 1966 consisted of the completion of five diamond-drillholes totalling 2,466 feet from surface.

PENN MILL

The Penn mill operated from 3 January to 30 December.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

The main source of production during 1966 was from 407 shaft which is now producing ore from three levels. Stopping on the third level has produced very rich ore from veins of limited vertical dimensions. The Cart Lake No. 2 shaft produced a modest tonnage of ore up until the end of the year. The Christopher and O'Brien properties produced a small tonnage of ore before being closed down early in the year.

The average monthly production for 1966 was 66,845 ounces. The decrease from the previous year is a result of reduced production due to phasing out two producing properties.

The following is a comparative summary of the main production items:

		1966	1965
Silver produced	oz.	802,151	1,101,932
Cobalt produced	lb.	71,779	93,257
Gross value of metals sold	\$	1,083,288	1,486,633
Gross value per ounce of contained silver	\$	1.35	1.35
Total milled from company properties	tons	47,550	70,975
Custom ore milled	tons	1,790	38,051
Total milled	tons	49,340	109,026
Total hoisted	tons	46,848	74,198
Calculated head silver	oz. per ton	17.69	16.40
Recovery silver	oz. per ton	16.87	15.53
Extraction efficiency	percent	95.36	94.64

Tailings Reclamation Project

A mill located on the south shore of Cobalt Lake has been rehabilitated and equipped to recover silver from an estimated 1,000,000 tons of tailings averaging about 4 ounces per ton.

A barge on the lake is used to pump the tailings to the mill at a rate of 1,000 tons per day where they are processed by grinding and flotation.

A satisfactory test run was made in October resulting in an indicated recovery of 75.7 percent.

It is planned to use the personnel from the Penn mill to operate the tailings mill from May to October, after which time freezing conditions make it difficult to pump tailings. The Penn mill will run during the winter months on a higher tonnage basis, supplied by ore stockpiled during the summer months plus current mine production. This will result in a more efficient operation.

Employment and Management

The average number of employees at all operations was 123: 57 underground and 66 on surface. G. W. Kirk was mine manager.

Amerigo Silver Mines Limited

Amerigo Silver Mines Limited is a private company of which J. J. Gray is president and director; C. L. Murray, vice-president and director; M. A. Sheridan, secretary-treasurer and director. The head office is at Suite 1307, 330 Bay Street, Toronto 1. The mine address is Box 769, Cobalt.

SILVER BANNER PROPERTY

The company acquired the former Silver Banner property comprising three claims located in Coleman township, District of Timiskaming, about six miles

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southeast of Cobalt. The Silver Banner and Mayfair underground workings are connected.

The vertical two-compartment No.3 shaft located on claim 2016, sunk by former operators to a depth of 618 feet below the collar, was used. The plant operated on compressed air supplied from the Ragged Chutes installation. No development work was completed in 1966 and the following table gives the total footage that had been completed up to the time of closure.

LEVEL	DRIFTS TOTAL	CROSSCUTS TOTAL	RAISES TOTAL
feet	feet	feet	feet
200	295.0	.....	.....
300	100.0	.....	.....
400	718.0	986.0	.....
475	1,931.0	573.0	.....
535 No. 1 Sub	410.0	205.0	.....
524 No. 2 Sub	218.0	.....	218.0
500	18.0	1,218.0	25.0
600	475.0	311.0	93.0
Total	4,165.0	3,293.0	336.0

20TH CENTURY PROPERTY

This property comprises approximately 120 acres in Coleman township, District of Timiskaming.

SHAFTS, 20TH CENTURY PROPERTY

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
1	417	Vertical	2	Surface	175
2	59	Vertical	2	Surface	365
3	1770	Vertical	2	Surface	41

Former operators had completed a total of 300 feet of crosscutting from No.1 shaft and 200 feet of drifting from No.2 shaft.

A limited amount of diamond-drilling was completed on the properties in early 1966 after which they were closed down.

Employment and Management

Gordon Watts was manager and there were several employees during the period of operation.

Canadian Keeley Mines Limited

Keeley-Frontier Mines Limited was incorporated in September 1959; in February 1964 the name was changed to Canadian Keeley Mines Limited on a basis of one new share for two old. The authorized capitalization was increased to 7,000,000 shares of no par value, of which 6,940,936 shares have been issued. The directors and officers were: M. E. Watts, president, general manager and director; M. C. Mosher, vice-president and director; T. J. Day, Jack Kaplan,

and F. H. Todd, directors; R. Y. W. Campbell, secretary. The head office is at Suite 911, 159 Bay Street, Toronto 1. The mine address is Box 339, Cobalt.

The company acquired the adjoining Keeley and Frontier properties, comprising 12 claims approximately 386 acres at Silver Centre in South Lorrain township, District of Timiskaming, about 20 miles south of Cobalt.

There were no mining operations carried out in 1966; the mill operated from 5 to 24 July on a trial run of reprocessing tailings. Some 1,194 tons of tailings was treated at a daily average of 185 tons but proved uneconomical. The recovery of most of the underground equipment and other salvage operations had been completed at year end.

SHAFTS, CANADIAN KEELEY MINE

SHAFT	CLAIM	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
Frontier Property					
F 1	HR16	Vertical	2	Surface	376
F 2	HR16	Vertical	2	Surface	62
F 3	HR16	Vertical	3	Surface	641
Crompton	HR25	Vertical	2	Surface	40
F 8	HR25	Vertical	2	540	1,360
F 9	HR25	Vertical	2	1,360	1,455
Keeley Property					
K 1	HR19	Vertical	2	Surface	240
K 2	HR19	Vertical	2	Surface	100
K 3	HR19	Vertical	2	Surface	570
K 4	HR21	60°	2	Surface	55
K 828	HR21	Vertical	3 and 2	560	910
K 830	HR19	Vertical	1 and 2	560	705
K 826	HR21	Inclined	2	560	620
K 1162	HR21	Inclined	2	822	930
Little Keeley Property					
No. 2	HS40	Inclined	2	.....	90

The following table gives the total development footage completed by level to 31 December 1966.

LEVEL	DRIFTS TOTAL	CROSSCUTS TOTAL	RAISES TOTAL
	feet	feet	feet
1	7,020	380	147
2	6,020	280	145
3	9,470	970	644
4	7,786	610	648
5	7,506	1,130	261
6	8,795	1,108	494
7	5,300	1,010	91
8	9,135	3,391	.....
9	2,780	320	.....
10	2,635	225	.....
11	6,705	705	80
12	4,736	652	881
Total	77,888	10,781	3,391

The average number of employees was 10: 3 underground and 7 on surface. H. A. Kenty was mine manager.

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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 in Coleman township in 1964 from Agnico Mines Limited to mine out some old pillars.

The mining of the Old Nipissing pillars was completed in early June 1965. In September the equipment was moved to the No. 2 shaft of the Little Nipissing property on the shore of Peterson Lake. A headframe some 35 feet in height was constructed using 8 x 8 inch timber, and a hoistroom, 20 x 16 feet with 2 x 4 inch frame, 8 x 4-foot sheeting, concrete floor and base, was built.

Development work consisted of 100 feet of drifting and 140 feet of raising in 1966; total development footage to 31 December 1966 was 180 feet of drifts and 249 feet of raises.

Approximately 1,800 tons of ore was hoisted and custom milled by Agnico Mines Limited.

Employment and Management

The average number of employees was 5: 3 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 1,150,005 shares have been issued. The directors and officers were: G. C. Silverman, president and director; D. E. Silverman, vice-president and director; S. G. Hawkins and S. V. Meek, directors; M. H. Stekel, secretary-treasurer. The head office address is at Suite 201, 330 Bay Street, Toronto 1. The mine address was c/o Kakabeka Falls Hotel, Kakabeka Falls.

The company acquired 24 unpatented claims, four patented claims and four patented lots in Gillies and O'Connor townships, District of Thunder Bay, some 30 miles west of Port Arthur. 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 40, 1931, page 109) and reported the following development work had been completed at that time.

WORKINGS, ANIMIKIE MINES LIMITED

MINE	SHAFTS FEET	DRIFTS FEET	RAISES AND WINZES FEET
Badger	280	2,000	190
Porcupine	250	1,690	.....
Keystone	330		
	70		
	62	325	.....
	40		

The company carried out a sampling, exploration and diamond-drilling program. Shafts on lot 96T (Porcupine property) and 145T (Keystone property) were dewatered and examined. Two diamond-drillholes, totalling 450 feet, were completed from underground and two holes, totalling 50 feet, were completed from surface.

Two frame buildings, one 20 x 8 feet; one 16 x 8 feet, were constructed. Equipment used consisted of a portable compressor, pumps and pipe lines.

Employment and Management

The work was carried out with A.C.A. Howe & Associates as consultants and L. Cloutier as superintendent.

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: G. E. Buchanan, president and director; A. J. Fortens, vice-president and director; Frank Cadesky, secretary-treasurer and director; N. B. Sheriff, and Norman Lamport, directors. 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 3 January to 30 December, the mill from 3 January to 29 July 1966.

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

A total of 2,006 feet of drifting, 380 feet of crosscutting and 1,398 feet of raising was completed in 1966. Total development footage to 31 December 1966 was as follows: 48,797 feet of drifts; 16,204 feet of crosscuts; 18,108 feet of raises. Some 184 diamond-drillholes, totalling 24,224 feet, were drilled from underground.

A total of 13,333 tons of ore was hoisted; 13,695 tons were milled at an average of 90 tons per working day from 3 January to 29 July.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Annual Report for 1966

Summary of Production

		1966	1965	1964	1963	1962	1961
Ore hoisted	tons	13,333.0	26,183.0	26,951.0	30,257.0	22,206.0	10,005.0
Ore milled	tons	13,695.0	25,092.0	27,690.0	29,584.0	22,022.0	8,725.0
Silver recovery	per ton	13.0	12.7	15.7	25.3	19.3	16.7
Total silver recovery	oz.	177,739.49	319,532.59	433,417.65	749,837.61	425,826.87	145,032.0

Exploration and Development

Exploration development and production was continued through to August when it was decided to suspend milling operations, reduce all costs and concentrate on developing sufficient ore, to sustain milling at its more efficient capacity rate and improve the grade of mill rock being processed.

Extensive exploration from the existing underground workings has been carried out north and south of the known ore zone but to date the success has been confined to this zone. The production in recent years of approximately 3,000,000 ounces of silver has been taken from new occurrences lying near existing workings east of the shaft above the 800-foot level.

With the deepening of the shaft to the 900-foot horizon, the downward extension of this zone to the northwest has now become accessible for exploration and development. The main drive on the 900-foot level has been following a very strong vein structure for 300 feet and has recently opened up a section of ore about 130 feet in length along the Cross Lake Fault. This new structure is located approximately under the centre of Cross Lake. It strikes northwest parallel to the shoreline towards the Queen Alexandra claim also owned by Deer Horn and remains totally unexplored in this direction. Although some exploration is being carried out on other potential ore structures, the main accent is now on development of this new structure.

Employment and Management

The average number of employees was 43: 29 underground and 14 on surface. G. A. Smith was mine manager; J. E. Armstrong was consulting engineer.

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 3,100,005 shares have been issued. The directors and officers were: Frank Cadesky, president and director; A. J. Fortens, vice-president and director; B. M. Apple secretary-treasurer and director; W. P. Armstrong and F. McCluney directors. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is Box 590, 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 3 January to 30 December 1966.

