LETTER OF TRANSMISSION

TO THE HONOURABLE RAY LAWSON,
Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:—

The undersigned has the honour to transmit to you herewith, for presentation to the Legislative Assembly of the Province of Ontario, the Fifty-fifth Annual Report, 1946, of the Department over which I have the honour to preside.

Respectfully submitted,

LESLIE M. FROST,
Minister of Mines

DEPARTMENT OF MINES,
Toronto, 1947.

INTRODUCTORY LETTER

TO THE HONOURABLE LESLIE M. FROST,
Minister of Mines.

SIR,—The undersigned has the honour to submit the Fifty-fifth Annual Report of the Department of Mines, issued in five parts, as follows:—

PART I

Statistical Review of the Mineral Industry of Ontario for 1945, by Maurice Tremblay.
List of Quarries and Works for Structural Materials and Clay Products, 1945.
Mining Accidents in 1945, by W. O. Tower, R. L. Smith, W. E. Bawden, D. F. Cooper, J. B. Taylor, L. K. Walkom, E. S. Little, E. B. Weir, D. P. Douglass, J. L. Ward.

PART II

Mines of Ontario in 1945, by W. O. Tower, R. L. Smith, W. E. Bawden, D. F. Cooper, J. B. Taylor, L. K. Walkom, E. S. Little, E. B. Weir, D. P. Douglass, J. L. Ward.
List of Mines, Quarries, and Works Operating in 1945.

PART III

Natural Gas in 1945, by R. B. Harkness.
Petroleum in 1945, by R. B. Harkness.

PART IV

Iron Deposits in the District of Algoma, with maps Nos. 1946-4a, b, c, 1946-5, 1946-5a, 1946-6, 1946-7, 1946-8, by E. S. Moore and H. S. Armstrong.

PART V

Sandstone as a Source of Silica Sands in Southeastern Ontario, with map No. 1946-9, by M. L Keith.

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

Respectfully submitted,

H. C. RICKABY
Deputy Minister of Mines

DEPARTMENT OF MINES,
Toronto, 1947.

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. LESLIE M. FROST, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FIFTY-FIFTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LV, PART I, 1946

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
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1948

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Vol. LV, Part I

Insert Table

Tables Showing Annual Gold Production by Mines and Areas
(In pocket at back of report)

Statistical Review of the Mineral Industry of Ontario for 1945

By Maurice Tremblay

GENERAL SUMMARY

Mineral Production

The value of the mineral production of Ontario for 1945 showed a slight increase over that for 1944. Final figures for 1945 total $216,708,183, as against $212,755,354 in 1944. The output of metals and metallic minerals amounted to $188,210,393; that of non-metallics, $10,909,496; that of structural materials, $14,481,105; and that of clay products, $3,107,189.

The output of gold continued to drop. In 1945, $62,576,089 worth of gold was produced, as against $66,675,000 in 1944. This is equivalent to a drop of 6.15 per cent.

Platinum metals, on the other hand, rose in value from $8,024,719 in 1944 to $26,688,646 in 1945, an increase equivalent to 232.58 per cent. This is largely attributed to a new method of computing the production of metals of the platinum group.

Great increases were also recorded by the iron ore industry owing to the stepped-up production at Steep Rock Iron Mines. Iron ore shipments rose in value from $1,036,773 in 1944 to $3,635,095 in 1945, which is equal to an increase of 250.62 per cent.

Nickel output dropped by 10.44 per cent., or from $69,204,152 in 1944 to $61,982,133 in 1945. Returns from the copper producers show a drop in the production value from $33,845,632 in 1944 to $29,772,270 in 1945. The total output value of the nickel-copper industry rose from $111,208,828 in 1944 to $123,087,992 in 1945.

In the non-metallic group of minerals increases in value were reported by producers of corundum, fluorspar, graphite, gypsum, mineral waters, natural gas, nepheline syenite, peat moss, and salt, whereas reduced output values are noticeable in the case of arsenic, feldspar, mica, peat fuel, petroleum, quartz and quartzite, silica brick, sulphur, and talc. The total value of non-metallic minerals receded from $11,075,707 in 1944 to $10,909,496 in 1945.

Structural materials, reflecting the continuation of the increased demand, rose in value from $13,391,477 in 1944 to $14,481,105 in 1945. Clay products also showed a great improvement, from $2,347,396 in 1944 to $3,107,189 in 1945.

The total number of wage-earners dropped from 29,563 in 1944 to 27,194 in 1945, and wages from $55,166,773 in 1944 to $51,283,029 in 1945. These labour statistics cover only producing mines. A considerable number of men were also employed by prospects under development during the year.

Beginning with the year 1945, production of pig iron from Ontario iron ores will no longer be included in the table "Summary of Mineral Statistics," but a record of pig iron and steel production from such ores will be continued in the "Iron and Steel Statistics" table (see page 33). This decision is due to the increased importance of the Province's iron ore production and to the fact that it is practically impossible to trace the use of the raw material in the production of pig iron and steel products.

SUMMARY OF MINERAL STATISTICS, 1945

Product		Quantity	Value[1]	Employees	Wages
METALLIC					
Gold	oz.	1,625,364	$33,600,205	10,078	$20,159,554
Exchange equalization			28,975,884		
Silver	oz.	3,190,454	1,467,532	(2)	(2)
Copper in matte exported[3]	lbs.	10,966,067	1,096,628		
Copper, metallic and in concentrates, exported	lbs.	228,491,175	28,675,642		
Nickel in matte,[3] in speiss, and in ore exported; metallic nickel; and nickel content of oxides and salts	lbs.	245,130,983	61,982,133	[4]11,591	22,889,025
Platinum metals	oz.	666,908	26,688,646		
Selenium	lbs.	168,000	322,560		
Calcium	lbs.	22,720	19,312		
Cobalt in metal, oxides, salts, ores, and residues	lbs.	109,123	90,026	[5]317	481,175
Lead in concentrates exported	lbs.	668,762	33,438		
Iron ore[6]	tons	[7]1,135,444	3,635,095	657	1,435,478
Magnesium	lbs.	7,358,545	1,607,264	244	393,635
Tungsten, concentrates	lbs.	787	714		
Zinc	lbs.	237,799	15,314		
Total			$188,210,393	22,887	$45,358,867
NON-METALLIC					
Arsenic, white[8]	lbs.	224,467	$12,352	(9)	(9)
Asbestos[10]	lbs.	7,124	2,646		
Corundum	tons	1,317	130,393	19	$37,085
Feldspar, crude and ground	tons	3,857	35,414	29	25,616
Fluorspar	tons	7,369	233,708	74	80,934
Graphite, crude and refined	tons	1,910	179,001	64	94,352
Gypsum	tons	92,174	385,516	262	432,402
Mica (amber)	lbs.	3,263,646	66,017	27	18,706
Mica (white)	lbs.	65,717	73,599	53	44,678
Mineral waters	Imp. gals.	8,285	976		
Natural gas	M cu. ft.	7,199,970	4,837,586	[11]578	740,683
Nepheline syenite	tons	61,345	275,766	47	77,509
Peat fuel	tons	125	1,125	3	700
Peat moss	tons	11,667	224,100	202	127,114
Petroleum, crude	bbls.	113,325	268,478	144	112,755
Phosphate	tons	8	120	16	110
Quartzite and quartz[12]	tons	1,165,238	820,664	122	172,504
Silica brick	M	1,168	131,398	28	46,906
Salt	tons	578,697	2,920,973	358	634,884

Sulphur[13] . . . . tons	16,847	168,470	. . . .	. . . .
Talc . . . . tons	12,863	141,194	29	34,113
Total	. . . .	$10,909,496	2,055	$2,681,051
Structural Materials				
Cement, Portland . . . . bbls.	2,460,996	$3,805,131	375	$647,938
Hydrated lime . . . . tons	38,050	449,018	204	279,718
Quicklime . . . . tons	360,597	2,682,658		
Sand and gravel . . . . tons	10,466,891	4,466,862	252	355,422
Sand-lime products[14]	. . . .	150,742	37	50,286
Stone: limestone, marble, trap, granite, sandstone, slate . . . . tons	2,952,357	2,926,694	554	876,634
Total	. . . .	$14,481,105	1,422	$2,209,998
Clay Products				
Brick, face . . . . No.	62,542,530	$1,649,575	830	$1,033,113
Brick, common . . . . No.	13,722,788	287,316		
Brick, fancy and ornamental . . . . No.	129,790	6,658		
Brick, sewer	. . . .	816		
Tile, drain . . . . No.	10,232,911	355,264		
Tile, structural, roofing, and floor	. . . .	388,756		
Sewer pipe, copings, flue-linings, etc.	. . . .	337,609		
Pottery and other products	. . . .	69,800		
Haydite and clay	. . . .	11,395		
Total	. . . .	$3,107,189	830	$1,033,113
Grand Total	. . . .	$216,708,183	27,194	$51,283,029

[1]Canadian funds.
[2]Employees and wages included with figures for silver-cobalt smelters and refineries ([5]).
[3]Copper in matte valued at 10 cents per pound, and nickel at 18 cents.
[4]Employees and wages for nickel-copper mines, smelters, and refineries include statistics of the Ontario Refining Company.
[5]Employees and wages for silver-cobalt smelters and refineries.
[6]The production value of pig iron from Ontario iron ores is no longer included in the above table, but the record of domestic ore smelted in Ontario furnaces may be found on page 33.
[7]These figures represent total shipments and do not exclude Ontario blast furnaces as formerly.
[8]Shipments from Ontario sources and not actual production figures.
[9]Employees and wages included with figures for silver-cobalt smelters and refineries ([5]).
[10]These figures are for the 1943 and 1944 production, which had not been reported previously.
[11]Employment figures for the natural gas industry in previous years included salaried employees. These figures are for wage-earners only.
[12]Included is 2,918 tons of grinding pebbles valued at $41,586.
[13]Tonnage given is sulphur content of sulphuric acid.
[14]No deduction made for lime used in manufacturing.

COMPARATIVE VALUE OF MINERAL PRODUCTION, 1941-1945

Product	1941	1942	1943	1944	1945
METALLIC					
Gold (Canadian value)	$122,977,102	$106,413,978	$81,517,998	$66,675,000	$62,576,089
Silver	1,899,778	1,897,131	1,192,408	1,342,275	1,467,532
Platinum metals	8,144,164	19,176,254	13,691,748	8,024,719	26,688,646
Cobalt[1]	255,904	88,444	191,407	34,106	90,026
Nickel[2]	68,656,795	69,998,427	71,675,322	69,204,152	61,982,133
Copper, metallic and in matte	33,192,644	30,625,404	32,194,369	33,845,632	29,772,270
Selenium	272,171	145,920	143,500	117,000	322,560
Tellurium	18,394	15,200	15,050	17,325	....
Pig iron	2,590,066	2,870,432	2,094,126	2,909,390	(3)
Iron ore	803,071	784,169	881,143	1,036,773	[4]3,635,095
Lead, in ore	54,559	107,018	85,362	47,958	33,438
Bismuth	10,379	3,219	....	....	....
Tungsten concentrates	2,432	145,241	356,478	5,212	714
Magnesium	....	208,520	2,074,652	2,575,695	1,607,264
Molybdenum	....	150	....	1,082	....
Calcium	....	....	....	....	19,312
Zinc	37,553	160,671	131,992	104,455	15,314
Total	$238,915,012	$232,640,178	$206,245,555	$185,940,774	$188,210,393
NON-METALLIC					
Arsenic, white	$114,792	$152,331	$32,924	$26,922	$12,352
Asbestos	....	....	....	....	2,646
Celestite	280	....	....	....	....
Corundum	....	....	....	17,111	130,393
Feldspar, crude and ground	107,124	49,353	61,549	50,361	35,414
Fluorspar	93,867	113,957	301,424	217,031	233,708
Garnet rock	160	176	....	90	....
Graphite, crude and refined	132,924	117,904	197,431	171,166	179,001
Gypsum	276,459	304,170	335,637	348,873	385,516
Mica (amber)	47,047	57,703	58,262	68,984	66,017
Mica (white)	....	31,540	237,927	577,761	73,599
Mineral waters	14,469	14,189	5,748	805	976
Natural gas	7,115,473	6,669,819	6,354,045	4,694,097	4,837,586
Nepheline syenite	227,583	246,893	292,010	217,989	275,766
Peat fuel	2,155	1,204	2,560	1,800	1,125
Peat moss	42,708	147,729	136,595	144,820	224,100
Petroleum, crude	337,760	306,242	311,356	296,420	268,478
Phosphate	....	4,458	4,113	....	120

Quartzite and quartz	899,687	914,256	852,196	868,389	820,664
Silica brick	118,922	120,495	125,722	135,089	131,398
Salt	2,512,166	2,793,328	2,892,839	2,906,117	2,920,973
Sulphur[5]	100,570	186,340	169,070	178,760	168,470
Talc and soapstone	204,884	174,295	131,216	153,122	141,194
Total	$12,349,030	$12,406,382	$12,502,624	$11,075,707	$10,909,496
STRUCTURAL MATERIALS					
Cement, Portland	$4,019,656	$3,998,294	$2,872,732	$2,730,381	$3,805,131
Lime, hydrated and quicklime	3,246,647	3,125,574	3,115,194	3,311,177	3,131,676
Sand and gravel	4,524,463	3,433,986	3,620,852	4,417,427	4,466,862
Sand-lime products[6]	397,812	223,250	141,135	22,512	150,742
Stone: limestone, granite, etc.	3,274,027	2,985,937	2,958,383	2,909,980	2,926,694
Total	$15,462,605	$13,767,041	$12,708,296	$13,391,477	$14,481,105
CLAY PRODUCTS					
Brick, face	$1,256,246	$950,435	$875,535	$1,114,860	$1,649,575
Brick, common	520,622	399,227	310,634	203,534	287,316
Brick, fancy and ornamental	2,100	676	191,424	866	6,658
Brick, sewer	7,749	9,480	4,203	4,391	816
Tile, drain	225,334	234,971	279,806	309,245	355,264
Tile, structural, roofing, and floor	541,429	457,410	369,831	334,587	388,756
Sewer pipe, copings, flue-linings, etc.	480,036	409,660	348,641	312,081	337,609
Pottery and other products	46,670	25,000	63,600	60,000	69,800
Haydite and clay	7,430	62,628	10,155	7,832	11,395
Total	$3,087,616	$2,549,487	$2,453,829	$2,347,396	$3,107,189
GRAND TOTAL	$269,814,263	$261,363,088	$233,910,304	$212,755,354	$216,708,183

[1]Cobalt in oxide, metallic cobalt, and cobalt content of residues marketed.
[2]Nickel in matte, oxide, and metallic nickel.
[3]The production value of pig iron from Ontario iron ores is no longer included in the above table, but the record of domestic ore smelted in Ontario furnaces may be found on page 33.
[4]These figures represent total shipments and do not exclude Ontario blast furnaces as formerly.
[5]Value of sulphuric acid produced.
[6]No deduction made for lime consumed in manufacturing.

TOTAL MINERAL PRODUCTION

Year	Exchange equalization or discount	Metallics	Non-metallics	Structural materials	Clay products	Total
Before 1891[1]	....	$9,520,269		....		$9,520,269
1891	....	388,715		$4,316,958		4,705,673
1892	....	864,382		4,509,757		5,374,139
1893	....	614,762		5,505,991		6,120,753
1894	....	842,750		5,244,008		6,086,758
1895	....	616,055		4,554,083		5,170,138
1896	....	963,288		4,271,715		5,235,003
1897	....	1,038,089		4,480,452		5,518,541
1898	....	1,689,002		5,546,875		7,235,877
1899	....	2,055,592		6,361,081		8,416,673
1900	....	2,565,286		6,733,338		9,298,624
1901	....	5,016,734		6,814,352		11,831,086
1902	....	6,257,499		7,134,135		13,391,634
1903	....	5,242,575		7,628,018		12,870,593
1904	....	4,906,677		6,665,970		11,572,647
1905	....	10,201,010		7,653,286		17,854,296
1906	....	13,353,080		9,035,303		22,388,383
1907	....	14,550,835	3,020,537	3,876,275	3,571,726	25,019,373
1908	....	16,754,986	2,629,749	3,396,406	2,856,476	25,637,617
1909	....	22,928,496	2,825,751	4,028,206	3,198,922	32,981,375
1910	....	28,161,678	3,141,658	4,380,000	3,630,559	39,313,895
1911	....	29,102,867	3,674,926	4,935,609	4,263,395	41,976,797
1912	....	34,799,734	4,009,643	4,701,170	4,831,056	48,341,603
1913	....	37,507,935	4,296,450	5,866,775	5,561,151	53,232,311
1914	....	33,345,291	4,339,703	4,505,368	4,105,597	46,295,959
1915	....	44,109,679	4,655,250	3,609,371	1,871,379	54,245,679
1916	....	55,002,918	4,982,140	3.734,065	1,584,699	65,303,822
1917	....	56,831,857	7,702,942	4,962,284	2,596,749	72,093,832
1918	....	66,178,059	7,815,062	4,297,401	2,018,450	80,308,972
1919	....	41,590,759	6,308,182	7,208,413	3,776,562	58,883,916
1920	$1,376,275	48,281,553	8,141,796	11,921,019	4,735,154	74,455,797
1921	1,359,636	28,777,581	6,636,217	13,967,386	5,183,125	55,923,945
1922	208,621	40,290,157	7,591,913	13,640,166	6,944,218	68,675,075
1923	280,196	44,076,660	8,511,786	13,139,757	6,269,140	72,277,539
1924	196,750	52,130,314	7,555,283	12,398,465	5,137,865	77,418,677
1925	−2,838	62,495,472	7,488,034	12,451,174	5,148,626	87,580,468
1926	−595	59,218,297	7,842,632	12,681,308	5,356,469	85,098,111
1927	....	62,631,255	7,638,605	14,160,552	5,853,035	90,283,447
1928	2,811	71,267,003	7,822,641	14,815,814	6,177,664	100,085,933
1929	157,456	83,967,446	8,621,427	18,541,687	6,830,162	118,118,178
1930	36,703	83,356,365	8,492,263	16,571,626	5,221,214	113,678,171
1931	1,926,221	72,452,544	7,642,308	11,995,556	3,552,799	97,569,428
1932	6,134,157	63,997,017	7,361,897	7,295,917	1,690,505	86,479,493
1933	16,486,437	78,877,928	7,094,636	6,335,977	1,024,579	109,819,557
1934	29,287,439	99,985,594	7,553,571	7,766,563	1,261,006	145,854,173
1935	32,169,797	110,718,768	7,766,657	7,555,508	1,370,225	159,580,955
1936	34,139,926	131,091,593	8,933,036	8,931,899	1,573,936	184,670,390
1937	37,028,708	167,814,485	10,055,177	13,241,244	2,033,845	230,173,459
1938	42,070,230	155,835,230	9,949,317	10,012,203	2,083,496	219,950,476
1939	48,322,783	161,208,555	11,470,739	10,705,629	2,341,617	234,049,323
1940	58,154,794	176,072,441	12,514,093	13,950,607	2,513,884	263.205,819
1941	56,925,914	181,989,098	12,349,030	15,462,605	3,087,616	269,814,263
1942	49,280,883	183,359,295	12,406,382	13,767,041	2,549,487	261,363,088
1943	37,751,307	168,494,248	12,502,624	12,708,296	2,453,829	233,910,304
1944	30,874,701	155,066,073	11,075,707	13,391,477	2,347,396	212,755,354
1945	28,975,884	159,234,509	10,909,496	14,481,105	3,107,189	216,708,183
Total	$513,144,196	$3,249,690,340		$912,891,308		$4,675,725,844

[1]Prior to 1891, when the Ontario Bureau (now Department) of Mines was established, it is estimated that metals to the value of $9,520.269 were produced. No estimate has been made of the output of non-metallics up to 1891.