SHAFTS, GLEN LAKE SILVER

SHAFT	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING 1966	VERTICAL DEPTH FROM SURFACE
1	Lot 4, S.W. ½ N. ½ Con. 4 Coleman	Vertical	2	feet Surface	feet	feet 283
1W	(same as above)	Vertical	2	283	102	455

The No.1 winze collared 283 feet below surface was sunk 102 feet in 1966 to a vertical depth of 455 feet below surface. The 7th level was established some 161 feet below the winze collar.

Development work consisted of 128 feet of drifting, 654 feet of crosscutting and 274 feet of raising. Total development footage to 31 December 1966 was as follows: 5,774 feet of drifts; 6,249 feet of crosscuts; 2,111 feet of raises. Diamond-drilling in 1966 consisted of 72 holes, totalling 10,390 feet from underground.

A total of 5,397 tons of ore was hoisted; 5,574 tons were milled; the mill averaged, including custom milling, 122 tons per working day.

Company Annual Report

The following is taken from the company annual report for the period from 1 August 1965 to 31 July 1966.

Production

Production has come from both Glen Lake Silver mine and Hiho Silver mine. The ore from each property is milled separately.

1 AUGUST 1965 TO 31 JULY 1966

		GLEN LAKE-BAILEY MINE	
Milled	ton	4,010	
Tails	oz.	6,657	
Average mill heads	oz. per ton	70.53	
Recovery	percent	97.64	
Production:			
September	oz.	46,084.81	
October	oz.	8,986.12	
December	oz.	35,519.00	
January	oz.	8,420.26	
June	oz.	75,125.00	
July	oz.	102,069.56	
Total silver	oz.	276,204.75	
Total silver production 1 Aug. 62 to 31 July 66	oz.	2,746,182.82	

1 AUGUST 1965 TO 31 JULY 1966

		HIHO-GLEN LAKE SUBSIDIARY	
Milled	ton	32,085	
Tails	oz.	30,873	
Average mill heads	oz. per ton	34.57	
Recovery	percent	97.21	
Production:			
August (½ month)	oz.	63,832.24	
September	oz.	68,979.00	
October	oz.	118,751.15	
November	oz.	103,749.19	
December	oz.	71,513.64	
January	oz.	102,032.84	
February	oz.	104,912.73	
March	oz.	125,950.43	
April	oz.	103,460.66	
May	oz.	100,780.00	
June	oz.	54,299.00	
July	oz.	60,219.79	
Total silver	oz.	1,078,480.67	
Total silver production 1 Aug. 64 to 31 July 66	oz.	1,927,335.25	

(Table continued p. 150)

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PRODUCTION FROM BOTH MINES			
1 Aug. 65 to 31 July 66	oz.		1,354,685.42
Prior to 1 August 1965	oz.		3,318,833.00
Total silver production both mines	oz.		4,673,518.42
Silver production both mines, month of July 1966	oz.		162,289.35

Diamond-drilling in the Hiho Cleopatra mine shows the downward extension of the various veins to be carrying silver values. Three intersections below the A17 or Patricia vein showed highgrade silver veins. A new crosscut is to be driven from the 233-foot level of the shaft which is 50 feet below the second or 183-foot level. The various veins will be developed at this new depth.

Stope preparation at the Hiho Giroux Lake Mine is continuing along the 457 feet of ore found on the 291-foot level below Giroux Lake. The vein shows native silver and an excellent grade of ore.

Employment and Management

The average number of employees was 31: 16 underground and 15 on surface. M. C. Halstead was general manager.

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, with further details as to directors, officers and operations recorded under Glen Lake in this report. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is Box 590, Cobalt.

The property comprises 430 acres in Coleman and Gillies townships, District of Timiskaming.

Operations proceeded from 3 January to 30 December 1966.

SHAFTS, HIHO SILVER MINE

	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
			feet	feet
University No. 1	Inclined	2	Surface	100
University No. 3	Vertical	2	Surface	298
Lawson No. 8	Vertical	2	Surface	410
Cleopatra Main	Vertical	2	Surface	243

The third level was established in the Cleopatra Main shaft at a depth of 235 feet below the collar.

Development footage consisted of 1,488 feet of drifting, 1,378 feet of crosscutting, and 587 feet of raising. Total development footage to 31 December 1966 was 4,909 feet of drifts; 7,700 feet of crosscuts; and 587 feet of raises. Diamond-drilling consisted of 190 holes totalling 27,688 feet from underground and 9,438 feet from surface.

New construction in 1966 consisted of an ore bin, 24 x 16 feet.

A total of 38,277 tons of ore was hoisted; 31,468 tons were custom milled at Glen Lake.

Employment and Management

The average number of employees was 71: 43 underground and 28 on surface. M. C. Halstead was general manager.

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 1966.

The company has obtained shipping contracts from most of the Cobalt-Gowganda silver mines.

Construction and added equipment in 1966 consisted of the erection and installation of a three compartment fibreglass baghouse to facilitate collection of dust and separate it from the arsenic trioxide produced in the roaster. Extensive engineering and metallurgical analyses are in progress to develop procedures designed to improve operations at the refinery.

The No. 1, 300-kva furnace treated 2,058 tons of concentrate and produced the following:

Refined silver	oz.	3,809,432
Bismuth (in base bullion)	lb.	6,313
Lead (in base bullion)	lb.	5,629
Cobalt (oxide)	lb.	95,012
Nickel oxide	lb.	39,517

Employment and Management

The average number of employees was 67. J. N. Cram was general manager.

Langis Silver and Cobalt Mining Company Limited

Langis Silver and Cobalt Mining Company Limited was incorporated in February 1953; in 1957 the capitalization was increased to 5,000,000 shares with par value of \$1 of which 3,800,015 shares have been issued. The directors and officers were: A. W. White, president and director; R. A. Halet, vice-president and director; K. J. Benner, D. F. Burt, and J. E. Armstrong, directors; H. R. Heard, secretary-treasurer. The head office is at Suite 416, 25 Adelaide Street West, Toronto 1. The mine address is Box 870, New Liskeard.

The property consists of 25 claims in Casey and Harris townships, District of Timiskaming, and includes the former Casey Cobalt property.

Mining and milling operations continued throughout 1966.

SHAFTS, LANGIS SILVER PROPERTY

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
				feet	feet
No. 1 shaft	T354	75°	2 (inactive)	Surface	270
No. 3 shaft	T354	Vertical	2	Surface	438
No. 4 shaft	T1474	Vertical	2 (inactive)	Surface	150
No. 6 shaft	T1110	Vertical	2	Surface	488
No. 4 winze	T1110	Vertical	2	371	421

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Development work consisted of 2,006 feet of drifting, 1,956 feet of cross-cutting, and 1,315 feet of raising. Total development footage to 31 December 1966 was as follows: 28,140 feet of drifts; 22,594 feet of crosscuts; 9,871 feet of raises. Diamond-drilling in 1966 consisted of 167 holes totalling 16,481 feet from underground.

Added equipment consisted of a steam boiler with trim.

A total of 34,760 tons of ore was hoisted; 35,258 tons were milled at a daily average of 99 tons.

DOLPHIN-MILLER PROPERTY

In 1963 Langis Silver and Cobalt Mining Company leased the adjoining Dolphin-Miller property from Dolphin-Miller Mines Limited which became a subsidiary company with operations under the direction of Langis. The property comprises 10 claims in Harris township, District of Timiskaming.

The vertical two-compartment No.5 shaft, located in the SW $\frac{1}{4}$ of N $1\frac{1}{2}$ of lot 5, concession VI, Harris township, is 370 feet in depth. There was no exploration or development work completed in 1966.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

Production and mine development for the year under review were seriously handicapped by an acute labour shortage.

Most of the flotation concentrates were again shipped to Noranda Mines smelter, whereas the higher grade table concentrates were shipped to the Cobalt Refinery. The Langis and Dolphin-Miller inventory of cobalt concentrates with low silver content was sold overseas.

The estimated gross value, of silver and other metals amounted to \$501,190. The net smelter return per ounce of silver produced was again unchanged at \$1.26.

Labour shortages resulted in most of the mill feed being drawn from No. 6 shaft, where the grade is lower and the ore more refractory than that from No. 3 shaft area.

The net mine operating loss for the year was \$140,347 which amounted to \$221,319 after allowances for depreciation, expenditures on leased properties and credits for interest and dividends.

Mine Operating Costs

	PER TON ORE TREATED	
	1966	1965
Shaft sinking	\$	\$ 1.32
Development	5.67	6.17
Mining	4.78	4.98
Ore treatment	3.32	3.10
Mine office management	.84	.85
General account	.23	.28
	<u>\$14.84</u>	<u>\$16.70</u>

Other than shaft sinking, the reduction in costs per ton reflects labour shortages in underground personnel.

Ore Reserves

Labour shortages limited most of the exploration to those objectives within easy reach of mine workings.

A new drilling program of 20,000 feet, as an addition to routine diamond-drilling, has been instituted to explore favourable areas which can still be approached from present workings.

Milling

		1966	1965
Milled	tons	35,258	34,992
Average per day	tons	96.60	99.28
Millheads	silver oz. per ton	10.86	12.98
Silver recovered	oz.	342,161	438,336

Tonnage milled includes 3,171 tons from the Murray claim.

Dolphin-Miller Mines Limited

The inventory of low, silver-bearing cobalt concentrates was sold overseas during the year. These concentrates were obtained from milling development ore. The net smelter return per ton of ore milled was \$8.22.

Any material improvement in the price of silver or cobalt would be sufficient justification to dewater the Dolphin-Miller shaft, resume development and ultimately production.

More diamond-drilling at some later date is planned from the Langis 285-foot level, where a crosscut has been driven 120 feet south of the common boundary and into Dolphin-Miller Mines holdings.

Employment and Management

The average number of employees was 75: 60 underground and 15 on surface. J. E. Jerome was manager at both operations.

Louanna Gold Mines Limited

Louanna Gold Mines Limited was incorporated in January 1963, with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 4,350,005 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; R. J. Juby, and R. J. Murphy, directors. The head office is at Suite 503, 365 Bay Street, Toronto 1; the mine address is Cobalt.

The property comprises the former Bomont Mining property comprising nine claims in Gillies Limit, District of Timiskaming. Former owner of the property was the Trainmen Silver Mining Company which sunk the vertical, two compartment No.1 shaft, located in claim T31230 Gillies Limit, to a depth of 140 feet below the collar in 1926. Some 60 feet of drifting and 309 feet of crosscutting had been completed at that time.

Louanna Gold Mines Limited operated from 26 July to 6 December 1966.

During the period of operation the site was cleared, the shaft rehabilitated, and the underground workings dewatered. Some four diamond-drillholes, totalling 1,033 feet were completed from underground.

Employment and Management

R. Gareau was manager and three men were employed during the period of operation.

Annual Report for 1966

Mentor Exploration and Development Company Limited

Mentor Exploration and Development Company Limited was incorporated in March 1926, with an authorized capitalization of 5,000,000 shares of 50¢ par value, of which 3,455,746 shares have been issued. The directors and officers were: P. Penna, president and director; J. Osheroff, vice-president and director; B. Kraft, secretary-treasurer and director; W. L. Hogarth and C. P. McTague, directors. The head office is at Suite 1101, 365 Bay Street, Toronto 1. The mine address is Box 9, Cobalt.

The Cobalt property comprises 4 claims in Coleman and Bucke townships, District of Timiskaming.

The vertical three-compartment main shaft was collared and sunk 411 feet in 1961. In 1962 some 1,200 feet of lateral development was completed on the 400-foot level. No further work was done on the property until 1966 when drilling from the adjoining O'Brien property of Agnico Mines Limited was carried out. Some five holes totalling 2,989 feet were completed from underground and four holes totalling 2,508 feet were completed from surface.

Management

The work was carried out under the direction of L. J. Cunningham, engineer.

Millerfields Silver Corporation Limited

Millerfields Silver Corporation Limited was incorporated in 1966 with an authorized capitalization of 3,000,000 shares of \$1 par value, of which 750,005 shares have been issued. The directors and officers were: N. B. Keevil, president and director; S. Kay, vice-president and director; J. B. Anderson and S. Miller, directors; J. H. Westell, secretary-treasurer. The company is a subsidiary of Copperfields Mining Corporation Limited. The head office is at Suite 1000, 11 Adelaide Street West, Toronto 1. The mine address is Box 249, Cobalt.

The company acquired the Miller Lorrain, formerly, Nipissing Lorrain property, comprising 32 claims in South Lorrain township, District of Timiskaming, on the shore of Lake Timiskaming. The vertical two-compartment No.1 shaft located in claim T19261 had been sunk to a depth of 290 feet below the collar and a winze collared at 270-foot depth extends down some 182 feet to a depth of 452 feet below surface. An adit some 1,515 feet long and drifting on two sub-levels and four levels, completed by former operators, total some 15,225 feet.

Operations progressed from May to December 1966.

The underground workings were dewatered, the old shaft and adit were rehabilitated. Geological mapping of the old workings was undertaken and a diamond-drill program commenced on the 205-, and 275-foot levels.

Major construction consisted of a headframe, some 65 feet in height, and a hoistroom-dry building, 28 x 20 feet.

Equipment installed included an air hoist, three air compressors of various sizes, one generator (115 kva), and two pumps.

Altogether 12 diamond-drillholes totalling 3,523 feet were completed from underground.

Employment and Management

The average number of employees underground and on surface was 10. K. F. O'Flaherty was mine manager.

R. C. McAllister

Buffalo Lease

R. C. McAllister and his partner A. P. Cloutier are operating by lease, the Buffalo property which comprises some 40 acres in Coleman township, District of Timiskaming. The address of the lessee is Box 283, 56 Jamieson Street, Cobalt.

Work continued from 1 June to 31 October 1966.

A vein intersected by previous drilling is being explored by sub-drifting from an old stope 50 feet below surface; some 30 feet of drifting, and 20 feet of cross-cutting had been completed at year end. Surface trenching about 200 feet long, averaging 3 feet in depth, and three diamond-drillholes, totalling 215 feet from underground, had also been completed.

McIntyre Porcupine Mines Limited

(Castle Division)

Castle-Trethewey Mines Limited was incorporated in January 1922; in December 1959 all assets were purchased by McIntyre Porcupine Mines Limited and it became the Castle Division of McIntyre. The directors and officers are given under McIntyre Porcupine Mines Limited in the gold operations section of this report. The McIntyre head office is at Suite 1500, 25 King Street West, Toronto 1. The mine address is O'Brien.

The Castle Division property, consisting of 42 claims, is located in Haultain and Nicol townships, Gowganda area, District of Timiskaming. The property comprises the Castle and Capitol sections; all work in recent years had been in the Capitol section of the mine.

No development work or major additions were completed during the year. Some ore was hoisted during the early part of the year but the Castle Division closed 30 April 1966.

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	(inactive)	Surface	460
No. 2 shaft	RSC101	Vertical	(inactive)	Surface	160
No. 3 shaft	RSC101	Vertical	2	Surface	850

Annual Report for 1966

The following table gives the total development work that had been completed up to the time of closure on 30 April 1966.

LEVEL	DRIFTS TOTAL	CROSSCUTS TOTAL	RAISES TOTAL
feet	feet	feet	feet
Castle Mine			
625	822	38	66
700	553	.....	94
850	459	1,901	423
Capitol Shaft			
800	1,394	2,766	233
825	1,589	28	48
875	678	210	345
950	36	12	.....
975	2,154	500	709
1,025	1,372	784	24
1,125	8,838	6,492	3,343
1,200	5,827	872	1,388.5
1,275	8,875	1,502	1,043
1,350	5,390	987	852
1,425	1,964	956	691
Total	39,951	17,048	9,259.5

Employment and Management

G. D. McLeod was manager during the period of operation, and two men had been salvaging equipment.

Otisse Property

The Otisse property, comprising 20 claims, is a silver prospect, located in Mickle township, District of Timiskaming, and is owned by G. S. Welsh of Matachewan. The property is about seven miles southwest of Elk Lake.

The vertical two-compartment Otisse shaft, located on claim 224, is 160 feet deep.

A limited amount of underground work was done during the summer months of 1966, and the ore produced, plus the ore remaining in the stockpile, was milled.

Employment and Management

G. S. Welsh was in charge and there were 8 employees during the period of operation.

Rusty Lake Mining Corporation

Rusty Lake Mining Corporation was incorporated in April 1957 with an authorized capitalization of 4,000,000 shares of \$1 par value, of which 3,452,229 shares have been issued. The directors and officers were: W. J. LaMorte, president and director; Bernard Marriott, J. C. D. Bouchard, J. A. Moss, A. F. Heather, T. V. Tozzi and W. M. Zilbersher, directors; Eileen McBain, secretary; W. H. Connolly, treasurer. The head office is at 1015 Beaver Hall Hill, Montreal, Quebec; the mine address is Box 159, Elk Lake.

The property, formerly known as The Hudson Bay Silver, comprises 31 claims in Leith township, District of Timiskaming.

Operations progressed from 1 January to 31 December 1966; underground work ceased on 30 June.

SHAFTS, RUSTY LAKE MINING CORPORATION

SHAFTS	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
No. 1	HS696	Vertical	1	Surface	190
No. 2	HS716	Vertical	1	Surface	90
No. 3	HS716	Vertical	2	Surface	225
No. 4	MR30006	Vertical	1	Surface	100

Development footage in 1966 consisted of 2,880 feet of drifting, 329 feet of crosscutting, and 452 feet of raising, all from No.3 shaft. Total development footage to 31 December 1966 was as follows: 6,771 feet of drifts; 461 feet of crosscuts; 1,361 feet of raises. Some 45 diamond-drillholes totalling 8,246 feet were completed from underground.

A total of 1,412 tons of ore was hoisted and stockpiled.

Employment and Management

The average number of employees was 10: 5 underground and 5 on surface. F. C. Cameron was manager.

Silverfields Mining Corporation Limited

Silverfields Mining Corporation Limited was incorporated in September 1962 with an authorized capitalization of 3,000,000 shares of \$1 par value of which 1,500,005 shares have been issued. The directors and officers were: N. B. Keevil, president and director; Stephen Kay, vice-president and director; Sir Michael Butler, Bt., secretary and director; J. H. Hirshhorn and D. A. Perigoe, directors; J. B. Anderson, general manager; J. H. Westell, treasurer; D. S. Brown, assistant secretary. The head office is at Suite 1000, 11 Adelaide Street West, Toronto 1. The mine address is Cobalt.

The property consists of four claims comprising 67 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 1966.

The vertical two-compartment Alexandra shaft has a depth of 436 feet below the collar. Development footage in 1966 consisted of 5,234 feet of drifting, 937 feet of crosscutting, and 295 feet of raising. Total development footage to 31 December 1966 was as follows: 12,258 feet of drifts; 5,796 feet of crosscuts; 1,221 feet of raises. Some 250 diamond-drillholes totalling 25,389 feet were completed from underground.

New construction in 1966 included an assay office, 35 x 18 feet and an addition to the warehouse, 16 x 14 feet, both frame construction.

About 72,302 tons of ore was hoisted; 74,847 tons were milled at a daily average of 205 tons.

Annual Report for 1966

Company Annual Report

The following is taken from the company annual report for the year ending 31 August 1966.

Production

Custom milling was continued until December 1965, with 11,750 tons being treated. For the remainder of the fiscal year, ore was milled in the company mill which treated 53,334 tons during the period.

Following tuneup of the circuit, the mill has operated satisfactorily and capacity is now rated at 230 tons per day.

		1966	1965
Ore milled	ton	65,084	37,041
Silver recovered	oz.	1,423,971	1,232,367
Tailings	oz. per ton	0.41	0.69
Calculated heads	oz. per ton	22.29	33.96
Recovery	percent	98.10	97.97

In addition to the silver, 63,609 pounds of cobalt and 80,098 pounds of copper were produced. Lower costs due primarily to higher tonnage milled and operation of the mill have permitted lower grade material to be mined at a profit. This policy is reflected in the reduced grade of ore milled during 1966 as compared to the previous year.

Operating Costs

The following is a comparative analysis of operating costs per ton milled.

	1966	1965
Mining	\$ 4.13	\$ 6.03
Milling	2.45	4.42
Exploration and development	3.67	4.26
Mine general and administrative expense	1.59	2.01
Head office and corporate expense	0.60	1.01
Cost per ton milled	\$12.44	\$17.73

Exploration

Diamond-drilling in the mine area was largely confined to exploring the vertical extent of the main vein. Detailed drilling to the north and south of the No.2 vein over a 600-foot strike length indicates the upward extension of the vein system through the quartzite horizon. This extension ranges 70 to 90 feet above the third level. Ore values are erratic, although the structure is generally strong with distinct contacts in the walls.

Drilling below the fifth level on known veins indicates vein penetration in the range of 100 feet. Ore values extend about 35 to 50 feet below the fifth level on at least three veins.

A drilling program was carried out in the southeast section of the property by drilling from the underground workings of the Hiho property. Several ore sections were encountered at and below the third level horizon. These will be explored later by crosscutting from the present Silverfields workings.

Ore Reserves

After the milling of 65,084 tons during 1966, indicated ore reserves were still maintained at the level of previous years. In addition, broken ore reserves now total 29,400 tons.

Employment and Management

The average number of employees was 82 : 46 underground and 36 on surface. W. C. Summers was mine manager.

Silver Miller Mines Limited

Silver Miller Mines Limited was incorporated in January 1946, with an authorized capitalization of 3,000,000 shares of \$1 par value; in 1952 the number of shares was increased to 4,000,000; in 1953 to 5,000,000 and in 1960 to 7,000,000 of which 6,646,181 shares have been issued. The directors and officers were: Murray Cooper, president and director; C. G. Gray, vice-president and director; J. M. Wainberg, secretary-treasurer and director; H. B. McLean, mine manager and director; E. F. Griffith, E. F. Furniss and W. A. Carter, directors. The head office is at 714, 62 Richmond Street West, Toronto 1. The mine address is Drawer 230, Cobalt.

The property formerly known as Conisil Mines, consists of about 270 acres in Coleman township, District of Timiskaming and comprises the following properties: Conisil, 40 acres; Hargraves, 80 acres; Merger, 90 acres; Gem, 20 acres; Badger, 40 acres.

Mining operations progressed from 1 January to 31 December 1966. The mill was idle.

The vertical two-compartment Conisil shaft located in claim JB27 has a depth of 625 feet below the collar. Development work in 1966 consisted of 56 feet of crosscutting and 17 feet of raising. Total development footage to 31 December 1966 was as follows: 3,798 feet of drifts; 1,279 feet of crosscuts; 3,356 feet of raises. Some 20 diamond-drillholes totalling 12,273 feet were completed from underground. A total of 263 tons of ore was hoisted and stockpiled.