Metal Production

The aggregate metal production of Ontario mines from the earliest records up to the end of 1945 was valued at $3,762,834,536. The value of this production in 1945, at $188,210,393, equals 86.85 per cent. of the total production of Ontario's mining industry.

METAL PRODUCTION TO DECEMBER 31, 1945

Metal or product	To December 31, 1944	1945	To December 31, 1945
Gold	$1,071,992,592	$33,600,205	$1,105,592,797
Exchange equalization	484,168,312	28,975,884	513,144,196
Nickel, including nickel oxides and salts	974,406,176	61,982,133	1,036,388,309
Silver	280,938,684	1,467,532	282,406,216
Copper[1]	475,603,597	29,772,270	505,375,867
Pig iron from domestic ore	98,257,508	....	98,257,508
Cobalt[2]	32,495,644	90,026	32,585,670
Platinum metals	129,228,126	26,688,646	155,916,772
Iron ore[3]	13,767,641	3,635,095	17,402,736
Lead	4,797,251	33,438	4,830,689
Zinc, in ore and concentrates	976,250	15,314	991,564
Molybdenum	224,110	....	224,110
Bismuth	218,841	....	218,841
Selenium	1,970,121	322,560	2,292,681
Tellurium	155,280	....	155,280
Chromite	55,090	....	55,090
Tungsten in concentrates	510,053	714	510,767
Magnesium	4,858,867	1,607,264	6,466,131
Calcium	....	19,312	19,312
Total	$3,574,624,143	$188,210,393	$3,762,834,536

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

Dividends.—During 1945 dividends were paid by 27 gold, 2 nickel-copper, and 1 silver-cobalt mining companies. Investment or holding companies, of which there are several, have been excluded in the case of gold and nickel-copper companies but not in the case of silver-cobalt companies.

DIVIDENDS PAID BY METAL-MINING COMPANIES TO DECEMBER 31, 1945

Industry	To end of 1944	1945	To end of 1945
Gold	$474,428,207	$16,694,416	$491,122,623
Nickel-copper	447,559,448	25,760,355	473,319,803
Silver-cobalt	101,624,786	70,000	101,694,786
Total	$1,023,612,441	$42,524,771	$1,066,137,212

Metal Prices and Exchange

The following table is a computation of the average exchange rate of the United States dollar in Canadian funds, the pound Sterling in Canadian funds, the price of silver and copper on the New York and London markets, and the price of gold in Canadian dollars per fine ounce. The price of gold in Canadian funds has not changed since it was pegged in the fall of 1939.

Month	Average exchange rate U.S. dollars in Canadian funds	£ Sterling in Canadian funds	Silver, cents per oz. New York market, U.S. funds	Silver, cents per oz. in Canadian funds	Copper, cents per lb. New York export, U.S. funds	Copper, cents per lb. London in Canadian funds	Gold in Canadian dollars per fine oz.
1944							
January	1.1	4.43	44.75	49.2	11.7	10.086	38.50
February	1.1	4.43	44.75	49.2	11.7	10.086	38.50
March	1.1	4.43	44.75	49.2	11.7	10.086	38.50
April	1.1	4.43	44.75	49.2	11.7	10.086	38.50
May	1.1	4.43	44.75	49.2	11.7	10.086	38.50
June	1.1	4.43	44.75	49.2	11.7	10.086	38.50
July	1.1	4.43	44.75	49.2	11.7	10.086	38.50
August	1.1	4.43	44.75	49.2	11.7	10.086	38.50
September	1.1	4.43	44.75	49.2	11.7	10.086	38.50
October	1.1	4.43	44.75	49.2	11.7	10.086	38.50
November	1.1	4.43	44.75	49.2	11.7	10.086	38.50
December	1.1	4.43	44.75	49.2	11.7	10.086	38.50
Average[1] (12 months)	1.1	4.43	44.75	49.2	11.7	10.086	38.50
1945							
January	1.1	4.43	44.75	49.5	11.7	10.086	38.50
February	1.1	4.43	44.75	49.5	11.7	10.086	38.50
March	1.1	4.43	44.75	49.5	11.7	10.086	38.50
April	1.1	4.43	44.75	49.5	11.7	10.086	38.50
May	1.1	4.43	44.75	49.5	11.7	10.086	38.50
June	1.1	4.43	44.75	49.5	11.7	10.086	38.50
July	1.1	4.43	44.75	49.5	11.7	10.086	38.50
August	1.1	4.43	44.75	49.5	11.7	10.086	38.50
September	1.1	4.43	65.45	49.5	11.7	10.086	38.50
October	1.1	4.43	70.75	78.2	11.7	10.086	38.50
November	1.1	4.43	70.75	78.2	11.7	10.086	38.50
December	1.1	4.43	70.75	78.2	11.7	10.086	38.50
Average[1] (12 months)	1.1	4.43	52.975	56.675	11.7	10.086	38.50

[1]Computed from daily quotations.

Diamond-Drilling

The unprecedented prospecting and mining development activity recorded in Ontario in 1945 was felt by the diamond-drilling industry. Thirty-six firms and individuals were active on contract work in the Province during the year under review. Many of these firms and individuals also worked in other provinces and territories of Canada.

Footage drilled in 1945 amounted to 1,669,622 feet, as against 1,348,813 feet in 1944. Labour statistics show that an average of 785 men were employed in 1945, as compared with 682 in 1944. Wages paid amounted to $1,324,785 in 1945, as against $1,042,591 in 1944. Income from drilling rose from $2,031,296 in 1944 to $2,801,163 in 1945.

Diamond-drilling machines used included both the X-ray or small drill for shallow exploration and the heavier types for deeper tests.

Consumption of Diamonds

It is impossible to give exact figures on the consumption of diamonds by contract diamond-drillers in Ontario because a great many bits were used both in this province and in other jurisdictions in Canada. Returns show, however, that the industry used industrial diamonds valued at $1,233,920 in 1945.

Prospecting

The number of mining claims recorded in 1945 was 16,362, the highest since 1936 when 17,280 mining claims were filed with the Department. Only 3,593 mining claims were recorded in 1942, but with the increasing interest in gold mining, the figures had increased to 12,527 in 1944.

Mining discoveries were made in all sections of Northern Ontario, but the Red Lake camp was, without a doubt, the most active for prospectors and mining companies during the year under review.

The great number of mining companies formed to develop new ground is an indication of the widespread interest in gold. These companies have millions of dollars in their treasuries, and they are operating over the full breadth of Northern Ontario.

In no gold camp in the whole shield is there the concentrated activity that there is at Red Lake. In the east the stretch from Night Hawk lake to the Quebec border is on the verge of very intensive development. In Kirkland Lake, Larder Lake, and the areas south of both these camps; in the Matachewan area and Midlothian township; at Birch lake and Springpole lake; in the Lake Nipigon area; and in Echo township, south of Sioux Lookout, the prospector, the diamond-drill crews, and in some cases sinking-crews are at work.

MINING CLAIMS RECORDED AND CANCELLED IN ONTARIO, 1907 TO 1945

Year	No. recorded	No. cancelled[1]	Year	No. recorded	No. cancelled	Year	No. recorded	No. cancelled
1907......	13,996	....	1920.....	2,160	2,203	1933.....	8,077	4,813
1908......	4,634	....	1921.....	2,459	1,791	1934.....	16,888	5,041
1909......	9,746	....	1922.....	5,686	1,490	1935.....	9,460	9,240
1910......	5,792	....	1923.....	6,092	2,328	1936.....	17,280	6,653
1911......	9,001	361	1924.....	5,222	2,804	1937.....	15,292	11,445
1912......	3,104	....	1925.....	4,751	2,460	1938.....	9,047	8,978
1913......	4,320	442	1926.....	13,496	5,322	1939.....	6,772	9,086
1914......	1,913	7,913	1927.....	15,554	5,537	1940.....	4,667	7,242
1915......	2,519	1,093	1928.....	15,046	3,662	1941.....	4,254	10,514
1916......	2,470	1,911	1929.....	8,207	8,090	1942.....	3,593	9,028
1917......	1,936	602	1930.....	3,886	8,887	1943.....	5,232	3,057
1918......	1,534	304	1931.....	5,779	10,885	1944.....	12,527	2,376
1919......	2,918	1,481	1932.....	4,945	15,425	1945.....	16,362	3,657

[1]Data on claims cancelled are not available for 1907, 1908, 1909, 1910, and 1912. These figures do not include cancellations of claims in Eastern Ontario, Parry Sound district, or Patricia portion of Kenora district.

METALLICS

Gold

GENERAL SUMMARY

The shortage of experienced labour resulted in a drop of 8.50 per cent. in the production value of Ontario's gold mines, but the industry witnessed the establishment of an all-time record in the field of prospecting and pre-production development throughout the whole of Northern Ontario.

Ore raised amounted to 6,357,134 tons, and ore milled to 6,277,436 tons. The industry recovered 1,533,995 ounces of gold and 973,891 ounces of silver for an aggregate value of $59,498,969. Gold from all sources totalled 1,625,364 ounces, valued at $62,576,089.

Fifty firms shipped gold bullion during the year under review. The gold mines proper reported paying $3,257,546 to 997 salaried employees and $20,159,554 to 10,078 wage-earners. Fuel and electricity consumed were valued at $3,167,423, and process supplies at $7,412,885. The value of gold from all sources accounted for 33.25 per cent. of the total value of all metals produced in 1945. According to monthly reports the industry milled a high of 550,348 tons in June and 474,362 tons in February for the year's low. Toward the end of the year an improvement in the labour supply resulted in a gradual increase from October on. December was the best month reported since March of 1944, with 589,792 tons of ore milled. The average monthly grade of ore treated by the mills fluctuated between a high of $9.88 in February to a low of $9.25 in June.

The producing gold mines reported sinking shafts for a total of 5,120 feet, driving crosscuts for a length of 51,841 feet, drifts for a total of 127,480 feet, and development in raises and winzes for a total of 13,860 feet. Diamond-drilling carried out at the producing mines aggregated 1,392,532 feet.

Freight and express paid on ore and bullion cost $100,905, and smelting charges were $582,199. Dividends paid out by the producing mines dropped to a low of $16,621,888, and total taxes paid out to the Dominion and Provincial governments and municipalities were reported at $5,997,413, the Dominion Government getting $5,533,036. The producing mines also paid out $645,594 for Workmen's Compensation assessment and $270,911 for silicosis assessment. Exploration in Ontario cost these companies $425,528, as against $316,515 in 1944 and $181,047 in 1943.

The best indication of the increased interest in Ontario's gold potentialities lies in the substantial increase in the number of mining companies carrying out development work at non-producing properties. Whereas only two such organizations reported work in 1943 and 29 in 1944, a total of 159 such firms reported work in 1945. They paid $239,161 to 160 salaried employees and $529,716 to 515 wage-earners besides spending $60,055 on fuel and electricity and $72,621 for process supplies. Total supplies purchased, which includes food for the working crews, totalled $371,878; and plant and equipment purchases amounted to $383,074. Other disbursements included taxes totalling $11,786; Workmen's Compensation Board, $17,230; silicosis assessment, $4,068; and unemployment insurance, $4,077. The aggregate cost of exploration in Ontario amounted to $809,310 in 1945, as against $128,400 in 1944.

Development work carried out by these non-producing companies included shaft-sinking, 601 feet; crosscutting, 755 feet; drifting, 6,240 feet; and diamond-drilling, 700,915 feet. Most of the drilling was done by diamond-drilling companies under contract to the mining companies.

Dividends and Production

The following tables show the production by areas in 1945, the dividends paid by the various gold-mining companies, the yearly dividends by areas, the annual production by mines in each area, and the total gold production from 1866 to 1945.

DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES TO DECEMBER 31, 1945

Name of company	Date of incorporation	Authorized capital, $ or shares	Capital stock issued, $ or shares	Par value per share	Dividends and bonuses paid to end of 1944	Dividends and bonuses paid during 1945	Rate per cent. or per share, 1945	Total dividends and bonuses paid to Dec. 31, 1945	Date when last dividend or bonus was paid
Acme Gold Mines, Ltd.	Dec. 13, 1911	$3,000,000	$3,000,000	$5.00	$160,000.00	....	......	$160,000.00	Dec. 31, 1916
Aunor Gold Mines, Ltd.	May 19, 1939	$2,000,000	$2,000,000	1.00	1,400,000.00	$400,000.00	20c.	1,800,000.00	Nov. 30, 1945
Berens River Mines, Ltd.	July 2, 1936	$2,000,000	$2,000,000	1.00	420,000.00	....	......	420,000.00	June 10, 1943
Broulan Porcupine Mines, Ltd.	Mar. 18, 1936	$3,000,000	$2,694,005	1.00	1,037,191.93	53,880.10	2c.	1,091,072.03	Dec. 28, 1945
Buffalo Ankerite Gold Mines, Ltd.	Oct. 5, 1932	$1,000,000	$701,679	1.00	2,727,924.73	35,083.95	5c.	2,763,008.68	Jan. 11, 1945
Central Patricia Gold Mines, Ltd.	April 20, 1931	$2,500,000	$2,500,000	1.00	3,675,000.00	300,000.00	12c.	3,975,000.00	Sept. 30, 1945
Chesterville Larder Lake Gold Mining Co., Ltd.	Mar. 20, 1907	$2,000,000	$1,735,559	1.00	442,567.55	....	......	442,567.55	Apr. 15, 1943
Cline Lake Gold Mines, Ltd.	Aug. 5, 1936	$2,000,000	$1,611,505	1.00	64,200.20	....	......	64,200.20	Feb. 28, 1941
Cochenour Willans Gold Mines, Ltd.	April 19, 1936	$3,000,000	$2,961,655	1.00	975,846.15	....	......	975,846.15	May 10, 1944
Coniaurum Mines, Ltd.	July 4, 1929	3,000,000	2,766,743	No par	3,006,411.79	221,339.44	8c.	3,227,751.23	Dec. 21, 1945
Delnite Mines, Ltd.	Oct. 23, 1934	$3,000,000	$2,978,767	1.00	625,541.07	....	......	625,541.07	May 31, 1943
Dome Mines, Ltd.[1]	July 7, 1923	2,000,000	2,000,000	No par	59,018,539.55	2,336,001.60	$1.20	61,354,541.15	Oct. 30, 1945
Gold Eagle Gold Mines, Ltd.	Feb. 13, 1943	$3,000,000	$2,638,339	1.00	[2] 237,450.51	....	......	237,450.51	Oct. 21, 1942
Hallnor Mines, Ltd.	April 6, 1936	$2,000,000	$2,000,000	1.00	5,500,000.00	600,000.00	30c.	6,100,000.00	Nov. 30, 1945
Hard Rock Gold Mines, Ltd.	Jan. 6, 1934	$3,000,000	$2,990,074	1.00	926,922.94	....	......	926,922.94	June 21, 1943
Hollinger Consolidated Gold Mines, Ltd.	May 25, 1916	$25,000,000	$24,600,000	5.00	118,389,600.00	2,263,200.00	46c.	120,652,800.00	Dec. 29, 1945
Howey Gold Mines, Ltd.	Mar. 12, 1926	$5,000,000	$5,000,000	1.00	2,150,000.00	....	......	2,150,000.00	Dec. 10, 1943
Jason Mines, Ltd.	Nov. 9, 1938	$3,000,000	$2,999,005	1.00	119,960.20	....	......	119,960.20	Dec. 30, 1941
Kerr-Addison Gold Mines, Ltd.	April 9, 1936	$5,000,000	$4,730,301	1.00	7,095,451.50	1,419,090.30	30c.	8,514,541.80	Dec. 28, 1945
Kirkland Lake Gold Mining Co., Ltd.	Nov. 19, 1915	$5,500,000	$5,326,699	1.00	4,146,943.38	213,067.96	4c.	4,360,011.34	Nov. 1, 1945
Lake Shore Mines, Ltd.	Feb. 25, 1914	$2,000,000	$2,000,000	1.00	92,420,000.00	1,600,000.00	80c.	94,020,000.00	Dec. 15, 1945
Leitch Gold Mines, Ltd.	July 23, 1935	$3,000,000	$2,850,005	1.00	1,454,602.55	232,550.40	8c.	1,687,152.95	Nov. 15, 1945
Little Long Lac Gold Mines, Ltd.	Jan. 26, 1933	2,000,000	1,841,000	No par	3,811,275.00	92,050.00	5c.	3,903,325.00	Dec. 15, 1945

[1]On April 22, 1922, the capital of Dome Mines Company, Limited, was reduced from $5,000,000 to $4,500,000, and $476,667 (repayment of capital not included in above table) distributed to shareholders in addition to dividends paid to September 30, 1923, when the new company, Dome Mines, Limited, issued 1,000,000 no par value shares at $7.00 per share. In 1936, 20,000 shares were paid in part payment for the Schumacher claims and 26,666 shares were then held in trust for the company. On June 20, 1938, the share capital was doubled from one to two million shares, and the shares held in trust then became 53,332.