Employment and Management

The average number of employees was 5 men on surface; H. B. McLean was manager.

Silver Pack Mines Limited

Silver Pack Mines Limited was incorporated in October 1964 with an authorized capitalization of 3,000,000 shares of \$1 par value, of which 1,250,005 shares have been issued. The directors and officers were: S. L. Kay, president and director; D. C. Vickers, secretary, treasurer and director; D. H. Slute, J. D. S. Bohme, and B. Attenborough, directors. The head office is at Suite 1601, 8 King Street East, Toronto 1; the mine address is Box 709, Haileybury.

The property, formerly known as the Hudson Bay south property, comprises three claims in Coleman township, District of Timiskaming.

Mining operations progressed from January to March 1966.

SHAFTS, SILVER PACK MINE

SHAFT	LOCATION	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH FROM SURFACE
				feet	feet
No. 1	S.E. ¼, S. ½, lot 7, Coleman twp.	Vertical	2	Surface	105
No. 2	S.E. ¼, S. ½, lot 7, Coleman twp.	70°	2	Surface	315

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The program of underground diamond-drilling was completed in February and the mine then closed down. No development work was carried out. Total development by previous operators consisted of 2,740 feet of drifting on the 125-, 230-, and 330-foot levels. Some 17 diamond-drillholes totalling 2,233 feet were completed from underground in 1966.

Employment and Management

The average number of employees was 2: 1 underground and 1 on surface; G. Shartner was manager.

Silver Regent Mines Limited

Silver Regent Mines Limited was incorporated in January 1962 with an authorized capitalization of 5,000,000 shares of no par value, of which 3,025,005 shares have been issued. The directors and officers were: G. E. Buchanan, president and director; A. J. Fortens, vice-president and director; N. B. Sheriff and N. W. Lampport, directors; Frank Cadesky secretary-treasurer. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is Cobalt.

The property comprises nine claims, about 400 acres, located in Bucke and Coleman townships, District of Timiskaming. It includes the former Genesee property and an adjoining property, leased from Agnico Mines, formerly known as Nipissing North.

Operations progressed from 1 January to 31 December 1966.

The vertical two-compartment No.1 shaft has a depth of 572 feet below the collar, and the vertical two-compartment No.2 winze collared on the 350-foot level reaches a depth of 390 feet below surface.

Development footage completed by previous operators consisted of 1,145 feet of drifts, 4,470 feet of crosscuts, and 390 feet of raises. Some 26 diamond-drillholes totalling 7,031 feet were completed from surface and a total of 17,586 feet of diamond-drillholes was completed from underground in 1966.

Underground diamond-drilling was still in progress, and included long holes on the 500-foot level being drilled into the Silver Belle property to the south of the Genesee, as well as surface drilling on the Nipissing North claim.

Management

The diamond-drilling was by contract, under the direction of J. E. Armstrong, manager.

Silver Summit Mines Limited

Silver Summit Mines Limited was incorporated in June 1962 with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 4,600,000 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; C. L. Murray, assistant secretary and director; E. F. Furniss, director. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is c/o Silverfields Mining Corporation Limited, Box 679, Cobalt.

The company had purchased the privately owned Mensilvo mine consisting of 25 acres in lot 5, concession IV, Coleman township, and combined it with their adjacent 40-acre Savage property, also in Coleman township. The Savage property lies to the north of the Mensilvo property about three miles southeast of Cobalt on the road leading to the Ragge Chute compressed air plant.

Mining operations continued from 1 January to 15 June 1966.

SHAFTS, SILVER SUMMIT MINE

CLAIM	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	VERTICAL DEPTH BELOW SURFACE
			feet	feet
No. 1	Savage	2	Surface	80
No. 2	Savage	2	Surface	290
No. 3	Savage	2	Surface	140
No. 4	Savage	2	Surface	230
8 others	Savage	1 (inactive)	Surface	no record
No. 1	Mensilvo	2	Surface	100
No. 2	Mensilvo	2	Surface	140
No. 3	Mensilvo	1	Surface	40
No. 4	Mensilvo	1	Surface	70
No. 7	Mensilvo	2	Surface	200

A joint exploration program was being carried out by Silverfields Mining Corporation Limited and Silver Summit Mines Limited. No underground development work was completed during 1966 and the total previously completed consisted of 7,549 feet of drifts; 2,505 feet of crosscuts; 2,342 feet of raises. Some 29 diamond-drillholes totalling 11,916 feet were completed in 1966 from underground. A bulkhead was constructed on the 140-foot level and the mine was allowed to flood.

Employment and Management

The work was carried out by Silverfields Mining Corporation employees; K. F. O'Flaherty was in charge.

Silver Town Mines Limited

Silver Town Mines Limited was incorporated in January 1963 with an authorized capitalization of 5,000,000 shares of \$1 par value, of which 3,967,505 shares have been issued. The directors and officers were: J. P. Arnott, president and director; A. J. Fortens, vice-president and director; Frank Cadesky, secretary-treasurer and director; N. W. Lampport and R. J. Murphy, directors. The head office is at Suite 503, 365 Bay Street, Toronto 1. The mine address is Box 800, Cobalt.

The property comprises about 258 acres and consists of several claims adjacent to, and embodying Peterson Lake, in Coleman township, District of Timiskaming.

Operations proceeded from 16 June to 31 December 1966.

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SHAFTS, SILVER TOWN MINES

LOCATION	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	TOTAL DEPTH FROM SURFACE
Peterson	SW476		feet	feet
No. 1	Coleman twp.	Vertical	2	Surface
No. 2	Coleman twp.	Vertical	2	Surface
Little Nipissing	Coleman twp.	Vertical	2	Surface
Winze No. 1	Coleman twp.	Vertical	.....	150
Winze No. 2	Coleman twp.	Vertical	.....	273
Susque-Hanna	Coleman twp.	Vertical	2	Surface
Nova Scotia No. 3	Coleman twp.	Vertical	2	Surface
Seneca No. 1	Coleman twp.	Vertical	2	Surface
Seneca No. 2	Coleman twp.	Vertical	2	Surface
Gould No. 3	Coleman twp.	Vertical	2	Surface

The property was reopened during the summer after being dormant since October 1964. A new headframe was erected at the old Peterson Lake No.1 shaft, the mine was dewatered and a hoisting plant installed and surface buildings constructed. Exploration and development has been confined to the 200-foot level; the sinking of an inclined winze from this level was started. The company has also purchased the old LaRose mill from Silver Miller Mines Limited.

Development work in 1966 consisted of 64 feet of drifting, 132 feet of crosscutting, and 95 feet of raising. Four diamond-drillholes, totalling 844 feet were completed from underground.

Major construction included the following:

- headframe, 46 feet high with ore bin for two compartment shaft
- hoist building, 16 x 16 feet, frame construction
- office, 16 x 16 feet, frame construction
- dry and shop building, 50 x 24 feet, frame construction
- lamp house, 16 x 12 feet, frame construction
- compressed air and tool shed, 12 x 12 feet, frame construction

Major equipment installed included a single drum hoist, 24 x 42 ins., 5,500 lbs. rope pull; a two drum slusher, 40 hp. 60/3/550 motor, 4,400 lbs. rope pull, 300 fpm; two trammers each 1½ ton.

Employment and Management

The average number of employees was 7: 3 underground and 4 on surface. R. Gareau 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; J. G. Ahern, H. Reimer, A. S. Fraser, R. E. Fasken, and W. Stollery, directors; C. M. Masterman, secretary-treasurer; R. M. P. Fisk, assistant secretary-treasurer. The head office is at Suite 1710, 360 St. James Street West, Montreal, P. Q. The mine address is O'Brien.

The company owns and 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.

Mining and milling continued throughout 1966. Work was carried on through No.6 shaft, which was created in 1956 by raising No.6 winze to surface.

SHAFTS, SISCOE MINE

	CLAIM NO.	INCLINATION	NUMBER OF COMPARTMENTS	COLLAR DEPTH	SINKING 1966	VERTICAL DEPTH BELOW SURFACE
				feet	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 BONSAI						
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 BONSAI						
No. 1 shaft	RSC83	76°	2 (inactive)	Surface	.....	132
No. 2 shaft	RSC83	Vertical	3	Surface	372	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

The vertical three-compartment Lower Bonsal No.2 shaft was sunk 372 feet to a depth of 511 feet below the collar. The 230-, 350-, 425-, and 500-foot levels were established at corresponding depths below the collar.

Development work in 1966 consisted of 1,141 feet of drifting, 1,155 feet of crosscutting, and 463 feet of raising. Total development footage by present operators to 31 December 1966 was as follows: 78,009 feet of drifts; 23,066 feet of crosscuts; 10,451 feet of raises. Diamond-drilling in 1966 consisted of 167 holes, totalling 28,926 feet, from underground and 18 holes, totalling 8,511 feet, from surface.

Major construction in 1966 consisted of a wooden plank ore bin, 14 x 16 x 16 feet.

A total of 52,398 tons of ore was hoisted and milled at a daily average of 243 tons.

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Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Production

SILVER CONCENTRATES PRODUCED			
Table concentrates	dry tons	222	at 4,445 ozs. per ton
Flotation concentrates	dry tons	871	at 176 ozs. per ton
Hand picked mine ore	tons	18	at 3,664 ozs. per ton
TOTAL FINE OUNCES RECOVERED 1,206,149			

PRODUCTION OVER PERIOD 1946-1966

YEAR	TONS ORE MILLED	GROSS PRODUCTION SILVER OUNCES
1946-1961	580,944	13,777,758
1962	68,665	1,469,370
1963	64,660	1,404,027
1964	64,019	1,399,522
1965	58,049	1,103,785
1966	53,050	1,206,149
Total	889,387	20,360,611

Mining

SOURCES OF ORE MILLED	1966			1965		
	Ore tons	Grade oz. per ton	Total oz.	Ore tons	Grade oz. per ton	Total oz.
Development	3,291	20.5	67,532	3,662	13.1	47,901
Mining	49,759	21.6	1,072,668	54,387	18.6	1,011,667
Waste rock (to backfill)	8,318			8,181		
Broken ore reserves	7,718			10,186		

Milling

	1966	1965
Ore treated	tons	53,050
Calculated heads	oz. per ton	22.07
Mill residues	oz. per ton	0.58
Recovery	percent	97.39
Total recovery at mill	oz.	1,140,200
Hand picked mine ore	oz.	65,949
Overall silver production	oz.	1,206,149

The mill continued to perform satisfactorily. The average tailings loss was 0.58 ounce per ton (same as last year). The percentage of silver recovered was slightly higher due to the better grade of ore milled. Including hand picked mine ore the overall recovery in high-grade form accounted for 87.3 percent (87.2 percent in 1965) of total production distributed as follows:

		1966	1965
Hand-picked mine ore	percent	5.5	4.0
Table concentrates	percent	81.8	83.2
Flotation concentrates	percent	12.7	12.8
Total		100.0	100.0

Operating Costs

	1966		1965	
	per ton	per oz. of Silver	per ton	per oz. of Silver
Marketing (including smelting)	\$ 2.33	\$0.102	\$ 2.04	\$0.107
Exploration and development	1.75	0.077	2.09	0.110
Mining	6.84	0.301	6.71	0.353
Milling	2.16	0.095	2.02	0.106
Mine overhead	1.90	0.084	1.53	0.080
Total mine operating cost	\$14.98	\$0.659	\$14.39	\$0.756

Employment and Management

The average number of employees was 99: 68 underground and 31 on surface. E. A. Pearson was mine manager.

Sudbury Contact Mines Limited

Sudbury Contact Mines Limited was incorporated in October 1927 with an authorized capitalization of 6,000,000 shares of \$1 par value, of which 4,955,000 shares have been issued. The directors and officers were: Paul Penna, president and director; Julius Osheroff, vice-president and director; W. L. Hogarth Jr., and C. P. McTague, directors; R. F. Righton, secretary-treasurer. The head office is at Suite 1101, 365 Bay Street, Toronto 1; the mine address is Box 9, Cobalt.

The property, formerly known as the Provincial mine, consists of approximately 40 acres in Gillies Limit, District of Timiskaming.

Operations progressed from 1 January to 31 December 1966. Three vertical two-compartment shafts had been sunk by former operators, the deepest being No.2 which was some 350 feet below the collar. Development work in 1966 consisted of some 320 feet of drifting, 410 feet of crosscutting and 165 feet of raising. Some 58 diamond-drillholes totalling 12,225 feet were completed from underground.

About 500 tons of ore was hoisted and stockpiled.

Employment and Management

The average number of employees was 6: 4 underground and 2 on surface; L. J. Cunningham was mine manager.

A. Townson Lease

Tormont Mine

A. Townson, leased claim 13255 located in Haultain township, District of Timiskaming, formerly known as the Tormont mine. The address of the lessee was Box 711, Bancroft.

Operations proceeded from 25 May to 1 October 1966.

Some 30 feet of trenching averaging 15 feet in depth was completed. A total of 1,377 pounds of ore was hoisted.

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TELLURIUM—*see* NICKEL AND COPPER

THORIUM

(Thorium and Yttrium)

The production of thorium increased 88.59 percent in quantity from 46,339 pounds in 1965 to 87,393 pounds in 1966; the value of production increased 11.47 percent from \$188,865 in 1965 to \$210,528 in 1966.

Thorium was first recovered as a by-product from milling of the Elliot Lake uranium ores in 1959, and to 31 December 1966 the accumulated production value was \$2,275,276.

The general statistics are given in this Volume under "Uranium Oxide".

Rio Tinto Nuclear Products Limited

Rio Tinto Dow Limited was incorporated in January 1958; in November 1965 Rio Algom Mines Limited, obtained sole control and the name was changed to Rio Tinto Nuclear Products Limited. The authorized capitalization was 200,000 shares; 100,000 preference shares and 100,000 common shares each of \$10 par value, of which 43,000 preference and 35,000 common shares have been issued. The directors and officers were: W. B. Malone, president and director; W. P. Arnold, vice-president and director; R. D. Lord, manager of operations and director; G. Baker, and B. R. MacKenzie, directors; G. R. Devey, secretary; D. G. Scott, treasurer; J. S. Turnbull, assistant-secretary. The head office is at Suite 2600, 120 Adelaide Street West, Toronto 1. The plant address is Box 190, Elliot Lake.

In the fall of 1965, new equipment was installed and a small building annex constructed at the thorium plant at Nordic mine in order to recover yttrium oxide concentrate as a co-product with thorium, by extraction from barren liquor of the Nordic uranium mill. The process employs solvent extraction, as did the original thorium recovery process. Initial yttrium production was reported in December 1965. The strong market for yttrium, which is used to make a better red phosphor for colour television tubes, has required seven-day operation of this plant at maximum capacity. The company announced in December 1965 that the plant had a capacity of 100,000 pounds per year of yttrium oxide.

Shipments of thorium produced in this plant have increased considerably over 1965. Additional equipment was installed in 1966 to upgrade the product to a purified thorium sulphate. Certain improvements and additions were made to ventilation and personnel facilities in the plant, and further improvements are in progress.

A start was made late in 1965 to erect a small uranium refinery with capacity to process 150 tons of U_3O_8 per year. A concrete block annex, 50 x 23 x 26 feet, was erected at the south end of the Nordic mill and equipment and other

facilities were installed both in the annex and the mill proper. Elute from the Nordic ion exchange process is the source of uranium for the refinery. The basic refining process uses solvent extraction to purify the uranium, followed by reduction in a hydrogen atmosphere to a final nuclear grade UO₂ powder. The plant was available for production near the year end.

Added equipment in the UO₂ semi-works plant included:

- 1 drum filter, 3 x 2 feet
- 1 water treatment installation
- 1 pit furnace.

Production in 1966 was as follows:

Thorium sludge	lb.	107,466
Yttrium oxide concentrate	lb.	56,599

Company Annual Report

The following is taken from the Rio Algom Mines Limited annual report for the year ending 31 December 1966.

Production of yttrium concentrates started late in 1965 as a supplement to thorium recovery. Market demand for yttrium was strong and sales contracts were developed. Technical difficulties arising from the complexity of this new process hampered production initially but substantial increases in output are expected in 1967.

Production and sales of thorium were substantially higher than in 1965 and increased requirements are forecast for 1967. The addition of yttrium recovery to that of thorium in a combined process has contributed significantly to the economics of thorium production.

The 150-ton-per-year uranium refinery was completed during the year and is now available for commercial production of nuclear pure uranium dioxide.

Employment and Management

The average number of employees was 16. M. E. Grimes was manager of operations.

URANIUM OXIDE

The production of uranium oxide in Ontario decreased 13.91 percent in quantity, from 6,825,046 pounds in 1965 to 5,875,698 pounds in 1966; the value of production decreased 9.48 percent, from \$47,234,892 in 1965 to \$42,758,135 in 1966.

The general statistics for thorium, uranium and yttrium are combined here. These industries paid \$1,953,431 to 274 salaried employees, \$7,698,431 to 1,171 wage-earners; fuel and electricity cost \$1,590,007 and process supplies \$6,856,095.

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 again changed to Consolidated Denison Mines Limited; in March 1960, on amalgamation of

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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, president and director; John Kostuik, vice-president, general manager and director; Jean Bodson, vice-president 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 and B. E. Willoughby, directors; E. B. McConkey, vice-president finance and treasurer; J. G. Pickard, vice-president industrial division; A. F. Risso, controller. 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	S58071	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 1966 consisted of 7,773 feet of drifting and 84 feet of raising. Total development footage on a single plane to 31 December 1966 was as follows: 172,009 feet of drifts; 3,198 feet of raises. Some 1,125 diamond-drillholes, totalling 24,288 feet, were completed from underground.

Construction of a new leaching building which was commenced in 1965 was completed in 1966.

Major equipment added to the leaching and yttrium extraction plants was as follows:

- 12 tanks, 22.5 ft. diam. x 50 ft. high (Pachuca)
- 3 leachers, 8 x 8 ft.
- 2 filters, 14.5 ft. diam. x 16 ft.
- 1 filter, 11.5 ft. diam. x 16 ft.
- 2 precipitation units, 10 ft. diam. x 10 ft.
- 3 dryers, 10 ft. diam. x 4 ft. high.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

During the year a dramatic increase in the demand for yttrium oxide developed as a result of its highly successful application in improving the brightness and trueness of colour rendition in colour television picture tubes. A second new application that is expected to prove equally important is the correction of the colour balance of mercury-vapour lamps.

The company has seized this very favourable opportunity to implement its plans for the extraction of yttrium oxide as a by-product of the uranium recovery process and to become a major supplier of this scarce metal oxide in early 1967. The high demand, which is expected to increase, the limited world supply and Denison's strong position as a long-term producer, make this an extremely important development for the company's future.

Mining

Mining continued to be localized in the northeast and southwest areas, from which ore was moved by the present conveyor systems to the No. 1 shaft. Production from these areas will be phased out as the Axis "B" conveyor system is completed and ore extraction shifts to this location. Development work on this system was advanced during the period and an underground crusher station has been planned. Late in the year, development headings were started to explore and develop the orebody east and west of the workings from No. 2 shaft. Readily accessible developed ore reserves were increased from 3,000,000 tons to 3,200,000 tons.

Ventilation capacity was increased from 300,000 cfm. to 500,000 cfm. early in the year. Additional work to further improve the ventilating system was concentrated underground: the various vitiated and fresh air streams were isolated by a series of concrete block walls, urethane foam-coated bulkheads, overpasses and underpasses. A 6,200-foot drive has been started to the east which will break into the Can-Met lower workings and make the two Can-Met shafts available for future expanded ventilation requirements.

The total tonnage of ore broken amounted to 975,486 tons while the waste tonnage was 21,067 tons. Of the total of 979,384 tons of ore hoisted, No. 1 shaft accounted for 913,449 tons and No. 2 shaft 65,935 tons. Headings were advanced for a total of 28,648 feet. The grade of ore hoisted averaged 2.86 pounds of U_3O_8 per ton.

The shortage of available skilled manpower for mining is still a major problem facing the industry. The miner training program instituted last year, which has graduated 84 trainees, has enabled the operation to maintain the level of the underground force. The company is participating in and co-operating with committees of industry and government which have been set up to alleviate the situation.

Extensive research work has been initiated in the development and use of new mining methods and new loading and hauling equipment to increase the productivity of available manpower.

SUMMARY OF PRODUCTION

		1965	1966
Ore broken	tons	874,544	975,486
Milled	tons	889,391	981,709
Recovery	percent	95.27	94.97
Average U_3O_8 per ton	lb.	2.93	2.86
U_3O_8 produced	lb.	2,561,164	2,748,602

The new leaching plant which was added to the complex was put on stream in mid year and is operating satisfactorily. Expected operating costs and performance are being met and additional improvements are projected.

Investigations and research are being carried forward on the methods and economics to upgrade the feed to the mill by a preconcentration step and to produce higher grade products.

Safety

The policy of safe production on the job and vigilance of the hazards off the job is constantly conveyed to the employees of the various departments and sub-sections at regular meetings. This, along with all the programs instituted during the years, has again helped to maintain a good safety record with the accident frequency being reduced from 27.2 to 23.1 compensable accidents per million man-hours worked.

Again this year one of the mine rescue teams distinguished itself by winning the District Competition, and then put on a creditable performance in the All-Ontario finals.

Employment and Management

The average number of employees was 748: 421 underground and 327 on surface. M. J. de Bastiani was mine manager.

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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 12,000,000 shares of no par value and 500,000 preferred shares of \$100 par value of which 10,716,422 common and 150,000 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; W. B. Malone, first vice-president and director; Henry Borden, F. G. Gardiner, Sam Harris, Leo Model, F. A. Petito, J. I. Crookston, W. A. Arbuckle, L. A. Lapointe, J. G. Edison, Hon. S. A. Hayden, Sir Mark Turner, J. H. Smith and R. W. Wright, directors; W. P. Arnold, vice-president and general manager of operations (mining division); E. J. Tanner, chief financial officer; A. C. Turner, controller; G. Baker, vice-president administration, and secretary; G. R. Albino, vice-president, planning and development. The head office is at 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 Division, Pater mine appear in the "Nickel-Copper" section of this report.

NORDIC MINE

Mining and milling operations continued throughout 1966 at the Nordic mine consisting of 140 claims in Townships 143, 149, and 155, District of Algoma.

The vertical six-compartment, Nordic No.1 shaft located on claim S66619, in Township 149, has a total depth of 1,780 feet below the collar. Development work in 1966 consisted of 9,610 feet of drifting, and 22,827 feet of raising. Total development footage to 31 December 1966 was as follows: 117,442 feet of drifts; 21,362 feet of crosscuts; 224,829 feet of raises.