[2]This is not a dividend, but a partial distribution of capital.

DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES TO DECEMBER 31, 1945—*Continued*

Name of company	Date of incorporation	Authorized capital, $ or shares	Capital stock issued, $ or shares	Par value per share	Dividends and bonuses paid to end of 1944	Dividends and bonuses paid during 1945	Rate per cent. or per share, 1945	Total dividends and bonuses paid to Dec. 31, 1945	Date when last dividend or bonus was paid
Macassa Mines, Ltd.	April 12, 1926	$3,000,000	$2,678,068	$1.00	$6,808,183.06	$321,368.16	12c.	$7,129,551.22	Dec. 15, 1945
McIntyre Porcupine Mines, Ltd.[3]	Mar. 16, 1911	$4,000,000	$3,990,000	5.00	35,726,806.43	2,657,340.00	$3.33	38,384,146.43	Dec. 1, 1945
McKenzie Red Lake Gold Mines, Ltd.[4]	Feb. 1, 1933	$3,000,000	$2,935,000	1.00	2,801,849.89	.....	.....	2,801,849.89	Sept. 16, 1944
McMarmac Red Lake Gold Mines, Ltd.	July 21, 1939	$3,000,000	$2,050,005	1.00	82,000.20	.....	.....	82,000.20	May 10, 1943
MacLeod-Cockshutt Gold Mines, Ltd.	Sept. 22, 1933	$3,000,000	$2,862,490	1.00	1,427,145.00	.....	.....	1,427,145.00	Dec. 15, 1944
Madsen Red Lake Gold Mines, Ltd.	Mar. 8, 1935	$3,500,000	$3,499,528	1.00	1,013,663.12	279,962.24	4c.	1,293,625.36	Dec. 22, 1945
Magnet Consolidated Mines, Ltd.	April 23, 1936	$3,000,000	$3,000,000	1.00	855,000.00	.....	.....	855,000.00	Dec. 10, 1943
Matachewan Consolidated Mines, Ltd.	July 10, 1933	4,000,000	3,430,000	No par	68,600.00	.....	.....	68,600.00	Nov. 30, 1940
Moneta Porcupine Mines, Ltd.	Oct. 14, 1910	$3,000,000	$2,543,860	1.00	1,399,123.00	50,877.20	2c.	1,450,000.20	Dec. 15, 1945
Naybob Gold Mines, Ltd.	Jan. 3, 1934	$5,000,000	$4,970,309	1.00	190,912.36	.....	.....	190,912.36	Oct. 15, 1941
Northern Empire Mines Co., Ltd.	July 28, 1932	$500,000	$400,000	1.00	1,492,000.00	.....	.....	1,492,000.00	Dec. 15, 1943
Pamour Porcupine Mines, Ltd.	Mar. 7, 1934	5,000,000	5,000,000	No par	3,300,000.00	250,000.00	5c.	3,550,000.00	Dec. 7, 1945
Paymaster Consolidated Mines, Ltd.	Feb. 15, 1930	$9,000,000	$8,629,090	1.00	604,034.50	86,290.90	1c.	690,325.40	Jan. 10, 1945
Pickle Crow Gold Mines, Ltd.	Jan. 8, 1934	$3,000,000	3,000,000	1.00	7,950,000.00	300,000.00	10c.	8,250,000.00	Dec. 31, 1945
Porcupine Crown Mines, Ltd.	May 25, 1913	$2,000,000	$2,000,000	1.00	840,000.00	.....	.....	840,000.00	July 15, 1917
Preston East Dome Mines, Ltd.	Jan. 7, 1911	$3,000,000	$3,000,000	1.00	3,300,000.00	540,000.00	18c.	3,840,000.00	Oct. 15, 1945
Rea Consolidated Gold Mines, Ltd.	April 5, 1911	$1,000,000	$200,000	5.00	12,000.00	.....	.....	12,000.00	1915
Sturgeon River Gold Mines, Ltd.	Aug. 22, 1934	$3,000,000	$2,749,758	1.00	219,980.64	.....	.....	219,980.64	Apr. 30, 1942
Sylvanite Gold Mines, Ltd.	June 13, 1913	$3,300,000	$3,299,500	1.00	8,347,735.00	395,940.00	12c.	8,743,675.00	Oct. 1, 1945
Teck-Hughes Gold Mines, Ltd., The	Mar. 2, 1923	$5,000,000	$4,807,144	1.00	40,209,866.72	721,071.60	15c.	40,930,938.32	Oct. 1, 1945
Toburn Gold Mines, Ltd.	Jan. 24, 1931	$2,000,000	$1,850,000	1.00	2,257,000.00	55,500.00	3c.	2,312,500.00	Nov. 22, 1945
Tombill Gold Mines, Ltd.	Oct. 7, 1935	$2,000,000	$1,520,000	1.00	454,000.00	.....	.....	454,000.00	Dec. 23, 1942
Tough-Oakes Gold Mines, Ltd.	July 15, 1913	$3,000,000	$2,657,500	5.00	398,625.00	.....	.....	398,625.00	Dec. 27, 1916
Upper Canada Mines, Ltd.	April 4, 1929	$3,000,000	$2,963,009	1.00	1,422,244.92	148,151.42	5c.	1,570,396.34	Dec. 7, 1945
Vipond Consolidated Mines, Ltd.	July 17, 1922	$2,500,000	$2,250,000	1.00	67,500.00	.....	.....	67,500.00	Apr. 15, 1927
Wendigo Gold Mines, Ltd.	Oct. 5, 1933	$2,000,000	$1,749,445	1.00	664,789.10	21,651.14	1.2376c.	686,440.24	May 1, 1945
Wright-Hargreaves Mines, Ltd.[5]	June 16, 1916	5,500,000	5,500,000	No par	42,432,500.00	1,100,000.00	20c.	43,532,000.00	Oct. 1, 1945
Young-Davidson Mines, Ltd.	April 8, 1926	$3,000,000	$1,584,108	1.00	277,218.90	.....	.....	277,218.90	Dec. 23, 1944
Total	.....	.....	.....	.....	$474,428,206.89	$16,694,416.41	.....	$491,122,623.30	.....

[3]Dividends are translated into Canadian funds.

[4]Distribution was also made in December, 1940, to shareholders of 1 share of stock of Madsen Red Lake Gold Mines, Limited, for each 5 shares of McKenzie Red Lake Gold Mines, Limited, then held.

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

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES IN THE KIRKLAND LAKE BELT,[1] 1915–1945

Year	Tough-Oakes Gold Mines	Lake Shore Mines	Teck-Hughes Gold Mines	Wright-Hargreaves Mines	Sylvanite Gold Mines	Toburn Gold Mines	Kirkland Lake Gold Mining Co.	Macassa Mines	Kerr-Addison Gold Mines	Upper Canada Mines	Chesterville Larder Lake Gold Mining Co.	Total
	$	$	$	$	$	$	$	$	$	$	$	$
1915	132,875											132,875.00
1916	265,750											265,750.00
1917												
1918		100,000										100,000.00
1919		100,000										100,000.00
1920		80,000										80,000.00
1921		120,000										120,000.00
1922		80,000	412,500.00									492,500.00
1923		160,000	206,250.00									366,250.00
1924		380,000		206,250								586,250.00
1925		600,000		550,000								1,150,000.00
1926		1,000,000	474,714.40	893,750								2,368,464.40
1927		1,400,000	713,571.60	1,237,500								3,351,071.60
1928		2,000,000	2,860,286.40	825,000								5,685,286.40
1929		2,200,000	2,866,286.40									5,066,286.40
1930		3,000,000	2,872,286.40		65,990							5,938,276.40
1931		4,800,000	3,118,143.60	825,000	131,980							8,875,123.60
1932		6,000,000	2,884,286.40	962,500	164,975							10,011,761.40
1933		6,000,000	2,884,286.40	1,512,500	164,975							10,561,761.40
1934		7,000,000	2,643,929.20	3,025,000	824,875	148,000	157,173.69	131,403.40				13,930,381.29
1935		8,000,000	1,922,857.60	3,300,000	659,900	148,000	157,173.69	396,710.20				14,584,641.49
1936		10,000,000	2,163,214.80	3,300,000	659,900	148,000	316,974.66	401,710.20				16,989,799.66
1937		12,000,000	2,403,572.00	3,850,000	824,875	166,500	479,402.91	535,613.60				20,259,963.51
1938		8,000,000	2,163,214.80	3,850,000	824,875	259,000	532,669.90	669,517.00				16,299,276.70
1939		7,500,000	2,067,071.92	3,850,000	824,875	296,000	532,669.90	870,372.10				15,940,988.92
1940		4,000,000	2,163,214.80	3,850,000	989,850	370,000	639,203.88	937,323.80	709,545.15	177,780.54	86,777.95	13,923,696.12
1941		3,100,000	1,922,857.60	4,001,250	923,860	333,000	585,936.89	937,323.80	1,655,605.35	414,821.26	260,333.85	14,134,988.75
1942		1,600,000	1,442,143.20	2,475,000	494,925	240,500	319,601.94	803,420.40	1,655,605.35	311,115.96	43,388.98	9,385,700.83
1943		1,600,000	1,442,143.20	1,925,000	395,940	74,000	213,067.96	642,736.32	1,655,605.35	296,301.48	52,066.77	8,296,861.08
1944		1,600,000	1,201,786.00	1,375,000	395,940	74,000	213,067.96	482,052.24	1,419,090.30	222,225.68		6,983,162.18
1945		1,600,000	721,071.60	1,100,000	395,940	55,500	213,067.96	321,368.16	1,419,090.30	148,151.42		5,974,189.44
Total	398,625	94,020,000	40,930,938.32	43,532,500	8,743,675	2,312,500	4,360,011.34	7,129,551.22	8,514,541.80	1,570,396.34	442,567.55	211,955,306.57

[1]Including Larder Lake area.

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES IN THE PORCUPINE BELT, 1912–1945[1]

Year	Hollinger Consol. Gold Mines	Porcupine Crown Mines	Dome Mines	Acme Gold Mines	Rea Consol. Gold Mines	McIntyre Porcupine Mines[2]	Vipond Consolidated Mines	Coniaurum Mines	Buffalo Ankerite Gold Mines
	$	$	$	$	$	$	$	$	$
1912	270,000								
1913	1,170,000								
1914	1,170,000	240,000							
1915	1,560,000	240,000	400,000.00	160,000	12,000				
1916	3,126,000	240,000	800,000.00						
1917	738,000	120,000	300,000.00			541,542.45			
1918	1,230,000					543,042.45			
1919	1,722,000					364,028.30			
1920	2,214,000		416,886.00			546,042.45			
1921	3,198,000		478,947.75			546,042.45			
1922	3,198,000		1,191,667.50			548,346.06			
1923	3,198,000		1,430,001.00			558,270.54			
1924	3,198,000		1,906,668.00			783,054.00			
1925	4,378,800		1,906,668.00			798,374.06			
1926	5,805,600		1,906,668.00			798,405.23			
1927	6,396,000		1,191,667.50			798,405.23	67,500		
1928	5,412,000		953,334.00			798,779.29			
1929	3,198,000		953,334.00			804,265.54			
1930	3,444,000		953,334.00			798,093.51			
1931	3,444,000		953,334.00			830,262.87			
1932	3,690,000		1,239,334.20			1,135,154.99		80,923.41	
1933	4,182,000		1,716,001.20			1,631,785.30			42,571.29
1934	6,888,000		3,336,669.00			1,617,446.24			89,371.77
1935	4,428,000		3,813,336.00			1,589,142.18			115,546.40
1936	5,412,000		3,873,336.00			1,596,000.00			140,335.80
1937	5,412,000		4,380,003.00			1,595,750.63		273,044.70	508,717.28
1938	5,412,000		3,893,336.00			1,588,207.03		411,381.85	701,679.00
1939	5,412,000		3,893,336.00			1,649,615.63		442,678.88	526,259.25
1940	5,412,000		3,893,336.00			2,637,390.00		498,013.74	217,520.49
1941	5,412,000		3,893,336.00			2,657,340.00		442,678.88	210,503.70
1942	3,198,000		3,309,335.60			2,657,340.00		359,676.59	
1943	3,198,000		3,114,668.80			2,657,340.00		276,674.30	70,167.90
1944	2,263,200		2,920,002.00			2,657,340.00		221,339.44	105,251.85
1945	2,263,200		2,336,001.60			2,657,340.00		221,339.44	35,083.95
Total	120,652,800	840,000	61,354,541.15	160,000	12,000	38,384,146.43	67,500	3,227,751.23	2,763,008.68

[1]The dividends of Anglo-Huronian, Limited, are not included because it is a holding company with widespread interests. To the end of 1945, dividends to the amount of $3,225,605 have been paid.

[2]Represents total paid translated into Canadian funds.

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES IN THE PORCUPINE BELT, 1912-1945—*Continued*

Year	Pamour Porcupine Mines	Paymaster Consol. Mines	Moneta Porcupine Mines	Hallnor Mines	Preston East Dome Mines	Delnite Mines	Broulan Porcupine Mines	Aunor Gold Mines	Naybob Gold Mines	Total
	$	$	$	$	$	$	$	$	$	$
1912										270,000.00
1913										1,170,000.00
1914										1,410,000.00
1915										2,212,000.00
1916										4,326,000.00
1917										1,699,542.45
1918										1,773,042.45
1919										2,086,028.30
1920										3,176,928.45
1921										4,222,990.20
1922										4,938,013.56
1923										5,186,271.54
1924										5,887,722.00
1925										7,083,842.06
1926										8,510,673.23
1927										8,453,572.73
1928										7,164,113.29
1929										4,955,599.54
1930										5,195,427.51
1931										5,227,596.87
1932										6,145,412.60
1933										7,572,357.79
1934										11,931,487.01
1935										9,946,024.58
1936										11,021,671.80
1937										12,169,515.61
1938	600,000	86,290.00	76,315.80							12,769,209.68
1939	600,000	172,580.90	305,263.20	1,200,000						14,201,733.86
1940	600,000	86,290.90	305,263.20	1,200,000	600,000	178,726.02	161,640.30			15,790,180.65
1941	600,000		254,386.00	1,200,000	900,000	178,726.02	242,460.45	320,000	190,912.36	16,502,343.41
1942	400,000	86,290.90	203,508.80	800,000	600,000	178,726.02	161,640.30	320,000		12,274,518.21
1943	250,000	86,290.90	152,631.60	700,000	600,000	89,363.01	242,460.45	360,000		11,797,596.96
1944	250,000	86,290.90	101,754.40	400,000	600,000		228,990.43	400,000		10,234,169.02
1945	250,000	86,290.90	50,877.20	600,000	540,000		53,880.10	400,000		9,494,013.19
Total	3,550,000	690,325.40	1,450,000.20	6,100,000	3,840,000	625,541.07	1,091,072.03	1,800,000	190,912.36	246,799,598.55

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES IN NORTHWESTERN ONTARIO, 1934–1945

Year	Howey Gold Mines	Northern Empire Mines Co.	Pickle Crow Gold Mines	Little Long Lac Gold Mines	Central Patricia Gold Mines	McKenzie Red Lake Gold Mines	Leitch Gold Mines	Hard Rock Gold Mines	Tombill Gold Mines	Young-Davidson Mines	MacLeod-Cockshutt Gold Mines
	$	$	$	$	$	$	$	$	$	$	$
1934	500,000										
1935	250,000	170,500									
1936	100,000		600,000	549,900	200,000	203,000.00					
1937	200,000	170,750	1,050,000	733,200	300,000	261,000.00					
1938	200,000	290,750	1,200,000	549,900	450,000	348,000.00	57,000.10				
1939	250,000	300,000	1,200,000	551,500	525,000	406,000.00	228,000.40	119,602.96	50,000	31,682.16	
1940	250,000	200,000	1,200,000	552,300	575,000	351,150.00	228,000.40	299,007.40	100,000	31,682.16	568,398.00
1941	200,000	160,000	1,200,000	368,200	600,000	352,200.00	228,000.40	239,205.92	152,000	63,364.32	286,249.00
1942	100,000	120,000	900,000	322,175	425,000	352,200.00	228,000.40	179,404.44	152,000	63,364.32	286,249.00
1943	50,000	80,000	300,000	73,640	300,000	322,850.07	256,500.45	89,702.22		63,364.32	143,124.50
1944	50,000		300,000	110,460	300,000	205,449.82	229,100.40			23,761.62	143,124.50
1945			300,000	92,050	300,000		232,550.40				
Total	2,150,000	1,492,000	8,250,000	3,903,325	3,975,000	2,801,849.89	1,687,152.95	926,922.94	454,000	277,218.90	1,427,145.00