Normal mining and milling procedures were carried on during the year. A production rate of 110,000 tons per month was maintained with stoping being carried out from the 7th down to the 14th level. The thinner Pardee reef, lying slightly above the main bed in the lower east section of the mine, was worked to a limited extent. Bacterial leaching is being carried on the upper levels. All mine water is treated for uranium recovery before being discharged.

A total of 1,284,650 tons of ore was hoisted; 1,285,400 tons were milled; the mill averaged 3,704 tons per working day and produced 2,749,965 pounds of uranium oxide.

QUIRKE MINE

The property comprises 63 claims in Township No.150, District of Algoma.

SHAFTS, QUIRKE 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

About 234,000,000 gallons of water was pumped from the No.1 shaft and workings from the period of October, 1965 to May, 1966. Ventilation was restored, rehabilitation, as required was completed and the uranium content of the mine water was recovered at the Nordic mill. For the present, Quirke No.1 is on a standby basis.

Late in 1966 a decision was made to prepare the No.2 shaft for production, a two or three year project. The original Spanish American headframe is on site and a 50-foot collar was sunk some years ago. Hoist and service buildings are being completed and sinking is scheduled to start early in 1967. This will be a six-compartment shaft to 2,260 feet with intervening levels and attendant ore and waste passes, bins, pockets and an escape and ventilation way. Ore from No.2 shaft will be processed in the original No.1 Quirke mill.

Major construction during 1966 included the following: one building comprising the following five sections: a hoistroom, 123 x 45 feet, a compressor room, 62 x 29.7 feet, an electrical room, 30.7 x 14 feet, a switch room, 69.5 x 31 feet, and a mine dry, 54 x 32 feet; a shafthouse comprising the following four sections: shop area, 50 x 38 feet, shaft area, 50 x 46 feet, coarse bin area, 44 x 43 feet and waste bin area, 37 x 22 feet; a pumphouse, 21.7 x 18.7 feet; a temporary office, 24 x 16 feet; a building for contractors, 60 x 15 feet.

Major added equipment was as follows:

Shafthouse

- 1 oil burner, 1,000,000 B.T.U.
- 1 propane heater, 2,000,000 B.T.U.
- 1 overhead crane, hand operated, 20 ton capacity.

Compressor room

- 2 air compressors, 29 x 18 x 14½ in., 3,000 cfm.
- 2 synchronous motors, 500 hp.
- 1 sump pump, 300 USG/Min. @ 20 ft. head
- 1 hydro-chlorinator, series 429
- 1 overhead crane, hand operated, 5 ton capacity.

Pumphouse

- 1 horizontal water supply pump, 300 USG/Min.
- 1 fire pump, 40 hp. motor, 500 USG/Min. @ 100 psi.

Hoistroom

- 1 skip hoist, 144 x 78 ins., 1,500 ft./min.
- 2 electric motors, 1,500 hp.
- 1 overhead crane, 20 ton capacity.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

Uranium oxide production and sales increased slightly and the sales value per pound also increased slightly under the company's several sales contracts. Unit operating expenses increased, in part by reason of increased labour, material and reagent costs and in part because of some reduction in grade as the Nordic mine approaches depletion of its ore reserves at presently developed mining levels.

Preparation for the re-opening of the Old Quirke mine continued on schedule as did work related to the opening of the New Quirke mine. Work preparatory to the sinking of the New Quirke shaft was completed during 1966 and actual shaft sinking began in January 1967.

The Nordic mine at Elliot Lake was the only uranium mine in operation. It produced a total of 2,741,340 pounds of U₃O₈; in addition, 102,515 pounds of U₃O₈ were recovered by treatment of mine water pumped from the Old Quirke mine in the course of preparing it for reactivation.

The production rate was increased at the Nordic mine and mill in February 1966 to meet delivery requirements under existing contracts. During 1966 a total of 1,285,400 tons of ore was milled; the average daily rate of 3,704 tons is a production record for this property. The average grade at Nordic was 2.13 pounds per ton and the recovery rate was 93.9 percent. The slight

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decreases in grade and recovery rate as compared to 1965 had been anticipated and are due to natural occurrences as the Nordic orebody approaches exhaustion at present mining levels.

Deliveries totalled 2,766,302 pounds of U_3O_8 , mostly under the master contract with Eldorado Mining and Refining Limited. Relatively small deliveries were also made under the stockpile contract with the Canadian Government.

Employment and Management

The average number of employees at the Nordic and Quirke mines was 635: 293 underground and 342 on surface. E. W. Cheeseman was mine manager.

Stanrock Uranium Mines Limited

Stanrock Uranium Mines Limited was incorporated in March 1956, with an authorized capitalization of 6,000,000 shares of \$1 par value, of which 4,993,286 shares have been issued. The directors and officers were: G. W. Rowe Jr., president and director; D. S. Robertson, vice-president and director; J. F. A. Nisco, V. V. Jacomini, J. R. Dunning, Robert Frankel, J. C. Ward Jr., James Bruce and N. C. Steenland, directors; Harmon Duncombe, secretary; D. C. Marshall, treasurer. The head office is at Suite 804, 80 Richmond Street West, Toronto 1. The mine address is Box 1700, Elliot Lake.

The property comprises 22 claims, about 595 acres in Township 144 and 150, Blind River area, District of Algoma.

Leaching operations at the mine continued from 1 January to 31 December 1966.

SHAFTS, STANROCK MINE

	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.

Uranium recovery during 1966 was restricted to bacterial leaching in the mined-out areas on a three-month cyclical schedule. Washing was carried out on two shifts per day with eight men comprising a washing shift.

In February the installation in No. 2 shaft of stainless steel multi-stage pumps and rubber-lined discharge piping, was completed, thus obviating the necessity for neutralizing the mine water before pumping to surface.

The mine water is treated in the mill for the production of U_3O_8 with the barren solution being processed for the extraction of yttrium oxide, a component of the rare earth concentrate, used in the manufacture of colour television tubes.

An intensive program to improve underground ventilation is currently in progress.

Major equipment installed was as follows:

- 3 pumps, 8-stage, 450 gpm., 1,000 ft. head.
- 1 pump, 4-stage, 450 gpm., 450 ft. head.
- 2 fans, with 75 hp. motors, 50,000 cfm. @ 5 ins. S.P.
- 1 fan, 60,000 cfm. @ 6 ins. S.P.

Company Annual Report

The following is taken from the company annual report for the year ending 31 December 1966.

During 1966, the outlook for the uranium industry improved sharply, and Stanrock looks forward to the time when economic conditions in the industry will permit the company to resume conventional underground mining of the uranium deposits. In the United States, over 50 percent of all new electrical generating capacity contracted for in 1966 will be nuclear powered. There were over 20 new U.S. nuclear plants contracted for during the year with a combined capacity of close to 20,000,000 kilowatts, and a like trend to nuclear power is evident in other countries.

The demand for uranium which this surge to nuclear power will create has not been matched so far by discoveries of new substantial deposits of uranium.

In 1966 the company produced, by bacterial leaching, uranium oxide and yttrium oxide with a sales value of \$818,681. All sales of uranium oxide were made to Eldorado. All yttrium oxide sales were made to Michigan Chemical Company.

Employment and Management

The average number of employees was 60: 32 underground and 28 on surface. B. G. MacDermid was mine manager.

YTTRIUM

The first production of yttrium, recorded in 1966, amounted to some 20,724 pounds valued at \$130,223. Both thorium and yttrium are recovered as by-product oxides from the milling of the Elliot Lake uranium ores. The general statistics are given in this Volume under "Uranium Oxide".

(See also "Thorium and Yttrium".)

ZINC—see LEAD AND ZINC

NON-METALLICS AND FUELS

ARSENIC

In 1966, 701,537 pounds of arsenic trioxide, valued at \$35,610, was recovered from concentrates shipped from the Cobalt-Gowganda area; in 1965, 403,011 pounds, valued at \$13,150 was recovered.

ASBESTOS

The production of asbestos in Ontario decreased 3.53 percent in tonnage from 1,758 tons in 1965 to 1,696 tons in 1966; the value of production decreased 6.84 percent from \$69,258 in 1965 to \$64,519 in 1966. There was no production from the Reeves and Munro properties of Canadian Johns-Manville Company Limited.

The general statistics for asbestos, gypsum, nepheline syenite, peat moss, quartz, salt and talc are combined here. These industries paid \$1,001,926 to 163 salaried employees, \$3,769,430 to 711 wage-earners; fuel and electricity cost \$1,133,064 and process supplies \$2,527,007.

Hedman Mines Limited

Hedman Mines Limited was incorporated in August 1956 with an authorized capitalization of 3,000,000 shares of \$1 par value, of which 1,451,431 shares have been issued. The directors and officers were: J. J. Mangan, president and managing director; J. C. Lavigne, vice-president and director; S. E. McCrory, secretary-treasurer and director; H. K. Passmore and H. E. Dyer, directors. The head office address is Box 590, Timmins. The mine address is P.O. Box 459, Matheson.

The property comprises 29 claims (about 1,164 acres) in Warden and Munro townships, District of Cochrane, about 25 miles northeast of Matheson. The open pit is near the centre of the Warden township property; the pilot plant is on the railway siding at Matheson.

Operations continued throughout 1966. The 40-ton pilot plant was operated intermittently; some 2,859 tons of ore was treated at an average of 7.8 tons daily producing special asbestos for test purposes. Market research, machinery evaluation and production mill planning were also carried out.

Added equipment consisted of:

- 2 electric motors; one 1 hp, one 5 hp.
- 1 dust collector, model 18 RJ36
- 1 blasting switch
- 1 mine grizzly
- 1 set of slide conveyors, 110 ft. long, 11 ins. wide.

Employment and Management

The average number of employees was 10: 2 in the open pit and 8 on surface; E. W. Gagan was consulting engineer in charge of operations.

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; J. M. Shackelford, treasurer. The head office is at Dover, Kent county, Delaware, U.S.A; the mine address is P.O. Box 1010, Timmins.

The company's new asbestos orebody is located on a property comprising 37 claims in Reeves township, District of Sudbury, southwest of Timmins. Mining and milling at the Munro mine, which had been the only company major asbestos producer in Ontario, was terminated on 31 July 1964.

Preparations for open pit mining and milling progressed at the Reeves property from 1 June to 31 December 1966.

About 316,547 tons of overburden was stripped, and 474,784 tons of waste rock removed from the orebody in 1966. One diamond-drillhole totalling 107 feet was completed from surface.

The following major construction was in progress or had been completed in 1966: a truck garage, 96 x 26 feet, one storey; a gate house, 12 x 10 feet, one storey; a lunchroom in pit, 32 x 16 feet, one storey; a mill building, 120 x 102 feet, six storeys; a crusher building, 100 x 68 feet; a service building, 240 x 100 feet, one storey; an office building, 94 x 48 feet, one storey, all of steel or wood frame with asbestos cement siding. In addition five dwellings located in Timmins, were under construction, one having nine rooms, one six rooms and three five rooms.

Major added equipment some of which was transferred from the Munro mine was as follows:

- 5 diesel shovels; two model 71B; one model 550; one model 93M; one model 22B.
- 2 bulldozers, model D8
- 2 front end loaders, various models
- 1 tournadozer, model C
- 1 grader, model D-495
- 11 haulage trucks; eight model 35; three 22 ton capacity
- 1 air compressor, 315 cfm.
- 1 rock drill, model PR-123
- 1 pump, 2-stage medivane
- 8 cars and trucks, various models and capacities.

Employment and Management

The average number of employees, excluding contractors, was 40. R. W. Winson was mine manager.

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FLUORSPAR

There was no recorded production of fluorspar in Ontario in 1966.

GARNET

There was no recorded production of garnet in Ontario in 1966.

GYPSUM

The production of gypsum in Ontario increased 6.25 percent in tonnage from 531,918 tons in 1965 to 565,185 tons in 1966; the value of production increased 9.47 percent from \$1,444,293 in 1965 to \$1,581,010 in 1966.

The general statistics for the industry are given in this Volume under "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; D. C. McConkey, secretary, treasurer and director; H. F. Kent, B. Matthews, R. M. Thomson, and Edward Rembert, 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, Haldimand county. The company owns or holds the mining rights on approximately 2,623 acres.

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. The room-and-pillar method of mining is used.

The mine and mill operated from 3 January to 31 December 1966.

The tonnage of gypsum mined during 1966 equalled that of the previous year. The demand for plaster and wall board and other building products was sustained.

The room-and-pillar mining method and ore disposal system will be slightly revised to permit additional mechanization. A second electro-hydraulic four-

wheel-drive auger-drill-mobile, three 250 volt dc shuttle cars, two electrically-driven loaders and other associated equipment will be installed and integrated with the current ore transfer facilities to recover about 70 percent of the plant's gypsum requirements from the four-foot-thick bed.

A total of 324,212 tons of ore was hoisted, and milled; the mill averaged 1,281 tons daily.

Employment and Management

The average number of employees, excluding the mill was 87; 72 underground and 15 on surface. R. C. Nelson was works manager; Ray Hartviksen was mine superintendent.

Domtar Construction Materials Limited

(Gypsum Division)

Gypsum, Lime and Alabastine, Canada, Limited was incorporated in July 1927, and in May 1956, the capitalization was increased. 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 head office is at 2100 Sun Life Building, Montreal 2, Quebec; the mine address is Caledonia.

The company has two gypsum properties and a mill in Seneca township, Haldimand county. 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 3 January to 30 December 1966. 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 of 13.3 tons of gypsum. The total advance in 1966 was 16,087 feet, approximately 10.5 acres were mined out.

The production and shipments in 1966 were about 10 percent higher than in 1965. There was an increased demand in the board and plaster divisions and the cement industry.

Several new pieces of mining equipment are scheduled for service during 1967 to augment the high-pressure hydraulic rotary drill and replace the existing electrically-driven continuous loaders and diesel-electric shuttle car combination. The initial transition period involves diesel-powered scoop loaders to handle about 75 percent of the mine production. The purpose is to streamline the room-and-pillar mining system eliminating high-voltage power lines in the seven-foot-high recovery rooms, and essentially shortcutting mechanization efficiently.

During the year a total of 217,614 tons of ore was hoisted; 179,762 tons were milled at an average of 642 tons daily.

Employment and Management

The average number of employees, excluding the mill, was 27; 24 underground and 3 on surface. C. L. Dryden was plant manager; G. R. Hunt was mine superintendent.

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MICA

The 1966 production reported by one operator amounted to about 200,920 pounds having a value of \$4,367.

NATURAL GAS AND PETROLEUM

Production of natural gas increased 23.12 percent in quantity from 12,619,867 thousand cubic feet in 1965 to 15,537,395 thousand cubic feet in 1966; the value of production increased 22.32 percent from \$4,856,125 in 1965 to \$5,940,000 in 1966.

Production of petroleum increased 3.48 percent in quantity from 1,279,321 barrels in 1965 to 1,323,781 barrels in 1966; the value of production increased 3.49 percent from \$4,093,318 in 1965 to \$4,236,099 in 1966.

Full details on these industries are given in the 1966 annual report of the Ontario Department of Energy and Resources Management.

NEPHELINE SYENITE

Production increased 7.86 percent in quantity from 339,982 tons in 1965 to 366,696 tons in 1966; the value of production increased 20.33 percent from \$3,415,387 in 1965 to \$4,109,744 in 1966.

The general statistics for the industry are given in this Volume under "Asbestos".

Industrial Minerals of Canada 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. It is a subsidiary of Falconbridge Nickel Mines Limited. The authorized capitalization is 1,000,000 shares of no par value, of which 856,855 shares have been issued. The directors and officers were: H. J. Fraser, president and director; J. J. Mather, executive vice-president and director; F. D. Hart, R. C. Mott, G. T. N. Woodroffe and P. Dessaulles, directors; J. D. Donovan, treasurer; 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 2,424 acres, is located in concession IX, Methuen township, County of Peterborough, about 35 miles northeast of Peterborough.

Operations continued throughout 1966 in the open pit on the Cabin Ridge section of the property. Some 24 diamond-drillholes, totalling 5,593 feet were completed from surface.

New construction in 1966 consisted of a full bag storage building, 112 x 35 feet, and two townsite garages, 24 x 14 feet.

Major added equipment included the following:

- 1 compressor
- 1 vacuum cleaning system
- 3 trucks; 2 pick-up, ½ ton; 1 dump, 3 ton.
- 1 fork lift truck, 5,000 lb. capacity

A total of 289,773 tons of ore was crushed and milled at a daily average of 822 tons per working day.

Employment and Management

The average number of employees was 76: 70 in the plant and 6 in the pit. D. C. McDonald was general manager; D. L. Murdy 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, Skokie, Illinois, U.S.A. The company officers were: T. M. Ware, chairman and director; N. C. White, president and director; B. R. Carlson, treasurer and controller; J. R. Taylor, secretary. 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 present operation is in lots 19, 20 and 21, concession VI, at the northeast end of Blue Mountain. The Blue Mountain nepheline syenite deposit is about 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 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.

Mining and milling continued throughout 1966. The mill treated 186,912 tons compared to 178,005 tons in 1965.

Employment and Management

The average number of employees was 47: 35 in the plant, and 12 in the pit. L. F. McDonnell was area manager.

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PEAT MOSS

The production of peat moss decreased in tonnage and value from 20,115 tons for \$389,615 in 1965 to 1,700 tons for \$30,000 in 1966.

The only reporting company in 1966 was Amaranth Peat Products of Shelburne in Dufferin county.

General statistics for the industry are given in this Volume under "Asbestos".

PETROLEUM—see NATURAL GAS AND PETROLEUM

QUARTZ

The production of quartz and quartzite decreased 10.80 percent in tonnage from 1,301,583 tons in 1965 to 1,161,057 tons in 1966; the value of production increased 14.15 percent from \$790,245 in 1965 to \$902,089 in 1966. The major portion is produced by the mines in the Sudbury area, from their own pits and quarries and used as flux for ore processing.

The general statistics for the industry are given in this Volume under "Asbestos".

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 Volume.

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.

Some 90 churn-drillholes, totalling 6,328 feet were drilled for quartzite production in 1966.

A total of 305,333 tons of quartzite was mined and delivered to the rock-house, 302,508 tons were shipped at a daily average of 1,350 tons.

Employment and Management

The average number of employees was 18; W. G. Tilston was superintendent.

Union Carbide Canada Limited

Killarney Quarry

Electro Metallurgical Company of Canada Limited was incorporated in December 1922; in December 1953 the name was changed to Union Carbide Canada Limited, having an authorized capitalization of 12,500,000 shares of no par value, of which 10,000,000 shares have been issued. The directors and officers were: J. S. Dewar, president and director; P. L. Alspaugh, D. B. Benedict, A. A. Cumming, S. A. Hayden, A. T. Lambert, J. F. Shanklin, and G. C. Wells, directors; R. O. Holditch, secretary and treasurer. The head office is at 123 Eglinton Avenue East, Toronto 12; the mine address is Killarney.

The property comprises 17 claims in Killarney township, District of Manitoulin.

The quarrying of quartzite continued from 1 May to 4 November; the mill operated from 2 June until 29 October 1966.

New construction included a repair shop for the mill, 30 x 20 feet, concrete block structure with wooden rafters, steel sheeting on roof, steel sash windows and three doors.

New equipment comprised the following:

- 1 tractor, model D-8 with hydraulic angle blade and Hyster winch
- 1 pick-up truck, ½-ton capacity
- 1 gantry crane, 5-ton capacity with 5-ton electric hoist.
- 1 portable fire pump, 2½ in. suction, 1½ in. discharge.

A total of 195,847 tons of quartzite ore was removed from the quarry; 164,602 tons was milled at a daily average of 1,338 tons during the period of operation.

Employment and Management

The average number of employees was 18; A. MacMillan was general foreman.

SALT

The production of salt decreased 3.03 percent in quantity from 3,900,484 tons in 1965 to 3,782,191 tons in 1966; the value of production decreased 1.65 percent from \$15,499,274 in 1965 to \$15,243,719 in 1966. Brining operations were continued as follows: in Essex county at Brunner Mond Canada Limited, Canadian Brine Limited and Canadian Salt Company Limited in the Windsor-Amherstburg area; in Lambton county by Dow Chemical of Canada Limited; in Huron county by Domtar Chemicals Limited, Sifto Salt Division in the Goderich area. Underground mining of salt continued at the Canadian Rock Salt Company Limited at Ojibway near Windsor, and at Domtar Chemicals Limited, Sifto Salt Division, Goderich mine at Goderich.

The general statistics for the industry are given in this Volume under "Asbestos".

Annual Report for 1966

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, of which 5,162 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; J. D. Mair, vice-president and director; L. M. McBride, assistant secretary and director; F. B. Common Jr., F. H. Sobey, E. G. Smith, H. R. Stratford and R. C. Vail, directors. The head office is at 30 Prospect Avenue, Windsor. The mine address is Ojibway mine, Windsor.

The company's property is in concession 1, Sandwich West township, Essex county, on the shore of the Detroit River.

Mining and milling operations continued from 1 January to 31 December 1966.

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 in 1966 were at a fairly high level. An increased demand in both the export and domestic markets was experienced over the latter half of the year. Hoisting continued on a two-shift basis as a result of this demand. During the year, an additional 2,000-foot conveyor was installed as development headways were driven to open new mining areas. Included with this facility was a new crushing station. The program of phasing out older mining equipment was continued with the purchase of two large front-end loaders and one 45-ton hauling unit.

The mining pattern of room-and-pillar layout, with faces to a height of 20 feet, continues. The rooms are 50 feet wide and truckways 30 feet wide. A recovery factor of 53 percent is in effect as is the practice of leaving six feet of salt on the roof for pillar stability. In the mill, new screening and crushing units are being installed to handle a further reduction in size of mined product.

Development work in 1966 on the 975-foot level consisted of 6,102 feet of drifting, 6,060 feet of crosscutting and 11,316 feet of rooms. Total development footage to 31 December 1966 was as follows: 59,134 feet of drifts; 53,813 feet of crosscuts; 109,764 feet of rooms.

A total of 1,162,356 tons of salt was hoisted and milled as compared to 1,536,792 tons in 1965. The mill treated a daily average of 5,756 tons.

Employment and Management

The average number of employees was 161; 90 underground and 71 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.

Operations continued throughout 1966.

SHAFTS, SIFTO SALT DIVISION, GODERICH MINE

	INCLINATION	NUMBER OF COMPARTMENTS	TOTAL DEPTH
No. 1 shaft	Vertical	3	1,867.5 feet
No. 2 shaft	Vertical	.....	1,835
No. 2 shaft is 16 feet in diameter with partitioned manway from collar to sump.			

Production and shipments during 1966 continued at a high rate. The demand for road and chemical salt was particularly good in the domestic market.