Year	Magnet Consol. Mines	Madsen Red Lake Gold Mines	Cochenour Willans Gold Mines	Matachewan Consol. Mines	Sturgeon River Gold Mines	Wendigo Gold Mines	Berens River Mines	Cline Lake Gold Mines	Jason Mines	Gold Eagle Gold Mines	McMarmac Red Lake Gold Mines	Total
	$	$	$	$	$	$	$	$	$	$	$	$
1934												500,000.00
1935												420,500.00
1936												1,652,900.00
1937												2,714,950.00
1938												3,095,650.10
1939												3,661,785.52
1940	300,000	208,771.68	87,349.65	68,600	54,995.16	52,483.35						5,127,737.80
1941	375,000	104,985.84	177,699.30		109,990.32	52,483.35	60,000	64,200.20	119,960.20			4,913,538.85
1942	90,000	209,971.68	266,548.95		54,995.16	52,483.35	240,000			[1]237,450.51		4,279,842.27
1943	90,000	209,971.68	266,548.95				120,000				82,000.20	2,447,702.39
1944		279,962.24	177,699.30			[1]507,339.05						2,326,896.93
1945		279,962.24				[1]21,651.14						1,226,213.78
Total	855,000	1,293,625.36	975,846.15	68,600	219,980.64	686,440.24	420,000	64,200.20	119,960.20	237,450.51	82,000.20	32,367,718.18

[1]This is not a dividend, but a partial distribution of capital

YEARLY DIVIDENDS AND BONUSES PAID BY GOLD-MINING COMPANIES BY AREAS, 1912–1945

Year	Porcupine	Kirkland Lake[1]	Northwestern Ontario	Total
1912	$270,000.00	....	....	$270,000.00
1913	1,170,000.00	....	....	1,170,000.00
1914	1,410,000.00	....	....	1,410,000.00
1915	2,212,000.00	$132,875.00	....	2,344,875.00
1916	4,326,000.00	265,750.00	....	4,591,750.00
1917	1,699,542.45	....	....	1,699,542.45
1918	1,773,042.45	100,000.00	....	1,873,042.45
1919	2,086,028.30	100,000.00	....	2,186,028.30
1920	3,176,928.45	80,000.00	....	3,256,928.45
1921	4,222,990.20	120,000.00	....	4,342,990.20
1922	4,938,013.56	492,500.00	....	5,430,513.56
1923	5,186,271.54	366,250.00	....	5,552,521.54
1924	5,887,722.00	586,250.00	....	6,473,972.00
1925	7,083,842.06	1,150,000.00	....	8,233,842.06
1926	8,510,673.23	2,368,464.40	....	10,879,137.63
1927	8,453,572.73	3,351,071.60	....	11,804,644.33
1928	7,164,113.29	5,685,286.40	....	12,849,399.69
1929	4,955,599.54	5,066,286.40	....	10,021,855.94
1930	5,195,427.51	5,938,276.40	....	11,133,703.91
1931	5,227,596.87	8,875,123.60	....	14,102,720.47
1932	6,145,412.60	10,011,761.40	....	16,157,174.00
1933	7,572,357.79	10,561,761.40	....	18,134,119.19
1934	11,931,487.01	13,930,381.29	$500,000.00	26,361,868.30
1935	9,946,024.58	14,584,641.49	420,500.00	24,951,166.07
1936	11,021,671.80	16,989,799.66	1,652,900.00	29,664,371.46
1937	12,169,515.61	20,259,963.51	2,714,950.00	35,144,429.12
1938	12,769,209.68	16,299,276.70	3,095,650.10	32,164,136.48
1939	14,201,733.86	15,940,988.92	3,661,785.52	33,804,508.30
1940	15,790,180.65	13,923,696.12	5,127,737.80	34,841,614.57
1941	16,502,343.41	14,134,988.75	4,913,538.85	35,550,871.01
1942	12,274,518.21	9,385,700.83	4,279,842.81	25,940,061.85
1943	11,797,596.96	8,296,861.08	2,447,702.39	22,542,160.43
1944	10,234,169.02	6,983,162.18	2,326,896.93	19,544,228.13
1945	9,494,013.19	5,974,189.44	1,226,213.78	16,694,416.41
Total	$246,799,598.55	$211,955,306.57	$32,367,718.18	$491,122,623.30

[1]Including Larder Lake area.

The tables showing the production statistics of gold mines for the following areas will be found in the pocket at the back of the report: Larder Lake gold area (No. I), Kirkland Lake gold belt (No. II), Porcupine gold belt (No. III), Algoma district (No. IV), Thunder Bay district (No. V), and Patricia portion of Kenora district (No. VI); and the annual production by areas (No. VII).

The production tables for Southeastern Ontario, Rainy River district, the Matachewan and West Shiningtree areas, and Sudbury and Kenora districts will be found in the following pages.

SOUTHEASTERN ONTARIO

Production Statistics of Gold Mines, 1891–1945

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

Mine	Year	Quantity	Value
		tons	
Atlas Arsenic	1900, 1902, 1903	6,114	$44,667
Bannockburn	1895	....	58
Big Dipper	1907, 1909	52	340
Boerth	1900	....	208
Cleveland	1908	239	5,475
Cobalt Frontenac	1919, 1922	....	1,364
Cook Land	1901, 1902, 1904	1,483	6,989
Cordova (Belmont)	1892, 1893	560	5,450
	1898–1903	70,185	289,517
	1912–1915, 1917	16,491	45,480
	1939, 1940	33,434	134,101
Craig	1905, 1906	1,850	5,760
Crescent	1891, 1892	1,700	6,780
Deloro (Canadian Goldfields)	1897–1902	39,143	213,973
Gatling Pearce	1893	....	1,918
Gilmour	1909, 1910	550	3,669
Ledyard	1893, 1894	55	236
Little Doris	1898	400	2,500
Old Diamond (Mayboro)	1941	300	2,310
Sophia	1900	1,500	850
Sovereign	1900	262	861
Star of the East	1905, 1907	976	1,941
Miscellaneous[1]	1937	....	238
Total	....	175,294	$774,685

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

RAINY RIVER DISTRICT

Production Statistics of Gold Mines, 1895–1945

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

Mine	Year	Quantity	Value
		tons	
Barker	1898	70	$490
Big Turtle River	1929	19	245
Central Canada[1]	1934	350	742
Elizabeth	1912	50	400
Foley[2]	1897, 1898, 1933–1935	5,568	52,658
Gold Winner	1900	15	70
Golden Crescent (A.D. 2)	1897	192	1,543
Golden Star[3]	1898–1901, 1934, 1938, 1941	19,345	170,616
Hammond Reef	1897	977	3,857
Harold Lake	1895, 1896	1,131	11,236
Independence (Bennett tp.)	1898	125	1,906
Lucky Coon	1899, 1935, 1936	10	249
Manitou	1896	12	413
Olive	1897–1900, 1937, 1941, 1942	7,255	80,636
Saundary[4]	1934	13	435
Upper Seine (Sawbill[5])	1897–1899, 1940, 1941	5,368	21,785
White Lilly	1933	65	53
W. E. Stone	1919, 1920	2	319
Miscellaneous[6]	1935	....	263
Total	....	40,567	$347,916

[1]Formerly the Walsh. [2]Acquired in 1936 by Santa Fe Gold Mines, Limited.
[3]Acquired in 1936 by Orelia Mines, Limited. [4]Formerly the Headlight or Swede Boy.
[5]Acquired in 1936 by Upper Seine Gold Mines, Limited. [6]Mint sundries.

MATACHEWAN AND WEST SHININGTREE GOLD AREAS

Annual Production Statistics by Mines, 1922 and 1932–1945

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

Year	Ashley		Young-Davidson		Matachewan Consolidated		Ronda		Tyranite		Miscellaneous		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1922	...	...	...	...	...	...	...	...	...	...	...	[1]987	...	987
1932	6,805	70,142	...	...	...	...	...	...	...	...	...	...	6,805	70,142
1933	37,975	495,364	...	...	...	...	...	...	...	...	[2]29	620	38,004	495,984
1934	43,532	456,830	51,842	134,511	4,680	23,568	...	...	...	...	...	...	100,054	614,909
1935	47,366	440,531	229,793	713,380	48,362	356,818	...	...	...	...	...	...	325,521	1,510,729
1936	21,958	158,533	301,163	892,713	55,797	425,259	...	...	...	...	...	...	378,918	1,476,505
1937	...	...	337,556	1,127,247	132,754	709,607	...	...	...	...	...	...	470,310	1,836,854
1938	...	...	359,266	1,249,374	154,409	822,555	...	...	...	...	...	...	513,675	2,071,929
1939	...	...	376,265	1,438,041	155,238	867,025	24,592	97,644	35,752	198,128	...	...	591,847	2,600,838
1940	...	...	368,247	1,505,338	182,033	828,655	...	...	79,875	385,478	...	...	630,155	2,719,471
1941	...	...	346,715	1,374,609	196,962	889,324	...	...	76,800	431,386	...	...	620,477	2,695,319
1942	...	...	296,942	1,306,794	315,040	974,132	...	...	31,383	151,648	...	...	643,365	2,432,574
1943	...	...	192,727	772,171	249,779	723,713	...	...	...	...	...	...	442,506	1,495,884
1944	...	...	161,773	561,771	179,586	544,106	...	...	...	...	...	...	341,359	1,105,877
1945	...	...	206,556	752,171	161,361	603,004	...	...	...	...	...	...	367,917	1,355,175
Total	157,636	1,621,400	3,228,845	11,828,120	1,836,001	7,767,766	24,592	97,644	223,810	1,166,640	29	1,607	5,470,913	22,483,177

[1]White Rock.
[2]White Rock, 17 tons, $419; Atlas, 12 tons, $201.

SUDBURY DISTRICT[1]

Annual Production Statistics of Gold Mines, 1897–1945

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

Year	Long Lake[2]		McMillan		New Golden Rose[3]		Smith-Thorne (Tionaga)		Jerome		Miscellaneous[4]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1911	[5]3,294	18,553									9,320	55,982	12,614	74,535
1911	1,750	9,828											1,750	9,828
1913	20,646	114,833											20,646	114,833
1914	45,458	217,103											45,458	217,103
1915	44,271	282,123											44,271	282,123
1916	26,846	187,103											26,846	187,103
1932	[6]22	2,993									10	725	32	3,718
1934	7	1,256	12,313	67,344									12,320	68,600
1935			40,218	273,315							256	1,665	40,474	274,980
1936				3,139							10,555	77,476	10,555	80,615
1937	23,687	150,422	7,608	26,874	16,811	135,541					7,961	88,910	56,067	401,747
1938	34,627	226,096			40,161	492,496	2,122	22,272				588	76,910	741,452
1939	20,462	141,854			36,195	460,702	4,531	58,787					61,188	661,343
1940					38,575	443,045							38,575	443,045
1941					12,495	132,680			58,824	338,050			71,319	470,730
1942									168,628	1,138,027			168,628	1,138,027
1943						204			107,608	719,574			107,608	719,778
1944						1,895						23		1,918
1945												414		414
Total	221,070	1,352,164	60,139	370,672	144,237	1,666,563	6,653	81,059	335,060	2,195,651	28,102	225,783	795,261	5,891,892

[1]Exclusive of Matachewan and West Shiningtree areas.
[2]Acquired by Lebel Oro Mines, Limited, in 1933.
[3]Acquired by Consolidated Mining and Smelting Company of Canada, Limited, in 1942.
[4]See table of "Miscellaneous Production" to the right.
[5]Production for 1910.
[6]R. Downey.

Miscellaneous Production, Sudbury District

Mine	Year	Quantity	Value
		tons	$
Alkins, A., claims	1945		148
Bousquet	1936–1938, 1915	17,129	163,661
Crystal	1897, 1898, 1908	730	4,998
Ensign (Shakespeare[1])	1905–1907, 1944, 1945	8,590	51,140
Gomak	1936	1,387	3,446
Halcrow-Swayze	1935	211	1,372
Mac-Auer	1935	45	293
Y ung, Cyril T.	1932	10	725
Total		28,102	225,783

[1]Acquired by Ensign Gold Mines, Limited, in 1934.

KENORA DISTRICT

Production Statistics of Gold Mines, 1885–1945[1]

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

Mine	Year	Quantity	Value
		tons	$
Baden-Powell[2]	1902–1905	163	4,952
Big Master[3]	1902, 1903, 1905, 1942, 1943	14,470	75,115
Black Jack	1893	50	300
Britannia	1899	20	110
Cameron Island (Damascus)[4]	1898, 1906, 1934, 1935, 1936	1,287	163,871
Camp Bay	1904–1906	1,417	7,559
Cedar Island (Cornucopia)[5]	1896, 1932, 1935, 1936	17,050	174,146
Champion (Bad)	1900	[6]100	....
Clark	1935	87	1,250
Combined	1904	37	220
Cross, J. G.	1937	....	107
Crown Point	1900	150	900
Darkwater	1936, 1937	13	1,086
Eldorado	1904	30	251
Elora[7]	1936, 1937, 1939	13,766	49,017
Empire	1908	300	1,800
Glass Reef	1900	....	171
Gold Hill	1886, 1893	220	19,610
Gold Panner	1900	100	900
Gold Rock	1929	300	726
Grace	1902, 1907, 1908	415	865
Kenricia	1939, 1940	22,344	97,518
Laurentian[7]	1906–1909[8]	19,950	141,140
Mikado[9]	1896–1902, 1910, 1911, 1931	57,813	421,070
Minerva	1885	28	1,372
Olympia	1906, 1911, 1912, 1915	1,598	4,782
Ophir	1893, 1894, 1900, 1911	6,089	22,677
Quarry Island	1899	176	1,063
Regina[10]	1895–1899, 1902, 1904, 1905, 1936, 1941–1943	36,828	299,552
Royal Sovereign	1902	....	122
Rush Bay (Golden Horn)	1904, 1906, 1907	615	1,120
Sakoose (Golden Whale)	1899–1901	8,028	58,758
Sandybeach Lake	1941, 1942	....	478
Straw Lake Beach	1938–1941	33,662	429,477
Sultana	1894–1902, 1904–1906	77,481	428,803
Sunbeam	1904	650	4,875
Treasure	1898	34	529
Twentieth Century	1902, 1903	8,688	43,586
Van Houten	1940, 1945	....	1,084
Vermilion Lake (Botham)	1930, 1935	43	575
Wabigoon-Contact Bay[11]	1905,[12] 1916,[13] 1917,[13] 1918,[14] 1920,[15] 1923,[15] 1929	1,839	7 936
Wendigo	1900,[16] 1936–1943	206,054	2,509,751
Miscellaneous[17]	1940–1942	476	10,851
Total	....	532,371	4,990,075

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

[2]Northern Lights Mines Company. [3]Acquired by Kenwest Gold Mines, Limited, in 1939.

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

[5]Acquired by Kenora Prospectors and Miners, Limited, in 1928. The mine was called Cornucopia prior to 1932. [6]Reported milled in custom mill, no data.

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

[8]Operated by Imperial Gold Mines, Limited.

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

[10]Or Black Eagle; acquired by Kenland Gold Mines, Limited, in 1936, from Horseshoe Mines, Limited, and by Goldwood Gold Mines, Limited, in 1938.

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

[12]Redeemer. [13]Rognon.

[14]Redeemer (with the exception of 8 tons, valued at $46, from Rognon). [15]Bonanza.

[16]Some 1,200 tons milled in custom mill in 1900, but no statistics of values available.

[17]Recoveries by Kenopo Mining and Milling, Limited, from shipments from the C. Alcock, Silverman, Dr. A. MacDonald, and Algot Nilson claims; La-Re Exploration Company; El Diver Mines; and Mint sundries.

GOLD PRODUCTION, 1866–1945
(On the standard basis of $20.671834 per ounce, or one dollar = 0.048375 ounces)

Year	Total production, value	Porcupine belt		Kirkland Lake belt[1]		N.W. Ontario[2]	
		Value	Per cent.	Value	Per cent.	Value	Per cent
1866–1891[3]	$190,258	....	....	....	....	....	....
1892–1909[4]	2,509,492	....	....	....	....	....	....
1910–1919.	58,822,292	$54,074,696	....	$2,977,462	....	....	....
1920.....	11,686,043	10,597,572	90.7	1,033,478	8.8	....	....
1921.....	14,692,357	13,103,526	89.5	1,524,851	10.4	....	....
1922.....	20,579,569	18,374,658	89.3	2,159,581	10.5	....	....
1923.....	20,136,287	17,313,115	85.9	2,719,939	13.5	....	....
1924.....	25,669,303	22,135,534	86.2	3,446,632	13.4	....	....
1925.....	30,206,432	24,733,120	81.8	5,385,256	17.8	....	....
1926.....	30,950,753	23,680,670	76.5	7,174,083	23.2	....	....
1927.....	33,627,040	23,851,857	70.9	9,674,114	28.7	....	....
1928.....	32,629,111	20,246,319	62	12,233,524	37.5	....	....
1929.....	33,535,226	19,281,286	57.6	14,046,596	41.8	$22,988	0.07
1930.....	35,886,558	17,758,842	49.6	17,172,770	47.9	461,730	1.3
1931.....	43,117,615	19,891,521	46.2	21,734,729	50.4	1,007,756	2.3
1932.....	47,284,621	21,422,117	45.2	23,782,313	50.3	1,607,831	3.4
1933.....	44,558,514	21,624,617	48.5	20,817,277	46.7	1,352,017	3
1934.....	43,521,249	19,634,097	45	20,424,716	46.9	2,214,385	5
1935.....	45,898,372	20,021,622	43.6	19,597,809	42.7	4,851,950	10.5
1936.....	49,168,253	21,154,555	43	19,951,731	40 5	6,545,127	13.3
1937.....	53,479,981	23,163,296	43.3	20,660,377	38.6	8,096,616	15.1
1938.....	59,875,211	26,019,011	43.4	21,309,165	35.5	10,888,589	18.1
1939.....	63,791,979	27,135,740	42.5	20,390,529	31.9	14,662,724	22.9
1940.....	67,424,803	29,472,002	43.7	21,170,061	31.3	14,836,008	22
1941.....	66,051,188	29,746,821	45	19,625,691	29.7	15,054,073	22.7
1942.....	57,133,095	27,050,171	47.3	15,635,909	27.4	12,999,494	22.7
1943.....	43,766,691	21,105,460	48.2	13,134,718	30	8,371,385	19.1
1944.....	35,800,299	18,047,819	50.4	10,299,980	28.8	6,309,232	17.6
1945.....	33,600,205	17,177,324	52.7	9,908,940	29.5	4,625,176	13.8
Total.	$1,105,592,797	$607,817,368	55.6	$357,992,231	32.4	....	....