No major underground equipment was placed in service during the year but studies continued in the evaluation of the various types so that decisions can be made quickly when the purchase of such equipment becomes warranted.

Additional electronic sorting machines were installed in the surface mill to keep pace with the rising demand for sorted salt, which is used extensively in automatic domestic water softeners.

The start of construction of the headframe for the No.2 shaft is scheduled for early spring. Orders have been placed for the service hoist and ropes so that this project can be completed during 1967.

Development footage in 1966 on the main level at 1,760 feet consisted of 6,140 feet of drifting. Total development footage to 31 December 1966 consisted of 50,274 lineal feet of drifts, and does not include 220 feet of drifting and 108 feet of raising driven for mine ventilation.

A total of 1,104,506 tons of salt was hoisted; 1,274,000 tons were milled at an approximate average of 4,500 tons daily to produce 1,109,512 tons of milled salt.

Employment and Management

The average number of employees was 120: 80 underground and 40 on surface. W. G. Muir was mine manager.

SULPHUR

The total value of sulphur and sulphur products increased 14.76 percent from \$1,322,611 in 1965 to \$1,517,809 in 1966. Some elemental sulphur is recovered; however, the greater portion of Ontario's production is represented by the sulphur content of liquid sulphur dioxide and sulphuric acid, manufactured from smelter gases in the Sudbury area. There is also production of liquid sulphur dioxide and sulphuric acid in the Port Maitland area, from the smelting of zinc concentrates received from the mines in the Manitouwadge area and the Kidd Creek mine in the Porcupine area.

General statistics for the production of sulphur are included in this Volume in the statistics under the section on "Nickel and Copper".

Canadian Industries Limited

The Sudbury area plants of the company lie adjacent to the Copper Cliff reduction works of The International Nickel Company. Sulphur dioxide gas is utilized to manufacture liquid sulphur dioxide and sulphuric acid.

Flash furnace gas from the Copper Cliff smelter is treated to produce liquid sulphur dioxide at the rate of about 270 tons per day. The oleum production has been discontinued and the old No.1 acid plant in this area will be phased out of production early next year.

The No.2 and No.3 acid plants, situated alongside the iron ore recovery plant, produce acid at the combined rate of about 975 tons per day. The No.4 acid plant, now under construction, will go on stream during the second quarter of 1967. This plant, with process improvements in the other two plants, will result in an overall capacity to produce acid at the rate of more than 2,000 tons per day. Storage tank capacity along with rail and truck loading facilities are being increased accordingly.

Operations continued throughout all plants in 1966.

Production

	1966	1965
	tons	tons
Sulphuric acid (liquid)	286,812	284,068
Sulphur dioxide	70,987	82,774

Employment and Management

The average number of employees was 119; J. Fitch was works manager.

TALC

The production of talc in Ontario increased 68.27 percent in quantity from 8,028 tons in 1965 to 13,509 tons in 1966; the value of production increased 59.99 percent, from \$137,458 in 1965 to \$219,924 in 1966. The sole producer, Canada Talc Industries, also produced 2,387 tons of marble chips, valued at \$39,014, which is included in the stone totals.

The general statistics for the industry are given in this Volume under "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 Conley and Henderson mines.

Operations continued throughout 1966. 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	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 1966 consisted of 911 feet of drifting; 307 feet of crosscutting, and 46 feet of raising. Total development footage to 31 December 1966 was as follows: 15,819 feet of drifts; 6,127 feet of crosscuts; 4,110 feet of raises. Some 22 diamond-drillholes totalling 2,903 feet were completed from underground.

New construction in 1966 consisted of a storage warehouse, additions to the main mill, south side, 57 x 16 x 10 feet, west side, 50 x 16 x 10 feet, both metal clad.

A total of 15,759 tons of ore was hoisted and 15,195 tons was milled.

Employment and Management

The average number of employees was 30: 16 underground and 14 on surface. H. E. Roscoe was manager.

STRUCTURAL MATERIALS

CEMENT

The production of cement in Ontario increased 3.07 percent in tonnage from 3,145,873 tons in 1965 to 3,242,591 tons in 1966; the value of production increased 5.24 percent from \$50,055,554 in 1965 to \$52,680,630 in 1966.

The industry paid \$1,517,673 to 214 salaried employees, and \$5,780,676 to 882 wage-earners. Fuel and electricity cost \$9,429,765 and process supplies \$6,320,023.

The following is a list of the Ontario cement producers for 1966:

Canada Cement Company Limited:
 Belleville Plant, Belleville
 Port Colborne Plant, Port Colborne
 Woodstock Plant, Woodstock
 Lake Ontario Cement Limited, Picton
 St. Lawrence Cement Company Limited, Clarkson
 St. Mary's Cement Company Limited, St. Mary's.

CLAY PRODUCTS

The value of clay products manufactured in Ontario increased 2.66 percent; from \$25,130,709 in 1965 to \$25,799,667 in 1966. There were 49 reporting companies operating 53 plants; they paid \$2,075,546 to 312 salaried employees and \$7,951,452 to 1,687 wage-earners. Fuel and electricity cost \$3,700,902 and process supplies cost \$3,598,239.

CLAY PRODUCTS MARKETED, 1966

KIND OF PRODUCT	QUANTITY	VALUE \$
BRICK:		
Soft-mud process {face	M	600
{common		30,194
Stiff-mud (wire cut) process {face	M	262,169
{common	M	28,096
		13,409,935
Dry-press {face	M	15,903
{common	M	90
		555,336
Fancy or ornamental brick (including special shape, embossed or enamelled brick)	M	16,511
Sewer	M	1,506
Paving	M	788
		82,968
TILE:		
Structural (hallow blocks, including fireproofing and load-bearing tile)	tons	30,568
Floor	sq. ft.	1,183,006
Drain	M	59,804
Sewer pipe	feet	4,571,573
Pottery, from domestic clays	.....	1,200,865
Flue lining	feet	1,086,544
Other products	.....	1,175,720
Total		\$25,799,667

Note: M=1,000

LIME

Production of quicklime decreased 5.06 percent in quantity from 1,014,788 tons in 1965 to 963,458 tons in 1966; the value of production decreased 11.92 percent from \$11,295,729 in 1965 to \$9,949,325 in 1966.

Production of hydrated lime decreased 2.14 percent in quantity from 117,405 tons in 1965 to 114,892 tons in 1966; the value of production decreased 10.32 percent from \$2,546,440 in 1965 to \$2,283,542 in 1966.

The total production of lime decreased from 1,132,193 tons having a value of \$13,842,169 in 1965 to 1,078,350 tons having a value of \$12,232,867 in 1966. There were 8 operators with 10 plants having a total of 53 kilns, 49 were used in 1966. The industry paid \$277,228 to 42 salaried employees, and \$1,514,622 to 276 wage-earners. Fuel and electricity cost \$1,824,298, and process supplies cost \$1,182,114.

The following operators produced lime in Ontario:

- Bonnechere Lime Limited, Carleton Place
- Brunner Mond Canada Limited, Amherstburg
- Canada and Dominion Sugar, Chatham
- Canadian Gypsum Company Limited, Guelph
- Cyanamid of Canada Limited, Ingersoll
- Cyanamid of Canada Limited, Niagara Falls
- Dominion Magnesium Limited, Haley
- Domtar Chemicals Limited, Lime Division, Beachville
- Domtar Chemicals Limited, Lime Division, Hespeler
- The Steel Company of Canada Limited, Chemical Lime Works, Ingersoll.

INDUSTRIAL CONSUMPTION OF LIME, 1966

	QUICKLIME		HYDRATED LIME	
	QUANTITY	VALUE	QUANTITY	VALUE
	tons	\$	tons	\$
Building trades, finishing, and masonry	31,047	398,579	72,458	1,531,271
Agriculture	.....	.....	3,648	63,363
Industry:				
Smelters	10,032	96,866	153	2,685
Iron & Steel	225,755	2,545,366	.....	.....
Gold milling	9,219	113,698	1,269	22,202
Uranium milling	38,885	436,075	259	4,532
Pulp and paper	26,274	309,252	1,325	23,136
Sugar	6,086	37,040	.....	.....
Tanneries	3,797	43,374	1,811	31,703
Fertilizers & insecticides	4,169	47,740	10,029	168,000
Chemical industries	320,040	2,655,711	22,984	415,182
Other consumers	288,154	3,265,624	956	21,468
Totals	963,458	\$9,949,325	114,892	\$2,283,542

SAND AND GRAVEL

Production of sand and gravel increased 6.28 percent in tonnage from 88,564,687 in 1965 to 94,123,982 in 1966; the value of production increased 6.06 percent from \$63,405,954 in 1965 to \$67,245,821 in 1966. There were 298 pit operators and 11 dredge operators.

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General statistics compiled from 103 reporting companies indicated \$2,336,293 was paid to 333 salaried personnel and \$5,646,439 was paid to 1,210 wage-earners; fuel and electricity cost \$1,674,158 and process supplies cost \$1,585,952.

OUTPUT OF SAND AND GRAVEL

SOURCE		1962	1963	1964	1965	1966
Private pit operators	tons	37,742,342	41,033,231	42,406,064	53,939,630	60,179,741
	\$	27,102,169	30,265,051	31,552,711	38,482,968	43,093,266
Dredged from the Great Lakes and rivers	tons	1,074,148	1,033,666	1,264,731	1,479,324	1,320,255
	\$	1,257,201	1,158,613	1,563,194	1,750,842	1,584,306
Ontario Department of Highways	tons	21,123,800	23,802,679	19,876,157	19,914,573	19,322,120
	\$	15,842,850	18,852,009	14,907,118	16,686,700	16,041,408
Counties and townships	tons	14,820,156	13,033,912	12,211,227	12,003,199	12,821,163
	\$	7,410,078	6,516,956	6,105,614	6,001,600	6,410,582
Railway ballast	tons	1,840,367	1,386,262	1,159,217	1,227,961	480,703
	\$	752,906	545,575	460,807	483,844	116,259
Total	tons	76,600,813	80,259,750	76,917,396	88,564,687	94,123,982
	\$	52,365,204	56,388,204	54,589,444	63,405,954	67,245,821

STONE

Production of stone increased 4.23 percent in quantity from 24,659,053 tons in 1965 to 25,702,843 tons in 1966; the value of production increased 4.08 percent from \$32,284,988 in 1965 to \$33,602,286 in 1966. There were 89 reporting operators working about 95 quarries. The industry paid \$1,198,940 to 199 salaried employees, and \$5,290,150 to 818 wage-earners. Fuel and electricity cost \$1,341,743, and process supplies cost \$3,135,352.

OUTPUT OF STONE

VARIETY		1962	1963	1964	1965	1966
Limestone	tons	17,279,797	19,205,898	22,217,344	23,241,576	23,813,409
	\$	19,892,022	20,544,057	25,243,229	27,227,844	27,685,394
Marble	tons	34,926	44,866	56,029	50,420	38,657
	\$	288,480	448,220	568,456	660,641	576,990
Trap and granite	tons	1,448,916	1,116,629	1,533,473	1,320,619	1,809,034
	\$	4,318,067	3,537,948	4,323,305	3,788,385	4,741,209
Sandstone	tons	34,009	35,201	39,147	46,447	41,743
	\$	544,981	543,482	683,744	708,118	598,693
Total	tons	18,797,648	20,402,614	23,845,993	24,659,053	25,702,843
	\$	25,043,550	25,073,707	30,818,734	32,284,988	33,602,286

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