[1]Includes Larder Lake area.
[2]Recent production only. Gold output from 1866 to 1909, inclusive, came from Hastings county and Northwestern Ontario. No segregation of statistics can now be made.
[3]Estimated. [4]Maximum yearly output was $424,568 in 1899.

Labour Statistics

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

AVERAGE YEARLY WAGE, GOLD-MINING INDUSTRY, 1944 AND 1945

Area or district	1944			1945		
	No. of wage-earners	Wages paid	Average wage per annum	No. of wage-earners	Wages paid	Average wage per annum
Porcupine belt.......	5,597	$11,618,938	$2,076	5,789	$11,544,456	$1,994
Kirkland Lake area...	2,064	4,173,499	2,022	2,116	4,149,338	1,961
Larder Lake area.....	564	1,153,567	2,045	556	1,119,902	2,014
Matachewan area....	218	448,024	2,055	206	413,531	2,007
Sudbury district......	....	....	....	....	....	....
Algoma district.......	....	....	....	....	....	....
Thunder Bay district..	616	1,314,536	2,134	525	1,031,685	1,965
Patricia portion......	937	2,027,462	2,164	886	1,900,642	2,145
Kenora and Rainy River districts.....	....	....	....	....	....	....
Southeastern Ontario.	....	....	....	....	....	....
Operating but non-producing.........	125	194,195	1,554	515	529,716	1,029
Total..........	10,121	$20,930,221	$2,068	10,593	$20,689,270	$1,953

Gold-Milling Plants

The rated daily capacity of gold-milling plants in Ontario was estimated at 31,768 tons in 1945. The daily operating average reported to the Statistics Branch of the Department totalled 17,849 tons, and the capacity of idle plants was 5,320 tons.

TONNAGE OF GOLD-MILLING PLANTS IN ONTARIO, 1945

Area and mine	Rated daily capacity	Daily operating average	Plants under construction	Idle plants	Plants proposed
SOUTHEASTERN ONTARIO:					
Old Diamond (Mayboro)	....	....	....	20	....
LARDER LAKE AREA:					
Chesterville	700	420	....	....	....
Kerr-Addison	2,000	1,178	....	....	....
Omega	500	287	....	....	....
Yama	....	....	....	50	....
KIRKLAND LAKE BELT:					
Bidgood	150	89	....	....	....
Golden Gate	....	....	....	125	....
Golden Summit	....	....	....	15	....
Kirkland Lake Gold	400	234	....	....	....
Lake Shore	2,500	800	....	....	....
Macassa	400	197	....	....	....
Sylvanite	600	313	....	....	....
Teck-Hughes	1,000	290	....	....	....
Toburn	195	114	....	....	....
Upper Canada	225	229	....	....	....
Wright-Hargreaves	1,200	426	....	....	....
PORCUPINE BELT:					
Aunor	450	393	....	....	....
Broulan	350	245	....	....	....
Buffalo Ankerite (two mills)	1,300	666	....	....	....
Canusa	....	....	....	50	....
Coniaurum	600	270	....	....	....
Delnite	500	181	....	....	....
De Santis	....	....	....	160	....
Dome	1,700	1,444	....	....	....
Faymar	....	....	....	250	....
Hallnor	370	261	....	....	....
Hollinger	5,000	2,653	....	....	....
Hoyle	....	....	....	500	....
McIntyre Porcupine	2,500	1,549	....	....	....
McLaren-Porcupine	....	....	....	15	....
Moneta	....	....	....	175	....
Naybob	....	....	....	150	....
Pamour	1,500	1,145	....	....	....
Paymaster Consolidated	600	358	....	....	....
Porcupine Lake	....	....	....	25	....
Preston East Dome	1,000	609	....	....	....
Ross (Hollinger)	300	213	....	....	....
Vimy	....	....	....	50	....
MATACHEWAN AND WEST SHININGTREE AREAS:					
Churchill	....	....	....	10	....
Matachewan Consolidated	1,000	442	....	....	....
Tyranite	....	....	....	200	....
Young-Davidson	1,000	738	....	....	....

TONNAGE OF GOLD-MILLING PLANTS IN ONTARIO, 1945—*Continued*

Area and mine	Rated daily capacity	Daily operating average	Plants under construction	Idle plants	Plants proposed
SUDBURY DISTRICT:					
Fox Lake	....	....	....	25	....
Gomak	....	....	....	35	....
Halcrow-Swayze	....	....	....	25	....
Jerome	....	....	....	500	....
Smith-Thorne (Tionaga)	....	....	....	50	....
ALGOMA DISTRICT:					
Alden-Goudreau (Regnery Metals)	....	....	....	25	....
Algold	....	....	....	50	....
Algoma Summit (Magino)	....	....	....	500	....
Darwin	....	....	....	50	....
Edwards	....	....	....	75	....
Hiawatha	....	....	....	25	....
Ranson	....	....	....	25	....
Shenango	....	....	....	50	....
Stanley	....	....	....	35	....
THUNDER BAY DISTRICT:					
Bankfield	....	....	....	130	....
Hard Rock	350	111	....	....	....
Leitch	85	56	....	....	....
Little Long Lac	375	198	....	....	....
MacLeod-Cockshutt	650	286	....	....	....
Magnet	....	....	....	175	....
Sand River	....	....	....	75	....
Sturgeon River	....	....	....	75	....
Tombill	....	....	....	125	....
KENORA AND RAINY RIVER DISTRICTS:					
Big Master (Kenwest)	....	....	....	125	....
Kenopo	....	....	....	25	....
Straw Lake Beach	....	....	....	60	....
Wendigo	....	....	....	80	....
PATRICIA PORTION:					
Bathurst (Car Lake)	....	....	....	5	....
Berens River	225	216	....	....	....
Central Patricia	400	245	....	....	....
Cochenour Willans	250	86	....	....	....
Gold Eagle	....	....	....	125	....
Hasaga	353	288	....	....	....
Jason	....	....	....	125	....
J-M Consolidated	....	....	....	100	....
McKenzie Red Lake	240	174	....	....	....
McMarmac	....	....	....	80	....
Madsen Red Lake	400	280	....	....	....
Pickle Crow	400	165	....	....	....
Uchi	....	....	....	750	....
Total	31,768	17,849	....	5,320	....

World Output

The figures for the output by leading gold-producing countries from 1941 to 1945, inclusive, in the following table are those published in the Year Book of the American Bureau of Metal Statistics, 1945.

OUTPUT BY THE LEADING GOLD-PRODUCING COUNTRIES, 1941–1945[1]

(One dollar = 0.048375 ounces)

	1941	1942	1943	1944	1945
NORTH AMERICA:	fine ounces	fine ounces	fine ounces	fine ounces	fine ounces
United States[2]	5,980,746	3,618,503	1,365,223	1,001,865	996,502
Canada	5,345,179	4,841,306	3,651,301	2,922,911	2,651,250
Mexico	799,956	799,107	634,752	508,870	499,290
Newfoundland	21,194	15,750	18,735	18,329	15,354
Total North America	12,147,075	9,274,666	5,670,011	4,451,975	4,162,396
CENTRAL AMERICA AND WEST INDIES	330,000	330,000	302,300	275,000	285,000
SOUTH AMERICA:					
Brazil	235,343	229,068	191,300	178,300	195,000
Chile	263,827	186,997	173,745	203,749	179,551
Colombia	656,019	596,618	565,501	553,530	506,695
Ecuador	83,375	88,871	90,691	84,234	69,402
Peru	285,171	257,649	199,638	175,180	*175,000
Guiana—British	36,046	29,267	19,470	18,986	22,533
—Dutch	12,563	7,883	5,795	5,722	7,500
—French	34,272	25,173	12,989	19,194	20,640
Venezuela	99,090	88,150	62,802	59,064	57,700
Other South America	36,000	42,000	30,000	25,000	*20,000
Total South America	1,741,706	1,551,676	1,351,931	1,322,959	1,254,021
EUROPE:					
Czechoslovakia	....	....	....	....	....
France	59,960	44,335	34,111	16,053	....
Jugoslavia	....	....	....	....	....
Rumania	104,230	82,240	86,615	....	....
Sweden	152,262	175,025	156,603	140,000	95,000
AUSTRALIA:					
New South Wales	88,091	77,249	63,779	62,610	40,000
Queensland	120,000	96,416	62,838	53,000	60,000
Victoria	149,769	101,497	56,511	54,086	61,790
Western Australia	1,109,313	848,180	546,470	466,261	468,548
Tasmania	19,908	18,353	17,245	*17,000	13,050
Other Australia	20,547	13,391	4,436	4,613	*5,000
Total Australia (Commonwealth)	1,507,628	1,155,086	751,279	657,570	648,388
New Guinea	235,000	....	....	....	....
New Zealand	174,656	165,986	149,150	142,287	....
Fiji	118,681	90,973	64,420	40,443	....
Papua	14,056	....	....	....	....
British India	285,945	256,399	252,353	187,200	170,000
AFRICA:					
Belgian Congo	559,185	514,046	443,481	356,324	343,447
French West Africa	88,590	83,856	80,296	74,104	65,600
Kenya	72,148	56,771	45,118	42,273	45,000
Madagascar	10,995	8,359	9,163	9,388	6,430
Rhodesia	795,000	761,164	657,387	593,038	570,000
British West Africa[3]	930,000	800,000	600,000	566,000	565,000
Tanganyika	144,312	130,000	110,000	67,374	72,530
Transvaal, Cape Colony, and Natal	14,386,361	14,120,617	12,800,021	12,277,228	12,213,545
TOTAL FOR WORLD	40,816,000	35,582,000	29,541,000	27,075,000	26,590,000

[1]The compilations contain some preliminary data, and conjectural figures (*) have been inserted where necessary.

[2]Production of the Philippine Islands is included with the United States.

[3]Comprising Gold Coast, Sierra Leone, and Nigeria.

Maximum Canadian production	5,345,179 ounces in 1941
Maximum Russian production	6,500,000 ounces in 1936
Maximum U.S. production	5,980,746 ounces in 1941
Maximum Transvaal, Cape Colony, and Natal production	14,386,361 ounces in 1941
Maximum World production	40,925,330 ounces in 1940

In the absence of data from Russia and Siberia, and from Korea, Japan and other countries omitted from the above table, figures have been assumed for them in order to approximate world's totals, and consequently the figures given for these totals are not the additions of figures reported by countries. Among such conjectural insertions have been 4,000,000 ounces for Russia and Siberia in 1941 and for each year subsequently. The hypothetical insertion for Korea, Japan, etc., has been 2,500,000 ounces in 1941 and 1,300,000 ounces in each year subsequently. World's totals as reported in the above table are subject to these corrections if, when, and as the true figures for the missing gold productions become known.

Mint Receipts from Ontario Mines

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

RECEIPTS OF CRUDE GOLD BULLION FROM ONTARIO MINES AT THE ROYAL CANADIAN MINT, OTTAWA, 1941-1945

Year	Quantity	Precious metals		Total value (standard)	Buying rate in Canada for New York funds[1]
		Gold	Silver		
	crude ounces	fine ounces	fine ounces		cents
1941	3,976,329	3,165,509	432,039	$65,597,357	110
1942	3,385,022	2,702,485	359,677	56,555,420	110
1943	2,613,308	2,110,420	275,272	43,732,517	110
1944	2,135,843	1,724,976	225,047	36,745,281	110
1945	1,884,507	1,522,988	191,268	31,560,438	110

[1]The average rate of premium on New York funds is based on the day to day record of current quotations. The Federal Department of Finance pays for gold in Canadian funds and reimburses producers by an amount equivalent to the exchange premium on New York funds. Export of gold is prohibited except under license.

Nickel-Copper and Platinum Metals

The reduced metal requirements following the termination of the war resulted in a general curtailment of operations toward the latter part of 1945 at the mines and reduction works of the nickel-copper industry.

Ore shipments dropped from 12,954,346 tons in 1944 to 10,854,735 tons in 1945. The aggregate output of the industry was estimated at $123,087,992 in 1945, as against $113,580,317 in 1944. This increase is only apparent because it results from a change in the method of computing output of metals of the platinum group.

Nickel production from all sources totalled 245,130,983 pounds, valued at $61,982,133, in 1945, as compared with 274,598,629 pounds, valued at $69,204,152, in 1944. Of the 1945 total, only 56,138 pounds came from outside sources, in this case from the silver-cobalt ores of the Cobalt area.

The production of copper in 1945 from all sources amounted to 239,457,242 pounds, valued at $29,772,270. Comparable figures for the preceding year are 285,307,278 pounds, worth $33,845,632.

The nickel-copper industry proper, most of whose Canadian mines and works are located in the Sudbury area, treated 10,865,722 tons of ore in 1945 and produced 272,236 tons of matte, of which 41,854 tons were shipped to points outside Canada.

The Ontario mines and reduction works of the industry employed 12,851 salaried employees and wage-earners during the year, who were paid $26,504,330. Fuel, electricity, and process supplies valued at $26,946,673 were consumed in 1945. Dividends paid out amounted to $25,760,355. From the beginning of the industry up to the end of 1945 nickel-copper mining companies have produced metals valued at $1,734,589,455.

NICKEL-COPPER MINING AND SMELTING, 1941-1945

Item	1941	1942	1943	1944	1945
	tons	tons	tons	tons	tons
1. Ore shipped	9,974,272	12,078,145	12,913,346	12,954,346	10,854,735
2. Ore treated	9,974,409	12,078,722	12,912,332	12,966,679	10,865,722
3. Copper in blister produced in Ontario	158,788	146,362	130,906	133,849	114,249
4. Nickel produced in Ontario	97,033	102,478	106,070	103,287	92,794
5. Matte exported[1]	67,904	61,226	56,833	48,287	41,854
6. Nickel content of matte exported	43,955	40,112	37,911	32,618	27,705
7. Copper content of matte exported	7,735	7,583	7,532	6,517	5,479

[1]All matte was exported prior to 1918, when refining in Canada began at Port Colborne, Ont. The British America Nickel Corporation commenced refining operations at Deschênes, Que., in 1920, and closed down finally in July, 1924. Every year since 1934 and including that year, some thousands of tons were brought back to Canada for treatment. These have been deducted.

Production of Precious Metals

The nickel-copper industry of Ontario is recognized as the largest source of metals of the platinum group in the world. Russia is believed to be the second most important source, although no production figures have been published by the Soviet Union for many years.

The figures for the year 1945 include adjustments on the metal content of platinum concentrates produced from 1938 to 1944, inclusive, plus refined metals sold in 1945. Prior to 1945, the figures reported refined metals recovered during the year under review, plus the metal content of concentrates sold during the year under review.

PRECIOUS METALS RECOVERED, 1941-1945

	1941	1942	1943	1944	1945
	ounces	ounces	ounces	ounces	ounces
Platinum metals:					
Platinum	124,257	285,188	219,706	157,523	208,234
Palladium	85,406	197,642	105,736	33,950	385,590
Rhodium, ruthenium, osmium, and iridium	12,026	24,931	20,268	8,979	72,984
Total ounces	221,689	507,761	345,710	200,452	666,908
Value	$8,144,164	$19,176,254	$13,691,749	$8,024,719	$26,688,646
Gold ounces	77,960	70,861	55,776	55,286	91,369
Silver ounces	2,633,815	2,238,177	1,648,888	1,828,978	1,735,143

Dividends

Two operating companies, the International Nickel Company of Canada, Limited, and Falconbridge Nickel Mines, Limited, paid dividends amounting to $25,760,355.03. Total dividends paid by nickel-copper companies to the end of 1945 amounted to $473,319,803.

STATISTICAL SYNOPSIS OF THE NICKEL-COPPER INDUSTRY IN ONTARIO, 1943, 1944, AND 1945

Year	No. of producing companies	No. of plants in Ontario	Dividends paid	Salaried employees		Wage-earners		Selling value of products	
				No.	Salaries	No.	Wages	Kind	Value
								Nickel in matte	$13,648,063
								Metallic nickel	56,302,738
								Nickel oxide and salts	1,713,578
								Copper in matte	1,318,033
		10 mines[1]		445	$1,273,291	6,805	$14,590,355	Converter copper	30,762,902
1943	2	3 smelters	$31,590,864	540	1,506,368	4,508	8,250,256	Gold (standard)	1,152,992
		2 refineries		245	634,898	2,087	3,940,804	Exchange	994,384
								Silver	746,188
								Platinum metals	13,691,749
								Selenium and tellurium	158,550
Total			**$31,590,864**	**1,230**	**$3,414,557**	**13,400**	**$26,781,415**		**$120,489,177**
								Nickel in matte	$11,742,375
								Metallic nickel	56,807,789
								Nickel oxide and salts	652,263
								Copper in matte	1,172,986
		8 mines[2]		492	$1,428,118	7,153	$14,209,689	Converter copper	32,130,889
1944	2	3 smelters	$25,759,606	542	1,570,600	4,824	8,171,793	Gold (standard)	1,142,863
		2 refineries		245	659,709	2,184	4,136,648	Exchange	985,648
								Silver	786,460
								Platinum metals	8,024,719
								Selenium and tellurium	134,325
Total			**$25,759,606**	**1,279**	**$3,658,427**	**14,161**	**$26,518,130**		**$113,580,317**
								Nickel in matte	$9,919,343
								Metallic nickel	51,031,395
								Nickel oxide and salts	966,653
								Copper in matte	1,095,891
		8 mines[3]		438	$1,329,091	5,622	$11,690,999	Converter copper	28,675,642
1945	3	3 smelters	$25,760,355	571	1,615,204	3,883	7,320,963	Gold (standard)	1,888,765
		2 refineries		245	659,076	2,092	3,888,997	Exchange	1,628,942
								Silver	815,518
								Platinum metals	26,688,646
								Selenium	322,560
Total			$25,760,355	1,254	$3,603,371	11,597	$22,900,959		$123,033,355

[1]Includes Harlin Nickel Mines, Limited, Nickel Offsets, Limited, Ontario Nickel Mines, Limited, and Dominion Nickel Mining Corporation, Limited, which were active, but non-producing.

[2]Includes Harlin Nickel Mines, Limited, and Nickel Offsets, Limited, which were active, but non-producing.

[3]Includes Canadian American Nickel Mining Corporation.

DIVIDENDS PAID BY NICKEL COMPANIES TO END OF 1945

Company	Period	To end of 1944	1945
Canadian Copper Company	1894–1901	$1,975,000.00	....
International Nickel Company[1] preferred	1906–1928	12,299,273.00	....
International Nickel Company[1] common	1909–1928	65,811,694.00	....
International Nickel Company of Canada, Limited[2] preferred	1929–1944	30,721,697.80	$1,933,898.75
International Nickel Company of Canada, Limited[2] common	1929–1944	301,323,423.16	23,325,070.40
Falconbridge Nickel Mines, Limited	1933–1944	9,137,233.94	501,385.88
Total	....	$421,268,321.90	$25,760,355.03
Mond Nickel Company[3] deferred	1906–1914	£264,043	....
Mond Nickel Company[3] preferred	1904–1929	2,556,359	....
Mond Nickel Company[3] ordinary	1905–1929	2,581,984	....
Total	....	£5,402,386 or $26,291,126	....
GRAND TOTAL	....	$447,559,447.90	$25,760,355.03

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

[2]Dividends paid by the International Nickel Company of Canada, Limited, on the common stock in 1929 were 90 cents per share, and $1.00 per share in 1930. Common stock was increased to 15,000,000 shares of no par value on July 25, 1930; as a result shares issued were increased from 13,758,208 to 14,584,025. Seven per cent. preferred stock (cumulative) now stands at $27,627,825. Dividends on common stock aggregated $2.00 a share in 1940.

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

Operations at the Mines

International Nickel Company of Canada, Limited.—During the latter part of 1945, operations were considerably curtailed owing to the reduced metal requirements of the Allies following the termination of the war. At the Frood mine, production was obtained from the stopes of all levels between and including the 1,400- and 3,000-foot levels, with the 1,600- and 1,800-foot levels supplying more than half the tonnage mined. The deepening of No. 4 shaft from the previous bottom at 3,607 feet below surface was started in the fall, with an advance of 83 feet recorded by the end of the year. The Frood-Stobie open pits supplied a large proportion of the total ore mined by the company. At the Stobie mine, stations were cut at the 2,600- and 3,000-foot levels in the No. 7 shaft. Work was suspended for five months in this shaft. At the Creighton mine, production was obtained from recovery work or stopes on all levels between and including the 4th and 56th levels. The 62nd-level station was cut in No. 6 shaft, and the ore hoist for this shaft was being installed at the 52nd level at the end of the year. At the Levack mine, production was obtained from stopes on all levels between and including the 5th and 18th levels. The deepening of No. 2 shaft from the previous bottom at 2,222 feet from surface was started in April. An advance of 383 feet was recorded by the end of the year. Development work was continued at the Murray mine at the 450-, 600-, 750-, 900-, 1,050-, 1,200-, 1,350-, and 1,500-foot levels. The Copper Cliff and Coniston plants were in continuous operation, and the sulphuric acid plant at Copper Cliff was also operated throughout the year.

Falconbridge Nickel Mines, Limited.—Production was obtained from stopes on the 825-, 1,000-, 1,400-, 1,750-, 1,925-, and 5,000-foot levels. The sinking of No. 1 shaft was completed at a depth of 2,848 feet below surface, and a connection driven to No. 5 shaft at the 2,800-foot level. The smelter was in continuous operation, but as in the case of International Nickel, all operations were curtailed during the latter part of the year.

At the Nickel Offsets mine, the property was not in operation during the year, but a bunk-house and mess hall were constructed.

Silver-Cobalt

In 1945, the silver-cobalt mines of Northern Ontario shipped 1,351,778 pounds of ore containing 228,869 ounces of silver, 139,506 pounds of cobalt, 75,398 pounds of nickel, and 12,663 pounds of copper. Of this total, 491,701 pounds of ore was shipped to Deloro and the remainder, 860,077 pounds, went to consumers in the United States. The Deloro Smelting and Refining Company, Limited, produced no cobalt metal or oxides from Ontario ores during the year.

The industry, including shippers and the Deloro Smelting and Refining Company, Limited, employed 53 salaried employees and 317 wage-earners. Total wages and salaries were $634,280. Fuel and electricity consumed during the year was valued at $141,399, and progress supplies at $239,555.

SHIPMENTS FROM SILVER MINES, SMELTERS, AND REFINERIES

Material	1904–1944		1945		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
Bismuth......tons	99	$207,019	....	....	99	$207,019
Copper.......tons	980	296,690	2	$637	982	297,327
Lead.........tons	370	32,619	....	....	370	32,619
Nickel........tons	6,768	1,778,743	28	10,105	6,796	1,788,848
Cobalt........tons	17,600	32,300,354	55	90,026	17,655	32,390,380
Arsenic.......tons	77,714	6,341,418	112	12,352	77,826	6,353,770
Silver......ounces	437,141,422	261,185,906	481,420	211,427	437,622,842	261,397,333
Total.......	....	$302,142,749	....	$324,547	....	$302,467,296

SILVER PRODUCTION, 1944 AND 1945

Source	1944		1945	
	Fine ounces	Value	Fine ounces	Value
Sales of bullion by the reduction companies, smelters, and mines......... Contained in silver-cobalt concentrates and residues exported from Canada[1]. Estimated as recovered from concentrates treated in other provinces.....	694,283	$298,541	481,420	$211,427
In crude gold bullion.................	620,014	257,274	973,891	440,587
Recovered by nickel-copper refineries..	1,828,978	786,460	1,735,143	815,518
Total.........................	3,143,275	$1,342,275	3,190,454	$1,467,532

[1]Also silver-lead-zinc concentrates.

The following table shows the dividends and bonuses paid by silver-mining companies to the end of 1945:—

DIVIDENDS AND BONUSES PAID BY SILVER-MINING COMPANIES[1]

	To Dec. 31, 1944	1945	Total
Coniagas Mines, Ltd.	$12,760,000.00	....	$12,760,000.00
Nipissing Mining Co., Ltd.	33,732,297.25	$70,000	33,802,297.25
All other companies	55,132,488.91	....	55,132,488.91
Total	$101,624,786.16	$70,000	$101,694,786.16

[1]Up to 1929, dividends were attributable to silver-cobalt production. The Nipissing Mining Company, Limited, and Coniagas Mines, Limited, are holding companies and dividends result from investments in other fields.

The following review of operations in the Cobalt area was prepared by A. A. Cole, manager of the Temiskaming Testing Laboratories at Cobalt:—

OPERATIONS IN THE COBALT AREA

With the conclusion of hostilities the lack of interest in the silver and cobalt markets was shown in reduced shipments. During the calendar year 1945 shipments from the area were:—

	Gross weight	Silver	Cobalt	Nickel
	tons	ozs.	lbs.	lbs.
Silver ores	398,468	219,146	21,683	17,067
Cobalt ores	953,310	9,723	106,935	58,331
Total	1,351,778	228,869	128,618	75,398

The shippers of silver ores were:—

Company	Mine
Ausic Mining and Reduction Co., Ltd.	Genesee. Silver Cliff.
Cross Lake Lease	Miller Lake O'Brien. O'Brien.
R. Mercier	Foster.
Nipissing Mining Co., Ltd.	Nipissing.
J. H. Price	Kerr Lake.

Cobalt ores were shipped by the following companies:—

Company	Mine
S. B. Bond	University.
Cross Lake Lease	O'Brien.
Silanco Mining and Smelting Corp., Ltd.	Agaunico. Ruethel. Temiskaming.
J. H. Sutherland	Lawson.

The above lists show 5 silver producers operating 7 mines and 4 cobalt producers operating 6 mines, or 8 operators working 12 mines (Cross Lake Lease appears in both lists). In addition, several companies carried on exploration and made small ore shipments to the Temiskaming Testing Laboratories for sampling, but as the ore has not yet been shipped they do not appear in the above lists. Among these were: Silco Mines, Limited; Van Tassel Silver Mining Syndicate, Limited; and Windsor-Cobalt Silvers, Limited.

Silver

Cross Lake Lease has for some years been the largest producer of high-grade silver ore in the area. It operated the O'Brien mine at Cobalt and the Miller Lake O'Brien at Gowganda until the latter was sold in the summer of 1945 to Siscoe Gold Mines, Limited. In addition to silver ore they also produced some cobalt ore from the O'Brien mine.

Ausic Mining and Reduction Company, Limited, reconditioned the old Silver Cliff mill and operated it for a few months on ore from the Genesee and Silver Cliff mines.

Van Tassel Silver Mining Syndicate, Limited, has acquired the old Silver Bar mine. The property has been reopened and some development done by the new owners, but latterly has been closed down awaiting better markets.

Silco Mines, Limited, has been developing properties in the Gillies limit.

The Smelting of Silver Ores and the Price of Silver

The Deloro Smelting and Refining Company, Limited, continues to be the only plant treating high-grade silver ores from the Cobalt area. The company runs its silver furnace only when it receives enough ore to make the run worth while, the minimum set by the company being 300 tons. This point was reached and a run made in March, 1945. Since that time no silver ore shipments have been made. Cross Lake Lease, however, has continued to produce and has accumulated about 60 tons of high-grade ore, which it has stock-piled awaiting a higher price for silver. Later developments proved that this procedure was justified, for on September 21 the United States raised the ceiling price on foreign silver to 71.11 cents. This price, however, was not immediately available to Canadian silver producers.

Canada is the only country that has maintained a pre-war price ceiling. Throughout 1945, the silver-using industry continued to be supplied with metal on a 40-cent basis, this figure being the approximate equivalent in Canadian funds of the 35 3/8-cent foreign silver price that had prevailed in the United States until August 31, 1942, under the O.P.A. ceiling. The Dominion's mine production was made available first to the home trade and then to the Royal Canadian Mint; only after these requirements had been satisfied was the excess permitted to be exported under Government license for sale abroad at prices above the 40-cent level. Settlement with the Cobalt silver-ore producers was made on the basis of what was known as the "pool price," which was obtained by combining the total sales for Canadian requirements with silver exports and working out the average price per ounce of silver received. The pool prices for 1945 were:—

	Cents
1st quarter	42.68
2nd quarter	44.22
3rd quarter	43
4th quarter	44.59

In December, the Wartime Prices and Trade Board undertook to modify the existing arrangements. Under the proposed plan, which takes effect after January 1, 1946, the silver producers in the Cobalt area of Ontario having their ores smelted and refined at Deloro in 1946 *will be paid on the basis of the export price,* less the usual smelter charge as in the past.

Cobalt

The Silanco Mining and Smelting Corporation, Limited, is the largest producer of cobalt ore in the area. Most of its ore comes from the Agaunico mine at North Cobalt. The company operates its own mill on the old Colonial property and produces about 80 tons of cobalt concentrates a month. As its shipments are taking only a small part of its production, the stock-pile is constantly increasing and is now well over 1,200 tons. During the year the company also purchased several lots of ore from some of the other producers. Two cars have yet to be shipped to the Shepherd Chemical Company, of Cincinnati, Ohio, and then the balance will be held for treatment in the company's smelter.

The site chosen for the erection of this electric smelter and refining plant is on the Temiskaming and Northern Ontario railway on the banks of the Montreal river about six miles south of the town of Cobalt.

The *Lawson and University mines* were operated under lease from La Rose-Rouyn Mines, Limited, the Lawson by J. H. Sutherland and the University by S. B. Bond. Both are cobalt ore producers but are at present closed down awaiting a betterment of the cobalt market.

Shipments and Market

Since the completion, on February 22, 1944, of the contract for the purchase of cobalt ores by the United States Government for stock-piling purposes, the market has been dull. Shipments of cobalt ores during the year consisted of 9 cars, 8 being to the Shepherd Chemical Company from the Silanco corporation and one from the Cross Lake Lease to Deloro. The Deloro Smelting and Refining Company has been refining cobalt residues from the Rhokana Corporation of Northern Rhodesia for the British Government and has not been in the market for some time for cobalt ores from this area.

The Silanco company is definitely out of the ore market because all its production is being stock-piled awaiting the erection of its own smelter and refinery.

Several companies in the United States are equipped to refine ores from the Cobalt area and before World War II drew most of their supplies of ore from this area. During the war these companies have been kept busy on war work for the United States Government, but as soon as they are able to clear away this work are likely to come back into the cobalt ore market.

There has been much activity in the acquisition of old silver and cobalt properties, and many have changed hands. With the rise in the price of silver and the possibility of an improvement in the cobalt situation a more active season may be anticipated.

Iron Ore, Pig Iron, and Steel

Production of iron ore both raw and beneficiated totalled 1,135,444 tons, valued at $3,635,095, in 1945, an increase in value of 90.36 per cent. over the previous year. The largest shipper, Steep Rock Iron Mines, Limited, produced 565,345 tons, as against 565,078 tons by Algoma Ore Properties, Limited, from the Helen mine at Michipicoten. The third producer, Michipicoten Iron Mines, Limited, shipped a small amount of ore to the Algoma Steel Corporation, Limited. Three other properties which reported no production but carried out development work, Rebair Gold Mines, Limited, at Atikokan, Tomakawk Iron Mines, Limited, with a property in Lake township, and Westland Mining Company, Limited, whose property is located 22 miles north of Iron Bridge in the district of Algoma, employed 4 salaried employees, who were paid $9,386, as well as 18 wage-earners, who received $28,510 for the year's work. These non-producing companies also consumed fuel valued at $592 and process supplies worth $2,605.

IRON AND STEEL STATISTICS, 1941–1945[1]

Year	Domestic ore smelted	Foreign ore smelted	Limestone for flux	Pig iron produced		Steel made	
				Quantity	Value	Quantity	Value
	long tons	long tons	short tons	long tons		long tons	
1941....	166,263	1,683,180	396,776	988,178	$23,723,249	1,673,974	$69,185,345
1942....	229,253	2,717,257	555,137	1,507,064	36,130,452	2,218,469	103,336,286
1943....	198,244	2,604,163	548,107	1,409,667	34,320,400	2,182,995	102,600,765
1944....	244,176	2,712,206	512,346	1,456,194	35,484,407	2,260,673	106,251,631
1945....	235,757	2,228,075	512,327	1,403,655	35,479,434	2,066,389	97,120,283

[1]Figures supplied by the Dominion Bureau of Statistics.

The producing mines employed 134 salaried employees, who received $253,115, and 657 wage-earners, who were paid $1,435,178 for the year's work. This branch of the industry consumed fuel and electricity worth $704,556 and process supplies appraised at $303,542.

Steep Rock Iron Mines, Limited, operated continuously during the year. The "B" ore body was opened up for a length of 1,700 feet between sections Nos. 1 and 9. This length was only cleared at the end of the year, and ore production came from the north and south ends. One dredge was operated throughout the year, and two on a part-time basis. From 12 to 20 monitors were operated in conjunction with the dredges. Most of the operations consisted of the removal of the lake-bottom silt. At this property the ore is hauled from the pit to the crushing plant, some 8,000 feet distant. There, the ore is crushed to -10 inches and screened to three sizes. From the screen the ore is dropped into loading-bins over the railway siding.

Open pit work was carried on throughout the year at the Algoma Ore Properties' Helen mine. Production was obtained from the 1,450-foot bench in the West pit and from the first bench in the East pit. The construction of a sink-float plant was started in order that excess silica in the East pit ore could be removed. The sinter plant was in operation during the period of navigation.

At the Josephine mine of Michipicoten Iron Mines the sixth level was prepared for stoping and some production was obtained during the latter part of the year. An underground crusher was installed, and skip-hoisting instituted.

PIG IRON, STEEL, AND FERRO-ALLOY PRODUCERS, 1945

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

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

Furnaces were operated in 1945 by the Algoma Steel Corporation at Sault Ste. Marie, the Steel Company of Canada at Hamilton, and Canadian Furnace at Port Colborne. These had a combined daily capacity of 4,517 long tons per day.

IRON BLAST FURNACES IN OPERATION, 1945

Company	Stacks operating	Furnaces		Location
		No. of stacks	Daily capacity	
			long tons	
Algoma Steel Corporation, Ltd.	2	2	1,979	Sault Ste. Marie.
Canadian Furnace, Ltd.	1	1	466	Port Colborne.
Steel Company of Canada, Ltd.	3	3	2,072	Hamilton.

Lead

Berens River Mines, Limited, was the sole producer of lead in Ontario in 1945. The lead was contained in concentrates shipped to the American Smelting and Refining Company. The metallic content of these concentrates amounted to 668,762 pounds, valued at $33,438.

Magnesium

Dominion Magnesium, Limited, was the sole producer of magnesium metal in 1945. The output of both metal and metal contained in alloys amounted to 7,358,545 pounds, valued at $1,607,264. The company employed an average of 48 salaried employees, who received $123,384, and an average of 244 wage-earners, who were paid $393,635. Fuel valued at $77,752, electricity worth $124,351, and supplies to the amount of $733,386 were consumed during the year. Owing to the large stock-pile of finished materials on hand, operations were discontinued in August, 1945.

Tungsten

In 1945, the Bureau of Mines, Ottawa, shipped 785 pounds of tungsten concentrates originating from Ontario ores. The ores, which were old stock kept at the Bureau of Mines, came from the Delnite and McKenzie Red Lake mines. The value of this shipment was estimated at $714.

Zinc

The value of Ontario's zinc output in 1945 dropped by 85.3 per cent. Berens River Mines, Limited, was the only producer. Total output amounted to 237,799 pounds, all of which was contained in zinc concentrates shipped to the Metals Reserve Corporation. The production was valued at $15,314, as against $104,455 in 1944.

NON-METALLICS

Arsenic

The Deloro Smelting and Refining Company, Limited, produced 224,467 pounds of arsenic (As_2O_3), valued at $12,352, in 1945. The value was down by 5.41 per cent. from the preceding year.

Asbestos

Test shipments of asbestos were made in 1943 and 1944 by L. M. Carswell from a property located on lot 22, concession IV, Blithfield township, Renfrew county, but information was not available in time for inclusion in the annual reports for those years. It is estimated that 7,124 pounds of fibre, valued at $2,646, was sold to the Johns-Manville Company, Limited, at Asbestos, Que.

Barite

Woodhall Mines, Limited, operated their property in Langmuir township during 1945, but no sales of barite were reported. The company employed an average of 5 wage-earners during the first three months of the year, and total ore mined amounted to 150 tons.

Corundum

The Craigmont corundum project administered by the Wartime Metals Corporation, a Crown company, was the sole producer of corundum in Ontario in 1945. The retreatment of 64,482 tons of tailings resulted in the production of 1,317 tons of crude corundum concentrates, valued at $130,393, which were sold to the American Abrasives Company, Inc., of Westfield, Mass. Eight salaried employees received $15,887, and 19 wage-earners earned $37,085 during the year. The project used fuel and electricity valued at $14,697 and process supplies worth $5,272.

Feldspar

The output value of feldspar by Ontario producers dropped by 2.97 per cent. in 1945. Five producers reported sales which amounted to 3,857 tons, valued at $35,414. The industry employed 2 salaried employees, who were paid $5,600, and 29 wage-earners, who received $25,616. Fuel and electricity consumed cost $5,925, and process supplies $1,415.

Fluorspar

Shipments of fluorspar were reported by 4 producers in 1945. Ore mined totalled 10,259 tons, and ore milled 7,369 tons, the latter valued at $233,708. Ten salaried employees were paid $15,215, and 74 wage-earners received $80,934 for their year's work. The producers purchased electricity valued at $14,153 and process supplies worth $8,984.

Graphite

The Black Donald mine in Renfrew county was again the sole producer of graphite in Ontario in 1945. The mine was in operation throughout the year, and a total of 2,850 tons of ore was mined and milled. Products, including flake, dust, and amorphous graphite, totalling 1,910 tons, valued at $179,001, were shipped, most of it to United States consumers.

Six salaried employees earned $13,501, and 64 wage-earners received $94,352. Fuel consumed amounted in value to $10,517, and process supplies to $22,178.

Gypsum

The Canadian Gypsum Company, Limited, and Gypsum, Lime and Alabastine, Canada, Limited, were the sole producers of gypsum in Ontario in 1945. The two companies mined 120,032 tons of ore, of which 109,901 tons was calcined. Total sales amounted to 92,174 tons, valued at $385,516. The industry employed 24 salaried employees, who received $62,439, and 262 wage-earners, who were paid $432,402 for their work. Fuel and electricity consumed amounted to $169,030, and process supplies to $36,113.

The percentage increase in the value of the industry equalled 10.5 per cent. and reflects an increased demand for such products by the building industries.

The following table gives a 5-year record of gypsum sales along with labour statistics:—

GYPSUM SALES, 1941–1945

Grade	1941	1942	1943	1944	1945
	tons	tons	tons	tons	tons
Crushed	11,365	10,090	13,667	6,841	8,023
Fine-ground	76	109	201	1,200	304
Calcined, sold	4,977	11,614	7,986	149	3,374
Calcined, used in products	74,181	60,982	70,594	82,098	80,473
Total sold or used	90,599	82,795	92,448	90,288	92,174
Total value	$276,459	$304,170	$335,637	$348,873	$385,516
Wage-earners No.	[1]182	[1]168	[1]185	[2]55	[1]262
Wages paid	$242,553	$236,768	$290,282	$100,403	$432,402

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

Mica

Production of mica in Ontario in 1945 totalled 3,329,363 pounds, valued at $139,616, as against 3,486,212 pounds, valued at $646,745, in 1944. This includes both amber and white mica.

The most severe drop was felt in the white mica branch of the industry, where the drop is equal to 87.26 per cent. from the previous year. The recession was caused primarily by the end of the war.

SHIPMENTS OF AMBER MICA, 1943, 1944, AND 1945

Grade	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
	pounds		pounds		pounds	
Ground and rough	315,000	$24,285	233,100	$17,642	448,530	$44,657
Thumb-trimmed	....	....	....	....	....	....
Splittings and knife-trimmed	957,827	18,645	214,309	33,142	15,716	4,299
Scrap	2,435,130	15,332	2,764,960	18,200	2,799,400	17,061
Total	3,707,957	$58,262	3,212,369	$68,984	3,263,646	$66,017

SHIPMENTS OF WHITE MICA, 1943, 1944, AND 1945

Grade	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
	pounds		pounds		pounds	
Ground and rough	2,000	$500	13,106	$1,390	1,000	$42
Thumb-trimmed	....	....	....	....	....	....
Splittings and knife-trimmed	122,277	233,652	223,327	576,091	20,017	73,205
Scrap	421,785	3,775	37,410	280	44,700	352
Total	546,062	$237,927	273,843	$577,761	65,717	$73,599

Mineral Waters

Mineral waters from Eastern Ontario, totalling 8,285 gallons, valued at $976, were sold in 1945. The entire production is consumed in the east end of the Province and the adjoining centres in the province of Quebec. Only three shippers reported production.

Natural Gas

Production of natural gas by fields in 1945 is given in the following table:—

NATURAL GAS PRODUCTION BY FIELDS, 1945

County	Field	Quantity
		M cu. ft.
Brant	Onondaga	72,666
Elgin	Bayham	23,888
	Malahide	25,445
Essex	Kingsville	27,416
Haldimand	Haldimand	1,885,760
Kent	Chatham and Camden gore	297,978
	Dover	162,286
	Tilbury	2,125,982
	Zone	665,568
Lambton	Dawn and Oil Springs	421,320
Lincoln	Lincoln	70,614
Norfolk	Norfolk	463,243
Oxford	Brownsville	30,026
Welland	Welland	331,955
Wentworth	Wentworth	60,295
Wells in surface drift	Harwich and Howard	14,000
Private wells	....	60,000
Total produced		7,199,970
Retail value		$4,837,585

NATURAL GAS PRODUCTION, 1945—*Continued*

	Quantity
	M cu. ft.
Gas distributed other than natural gas:	
Mixed still gas	2,266,954
Coke oven gas	467,209
Imported mixed gas	347,097
Oil gas	192,307
Propane gas	170,103
Total of other gases	3,443,670
Total of all gases distributed	10,643,640

The output of the most important product of the non-metallic group of minerals, natural gas, rose slightly from the previous year. The production value of gas sold was $4,837,585 in 1945 as compared with $4,694,097 in 1944. This is equivalent to a rise of 3.06 per cent.

Nepheline Syenite

The American Nepheline Corporation, of Rochester, N.Y., again was the sole producer of nepheline syenite in 1945. It mined 63,451 tons of ore, the larger part of which was shipped to the United States, and milled 11,097 tons, most of which was sold in Canada. Sales amounted to $275,766 in 1945, up 2.65 per cent. from the previous year. Eighteen salaried employees received $21,894, and 47 wage-earners were paid $77,509. The company consumed fuel and electricity valued at $13,012 and process supplies worth $31,191.

Peat

Three firms produced peat moss, one produced humus, and another shipped peat fuel in 1945. The output of peat moss amounted to 21,084,635 pounds, valued at $201,600; that of humus amounted to 2,250,000 pounds, worth $22,500; and that of fuel, 125 tons, valued at $1,125. The Leasa Peat Works, which produced the fuel, employed 3 wage-earners, who were paid $700. This firm spent $140 for fuel, electricity, and process supplies. The four other companies who produced moss and humus employed 12 salaried employees, who received $14,363, and 202 wage-earners, who were paid $127,114, and spent $6,410 on fuel and electricity and $784 on process supplies.

Petroleum

The value of Ontario's petroleum production dropped by 9.43 per cent. in 1945. This industry produced a total of 113,325 barrels of oil, valued at $268,478. The average price per barrel was the same as in the previous year. The following table shows a general statistical picture of the oil wells and their production by fields:—

OIL FIELDS AND THEIR PRODUCTION, 1945

Field	No. of wells				No. of wells drilled		Production[1]
	Operating	Idle	Abandoned	Reopened	Producing	Dry	
							bbls.
Petrolia and Enniskillen	474	241	488	....	....	....	39,350
Oil Springs	710	110	185	....	....	....	25,657
Moore tp.	6	38	39	....	....	1	247
Sarnia tp.	6	5	75	....	....	1	190
Plympton tp.	1	2	25	....	....	....	9
Bothwell and Thamesville	186	114	45	....	....	3	22,791
Dover, Raleigh, and Romney tps.	15	2	....	1	....	1	5,935
Onondaga tp.	3	5	39	....	....	1	24
Mosa tp.	137	38	2	1	2	....	14,344
Euphemia and Dawn tps.	2	15	114	....	....	....	362
Dunwich tp.	21	69	....	....	....	1	1,677
Brooke tp.	....	4	1	....	....	2	....
Chatham tp.	....	1	....	....	....	....	....
Warwick tp.	7	30	2	....	....	1	2,739
Metcalfe tp.	6	11	6	....	....	1	
Adelaide tp.	5	2	1	....	....	2	
Other fields	....	[2]8	....	....	....	[3]5	....
Total	1,579	695	1,022	2	5	19	113,325

[1]Information from Imperial Oil Refineries, Limited.
[2]5 in Manitoulin Island and 1 in each of Bosanquet, Hullett, and Sarawak townships.
[3]3 in Harwich township, 1 in Tilbury East, and 1 in Sombra.

A comparison of the oil production by fields for the years 1938 to 1945 is given in the following table:—

OIL PRODUCTION BY FIELDS, 1938–1945

Field	1938	1939	1940	1941	1942	1943	1944	1945
	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.
Petrolia and Enniskillen	58,270	56,951	55,589	54,583	51,917	45,308	41,433	39,350
Oil Springs	32,299	32,422	31,392	29,783	27,369	27,270	28,537	25,657
Moore tp.	1,398	1,527	1,307	1,333	806	332	133	247
Sarnia tp.	595	397	370	213	237	305	268	190
Plympton tp.	191	156	89	93	24	26	27	9
Bothwell	40,430	39,616	36,685	33,053	28,033	25,908	24,966	22,791
Tilbury East tp.	206	....	....	....	....	....	....	....
Dover tp.	8,801	15,037	11,856	9,574	8,575	9,177	7,642	5,935
Raleigh and Romney tps.	....	27	76	245	(1)	(1)	(1)	(1)
Onondaga tp.	886	219	957	300	120	11	7	24
Mosa tp.	13,527	12,857	17,288	19,075	19,209	16,327	15,585	14,344
Thamesville	1,990	1,293	(2)	(2)	(2)	(2)	(2)	(2)
Euphemia tp.	406	385	(3)	(3)	(3)	114	58	77
Dunwich tp.	195	210	337	420	358	1,422	1,728	1,676
Brooke tp.	101	52	51	113	77	....	....	....
Dawn tp.	5,010	3,573	2,294	834	596	325	199	285
Warwick, Metcalfe, and Adelaide tps.	8,310	41,478	29,353	9,748	6,524	5,967	4,484	2,739
Chatham tp.	27	159	....	27	....	....	....	....
Other fields	....	....	....	[4]44	....	....	....	....
Total	172,642	206,379	187,644	159,438	143,845	132,492	125,067	113,324
Value	$359,268	$401,429	$397,078	$337,760	$306,242	$311,356	$296,420	$268,478
Average price	$2.08	$1.95	$2.11	$2.12	$2.13	$2.35	$2.37	$2.37

[1]Included in Dover township.
[2]Included in the Bothwell field.
[3]Included in Dawn township.
[4]In Assiginack township, district of Manitoulin.

Quartz, Quartzite, and Silica Brick

The output value of quartz and quartzite dropped by 5.5 per cent. in 1945. Ore mined totalled 179,461 tons, but shipments amounted to 1,165,238 tons, valued at $820,664. The value in 1944 was reported at $868,389. This industry employed 19 salaried employees, who were paid $37,418, and 122 wage-earners, who received $172,504. The value of fuel and electricity consumed was $68,830, and that of process supplies $135,710.

Buffalo Ankerite Gold Mines, Limited, again mined tourmaline, which was used in its milling plant in the form of grinding pebbles.

The Algoma Steel Corporation produced 1,168 M silica bricks, valued at $131,398, during the year. The company reported employing 28 wage-earners, who were paid $46,906, and consuming fuel and electricity valued at $18,959.

QUARTZ, QUARTZITE, AND SILICA BRICK, 1941-1945

Year	Rock sold or used		Silica brick sold or used		Total value
	Quantity	Value	Quantity	Value	
	tons		M		
1941	1,745,244	$899,687	1,283	$118,922	$1,018,609
1942	1,367,733	914,256	1,183	120,495	1,034,751
1943	1,350,640	852,196	1,052	125,722	977,918
1944	1,326,288	868,389	1,066	135,089	1,003,478
1945	1,165,238	820,664	1,168	131,398	952,062

Salt

Six companies produced salt and salt products in Ontario in 1945. Total tonnage, including table and dairy salt, common fine salt, common coarse salt, highway salt, land salt, and brine, amounted to 578,697 tons, valued at $2,920,973. The value of these products in 1944 was $2,906,117.

This industry, all of which is located in southwestern Ontario, employed 105 salaried employees and paid them $270,859, and 358 wage-earners, who received $634,884. Fuel and electricity valued at $498,179 and process supplies worth $79,996 were used during the year.

SALT SOLD OR USED, 1941-1945

Schedule	1941	1942	1943	1944	1945
	tons	tons	tons	tons	tons
Table and dairy	57,157	56,347	65,585	62,916	65,345
Fine	127,564	139,494	157,743	150,533	148,273
Coarse	27,681	29,735	22,260	16,960	13,064
Highway	5,416	582	2,999	3,100	3,396
Land	4,254	4,701	157	98	131
Other grades	....	....	....	....	....
Total	218,459	230,859	248,744	233,607	230,209
Brine (salt equivalent)	258,711	327,548	346,145	370,199	348,488
Total sold or used	477,170	558,407	594,889	603,806	578,697
Value	$2,512,166	$2,793,328	$2,892,839	$2,906,117	$2,920,973
Wage-earners ... No.	344	340	357	351	358
Wages	$440,319	$518,840	$596,109	$577,380	$634,884

Sulphuric Acid

The sulphuric acid plant of Canadian Industries, Limited, at Copper Cliff reported a sulphur content value of $168,470 for the year 1945. The sulphuric acid plant used by-product sulphur fumes escaping from the roasters of International Nickel's Copper Cliff plant.

Talc

Canada Talc, Limited, was the sole producer of talc in Ontario in 1945. The properties operated by the company are situated in Huntingdon township, Hastings county, and consist of the Conley and Henderson mines. Both the properties and the mill were in constant operation during the year.

Crude ore mined during the period totalled 12,763 tons, and ore milled amounted to 12,863 tons of grade No. 1 talc. The full production of the mill, valued at $141,194, was sold during the year. Two-thirds of the output was sold to Canadian customers, and nearly all the remainder was shipped to United States consumers. A very small percentage went to Europe.

The company paid $18,768 to 4 salaried employees, and $34,113 to 29 wage-earners. Fuel consumed amounted to $13,633, and process supplies worth $2,691 were used.

TALC STATISTICS, 1941-1945

Year	Sales		Wage-earners, mine and mill	Wages paid
	Quantity	Value		
	tons		No.	
1941	18,171	$204,884	55	$45,224
1942	15,499	174,295	39	42,962
1943	11,959	131,216	20	24,376
1944	13,584	153,122	22	24,348
1945	12,863	141,194	29	34,113

STRUCTURAL MATERIALS

Building Permits

In 58 Canadian cities, building permits in 1945 were valued at $136,963,438, as against $96,303,973 in 1944. Of this total, 28 Ontario cities accounted for $45,528,406, as noted in the following table abstracted from the *Annual Review of Building Permits in Canada in 1941*, issued by the Dominion Bureau of Statistics, Department of Trade and Commerce, Ottawa:—

BUILDING PERMITS, 1941-1945

Year	Ontario cities		Wholesale prices index[1]	Toronto metropolitan area,[2] value	Wages index[3]
	No.	Value			
1941	28	$45,937,844	107.3	$13,921,751	111.7
1942	28	35,939,104	115.2	11,758,559	118.4
1943	28	25,600,973	121.2	9,304,014	131.9
1944	28	31,449,289	127.3	10,753,199	133.9
1945	28	45,528,406	127.3	16,512,065	135.4

[1]Applies to average index numbers for Canadian wholesale prices of building materials on the basis of 1926=100, as compiled by the Dominion Bureau of Statistics. In 1913 the index was 67, dropping to a low of 60.5 in 1915.
[2]Includes York and East York municipalities.
[3]Average index numbers of wages in Canadian building trades as compiled by the Federal Department of Labour on the basis of 1935-39=100.

Construction Contracts

The value of Canadian construction contracts awarded in 1945, as reported by *Building Reporter*, was $409,032,700, as compared with $291,961,800 in 1944. Ontario contracts in 1945 amounted to $151,856,000, or 37 per cént. of the total.

VALUE OF CONSTRUCTION CONTRACTS, 1941–1945

Classification	1941	1942	1943	1944	1945
Residential	$44,299,900	$40,080,400	$33,583,900	$43,657,000	$73,868,000
Business	30,273,300	28,657,000	16,413,000	21,346,600	25,421,800
Industrial	47,694,800	32,120,200	13,752,700	32,430,900	32,718,600
Engineering	23,330,600	7,821,900	19,275,700	14,307,300	19,847,600
Total	$145,598,600	$108,679,500	$83,025,300	$111,741,800	$151,856,000

Cement

Cement production rose from 1,863,210 barrels, valued at $2,730,381, in 1944 to 2,460,996 barrels, valued at $3,805,131, in 1945. This is the highest figure for both production and value since 1942.

Two companies, the Canada Cement Company, Limited, and the St. Mary's Cement Company, Limited, were responsible for all of Ontario's cement production in 1945. The average price per barrel was reported as $1.55.

The two companies employed 39 salaried employees, who were paid $91,219, and 375 wage-earners, who received $647,938. Fuel and electricity consumed during the year amounted to $922,446, and process supplies to $260,402.

The following table gives a record of production for the past five years:—

PORTLAND CEMENT STATISTICS, 1941–1945

Year	Operating plants	Sales		
		Quantity	Value	Average price per barrel
	No.	bbls.[1]		
1941	3	2,748,854	$4,019,656	$1.46
1942	3	2,784,782	3,998,294	1.44
1943	3	1,972,009	2,872,732	1.46
1944	3	1,863,210	2,730,381	1.47
1945	3	2,460,996	3,805,131	1.55

[1]350 pounds.

Lime

Production of lime by 11 firms in 1945 amounted to 360,597 tons, valued at $2,682,658. Hydrated lime totalled 38,050 tons, worth $449,018. The total value of all products sold by the industry was $3,131,676. The industry employed 19 salaried employees, who were paid $36,643, and 204 wage-earners, who received $279,718 for their year's work. Fuel and electricity valued at $828,869 and process supplies valued at $44,179 were consumed during the year under review.

The following table gives the production of hydrated lime and quicklime, fuel costs, number of wage-earners, and wages paid over a 5-year period.

LIME STATISTICS, 1941–1945

Year	Lime marketed or used: Hydrated: Quantity	Hydrated: Total value	Hydrated: Value per ton	Quicklime: Quantity	Quicklime: Total value	Quicklime: Value per ton	Fuel costs	Wage-earners	Wages
	tons			tons				No.	
1941....	57,197	$597,344	$10.44	373,927	$2,649,303	$7.08	$777,902	294	$385,082
1942....	33,031	363,931	11.02	382,668	2,761,643	7.22	817,552	252	378,696
1943....	28,971	321,123	11.08	382,950	2,794,071	7.30	843,231	233	404,678
1944....	37,607	424,399	11.29	391,678	2,886,778	7.37	819,898	199	382,467
1945....	38,050	449,018	11.80	360,597	2,682,658	7.44	828,869	204	279,718

Distribution of the quicklime and hydrated lime sold in 1945, as reported by the producing companies, was as follows:—

Industrial consumption	Quicklime: Quantity	Quicklime: Value	Hydrated lime: Quantity	Hydrated lime: Value
	tons		tons	
Building trades: finishing and masons.....	13,018	$127,742	28,261	$346,919
Sand-lime brick........................	3,795	32,606	....	....
Agriculture............................	103,246	774,271	2,603	27,432
Chemical and metallurgical industries:				
Smelters............................	1,039	7,290	1	7
Iron and steel.........................	19,283	140,740	96	1,002
Gold-milling...........................	32,306	242,028	205	2,152
Pulp and paper.........................	10,262	67,787	3,089	33,047
Glass..................................	12,581	106,406	....	....
Sugar..................................	5,486	54,014	....	....
Tanneries..............................	2,125	15,029	1,145	12,103
Fertilizers and insecticides...............	936	6,550	52	459
Dealers and others......................	718	5,406	254	2,872
Other chemicals[1]......................	155,802	1,102,789	2,344	23,025
Total..............................	360,597	$2,682,658	38,050	$449,018

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

Sand and Gravel

Statistics for sand and gravel, which are given in detail in the following table, indicate an improvement in both quantity and value for the year 1945 as compared with 1944.

OUTPUT OF SAND AND GRAVEL, 1944 AND 1945

Source	1944: Quantity	1944: Value	1945: Quantity	1945: Value
	tons		tons	
Private pit operators.....................	2,462,858	$1,122,086	3,226,434	$1,500,234
Dredged from Great Lakes and rivers......	522,768	441,717	573,192	381,546
Department of Highways.................	1,570,000	805,000	1,193,309	536,881
Miscellaneous counties and townships......	3,689,047	1,844,523	3,385,336	1,692,668
Estimate for other producers[1]............	1,285,130	204,101	2,088,620	355,533
Total............................	9,529,803	$4,417,427	10,466,891	$4,466,862

[1]Railway ballast.

Sand-Lime Products

Only two plants produced sand-lime bricks and blocks during 1945. The value of these products amounted to $150,742. Seven salaried employees were paid $20,658, and 37 wage-earners received $50,286. Fuel and electricity used were valued at $14,302.

Stone

The production of stone in Ontario in 1945 by 49 producers was valued at $2,926,694 and was 0.58 per cent. above the figure for 1944. The following table gives a break-down of the varieties of stone sold by the producers for 1943, 1944, and 1945.

OUTPUT OF STONE, 1943, 1944, AND 1945

Variety	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
	tons		tons		tons	
Limestone	3,114,460	$2,704,205	2,852,241	$2,549,402	2,833,573	$2,582,663
Marble	4,167	24,852	5,215	32,650	5,818	45,081
Trap / Granite	79,582	212,136	125,604	307,497	109,286	279,105
Sandstone	7,818	17,190	5,223	20,431	3,680	19,845
Total	3,206,027	$2,958,383	2,988,283	$2,909,980	2,952,357	$2,926,694

CLAY PRODUCTS

The output value of clay products in 1945 bettered the previous annual figure by 32.36 per cent. The extraordinary demand for building materials, which is expected to continue for some years yet, is the cause of this increase.

The industry reported employing 113 salaried employees, who were paid $250,323, and 830 wage-earners, who received $1,033,113. Fuel and electricity valued at $770,028 and process supplies worth $51,473 were consumed during the year.

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

VALUE OF CLAY PRODUCTS SOLD OR USED, 1913, 1922, AND 1941–45

Product	1913	1922	1941	1942	1943	1944	1945
Brick:							
Common and sewer	$3,283,894	$2,614,120	$535,683	$408,707	$314,837	$207,925	$288,132
Pressed, fancy, building tile, etc.	1,162,860	2,899,205	1,792,463	1,408,521	1,436,790	1,450,313	2,044,989
Pottery	52,875	88,889	46,670	25,000	63,600	60,000	69,182
Drain tile	292,767	368,180	225,334	234,971	279,806	309,245	355,264
Sewer pipe	600,297	973,824	480,036	409,660	348,641	312,081	337,609
Haydite and other products; clay	....	....	7,430	62,628	10,155	7,832	12,013
Total	$5,392,693	$6,944,218	$3,087,616	$2,549,487	$2,453,829	$2,347,396	$3,107,189

The following table shows the quantities and values of the many clay products made and sold by Ontario producers in 1945:—

HEAVY CLAY PRODUCTS MARKETED, 1945

Kind		Quantity	Value
Brick:			
Soft-mud process, face	No.	11,368,629	$275,695
Soft-mud process, common	No.	5,773,511	116,755
Stiff-mud (wire cut) process, face	No.	40,629,745	1,080,017
Stiff-mud (wire cut) process, common	No.	3,948,197	74,099
Dry-press, face	No.	10,544,156	293,863
Dry-press, common	No.	4,001,080	96,462
Fancy or ornamental brick (including special shapes, embossed and enamelled brick)	No.	129,790	6,658
Sewer		....	816
Paving brick	No.	205,621	12,010
Tile:			
Structural (hollow blocks, including fireproofing and load-bearing tile)	tons	33,116	330,381
Roofing tile		....	....
Floor tile (quarries)		....	46,365
Drain	No.	10,232,911	355,264
Sewer pipe (including copings, flue linings, etc.)		....	337,609
Pottery (flower pots), from domestic clay		....	69,182
Haydite and other products		....	11,004
Blue clay	tons	295	1,009
Total value		....	$3,107,189

MISCELLANEOUS STATISTICS

Mining Company Incorporations

A summary of mining companies incorporated and licensed in Ontario from 1941 to 1945, inclusive, follows:—

MINING COMPANIES INCORPORATED AND LICENSED, 1941–1945

Year	Incorporated				Extra-provincial and mortmain companies licensed	
	No.	Nominal capital	"No par" companies		No.	Capital for use in Ontario
			No.	Shares		
1941	55	$77,970,000	14	11,390,400	......	....
1942	47	44,370,000	19	14,181,000	......	....
1943	108	176,710,000	17	31,685,000	2	$80,000
1944	320	885,570,000	38	82,788,000	......	....
1945	567	1,651,580,000	55	96,370,800	......	....

Of the 618 companies incorporated in 1945, 563 had specified capital only, 51 were companies having only shares without nominal or par value, and 4 had both specified capital and shares without par value.

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945

Name of company	Head office	Date of incorporation	Capital
Abacus Gold Mines, Limited	Toronto	Sept. 17	$3,000,000
Abbot Red Lake Mines, Limited	Toronto	Sept. 28	3,000,000
Abound Gold Mines, Limited	Toronto	Apr. 3	3,000,000
Abuy Gold Mines, Limited	Toronto	Apr. 3	3,000,000
Adele Malartic Mines, Limited	Toronto	Nov. 15	3,000,000
Adelemont Gold Mines, Limited	Toronto	July 6	3,000,000
Admiral Yellowknife Mines, Limited	Toronto	Apr. 26	3,000,000
Ahgim Mining Syndicate, Limited	Toronto	Feb. 28	30,000
Aiken Red Lake Gold Mines, Limited	Toronto	Mar. 15	3,500,000
Akaicho Yellowknife Gold Mines, Limited	Toronto	Jan. 24	3,000,000
Albion Pershing Gold Mines, Limited	Toronto	July 9	3,000,000
Alcan Diamond Drillers, Limited	Toronto	Aug. 13	40,000
Alexander Red Lake Mines, Limited	Toronto	June 4	3,000,000
Alger Gold Mines, Limited	Toronto	May 1	3,000,000
Alpha Yellowknife Gold Mines, Limited	Toronto	June 1	3,000,000
Alwyn Porcupine Mines, Limited	Toronto	Oct. 30	3,500,000
American Yellowknife Gold Mines, Limited	Toronto	Feb. 5	3,000,000
Amlartic Gold Mines, Limited	Toronto	Mar. 5	3,000,000
Amy Yellowknife Mines, Limited	Toronto	Apr. 14	3,000,000
Andrew Yellowknife Mines, Limited	Toronto	Oct. 11	3,500,000
Arakaka Alluvial Mines, Limited	Toronto	Aug. 27	3,000,000
Asher Gold Mines, Limited	Toronto	July 11	3,500,000
Astorand Mines, Limited	Toronto	Nov. 23	3,000,000
Atlas Yellowknife Mines, Limited	Toronto	Jan. 4	3,000,000
Atom Gold Mines, Limited	Toronto	Nov. 2	3,000,000
Attawapascat Mining Syndicate, Limited	Patricia	May 25	35,000
Auconda Porcupine Gold Mines, Limited	Toronto	Mar. 22	3,000,000
Aucourt Mines, Limited	Toronto	June 6	3,000,000
August Porcupine Gold Mines, Limited	Toronto	Sept. 13	3,000,000
Aulore Mines, Limited	Toronto	May 18	3,000,000
Auriga Yellowknife Mines, Limited	Toronto	Oct. 1	3,000,000
Aurlando Gold Mines, Limited	Toronto	Aug. 28	5,000,000
Aurlode Gold Mines, Limited	Toronto	Nov. 13	3,000,000
Avila Ligneris Gold Mines, Limited	Toronto	Oct. 3	3,500,000
Bacola Mining Explorations, Limited	Toronto	May 22	5,000,000
Baiville Gold Mines, Limited	Toronto	Apr. 17	3,000,000
Balmer Diamond Drilling Company, Limited	Balmer Tp.	Aug. 2	40,000
Balmoral Porcupine Gold Mines, Limited[1]	Toronto	Jan. 23	3,000,000
Bancroft Feldspar Mines, Limited	Hamilton	Dec. 15	50,000
Barbados Gold Mines, Limited	Toronto	Aug. 2	3,000,000
Bargold Mines, Limited	Toronto	Aug. 8	3,000,000
Bar-lan Gold Mines, Limited	Toronto	Dec. 18	3,000,000
Batori Mines, Limited	Toronto	Jan. 27	5,000,000
Bay Lake Gold Mines, Limited	Toronto	Aug. 20	3,000,000
Bay Yellowknife Mines, Limited	Toronto	Mar. 21	3,000,000
Beatrice Red Lake Gold Mines, Limited	Toronto	Apr. 4	3,000,000
Beaucamp Yellowknife Mines, Limited	Toronto	Sept. 8	3,000,000
Beauchance Mines, Limited	Toronto	Nov. 5	3,000,000
Beaudelair Mines, Limited	Toronto	May 30	3,000,000
Beaulieu Yellowknife Mines, Limited	Toronto	July 31	3,000,000
Beauregard Yellowknife Mines, Limited	Toronto	May 4	3,000,000
Beauriv Yellowknife Mines, Limited	Toronto	Apr. 14	3,000,000
Beauvale Mines, Limited	Toronto	Mar. 5	3,000,000
Bee Lake Mines, Limited	Toronto	Nov. 7	3,000,000
Belec Courville Mines, Limited	Toronto	July 24	3,000,000
Belfast Mines, Limited	Toronto	June 27	3,000,000
Belle-Malartic Mines, Limited	Toronto	July 17	3,000,000
Bellevue Gold Mines, Limited	Toronto	June 1	3,000,000
Belmont Gold Mines, Limited	Toronto	July 9	3,000,000
Benzac Gold Mines, Limited	Toronto	May 22	3,500,000
Bermor Porcupine Gold Mines, Limited	Toronto	May 10	3,500,000
Bertram Porcupine Mines, Limited	Tisdale Tp.	July 26	3,500,000
Berylaca Yellowknife Gold Mines, Limited	Toronto	June 21	40,000

[1]The capital of this company also includes 50,000 shares of no par value.

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorporation	Capital
Bevgold Mining Syndicate, Limited	Toronto	Nov. 17	$35,000
Big Joe Gold Mines, Limited	Toronto	June 15	3,000,000
Bilcora-Quebec Mines, Limited	Toronto	June 27	3,000,000
Bishu Mines, Limited	Toronto	Aug. 30	3,000,000
Black Hawk Porcupine Mines, Limited	Toronto	June 22	3,000,000
Blade Yellowknife Gold Mines, Limited	Toronto	Jan. 31	3,000,000
Blanchard Gold Mines, Limited	Toronto	May 25	3,000,000
Blue-Chip Yellowknife Mines, Limited	Toronto	Feb. 21	4,000,000
Blue Water Mines, Limited	Toronto	Apr. 30	3,000,000
Bobs Lake Gold Mines, Limited	Toronto	Jan. 26	3,000,000
Bomaque Mines, Limited	Toronto	Nov. 23	3,500,000
Bonore Gold Mines, Limited	Toronto	May 26	3,000,000
Bonville Gold Mines, Limited	Toronto	Feb. 23	3,000,000
Bordeaux Gold Mines, Limited	Toronto	Nov. 2	3,000,000
Bordessa Mines, Limited	Toronto	Nov. 24	3,000,000
Bordulac Mines, Limited	Toronto	May 4	3,000,000
Bouchard Gold Mines, Limited	Toronto	Dec. 19	3,500,000
Boulder Hill Mines, Limited	Toronto	Nov. 27	4,000,000
Bourbon Mines, Limited	Toronto	Apr. 17	4,000,000
Bouzan Gold Mines, Limited	Toronto	Feb. 17	3,000,000
Bowie Yellowknife Mines, Limited	Toronto	Apr. 19	3,000,000
Breezy Lake Gold Mining Syndicate, Limited	Toronto	Sept. 21	35,000
Brenbar Mines, Limited	Toronto	Nov. 10	3,000,000
Brenda Yellowknife Mines, Limited	Toronto	June 22	3,000,000
Bretton Red Lake Gold Mines, Limited	Toronto	Dec. 11	3,000,000
Brewis Red Lake Mines, Limited	Toronto	Aug. 30	3,500,000
Britaura Porcupine Mines, Limited	Toronto	Apr. 11	3,000,000
Bruell Consolidated Mines, Limited	Toronto	July 30	3,500,000
Bruin Yellowknife Gold Mines, Limited	Toronto	Feb. 17	3,000,000
Brunette Porcupine Gold Mines, Limited	Timmins	May 14	3,000,000
Budco Mines, Limited	Toronto	July 25	3,500,000
Buffadison Gold Mines, Limited	Toronto	Mar. 2	3,000,000
Bull Red Lake Gold Mines, Limited	Toronto	May 15	3,000,000
Bymar Yellowknife Mines, Limited	Toronto	Nov. 26	3,500,000
Cabala Yellowknife Mines, Limited	Toronto	Apr. 3	5,000,000
Cabanga Developments, Limited	Toronto	Aug. 20	40,000
Cabot Yellowknife Gold Mines, Limited	Toronto	Sept. 7	3,500,000
Cal-Carb Mining Syndicate, Limited	Toronto	May 2	35,000
California Yellowknife Gold Mines, Limited	Toronto	Feb. 2	100,000
Calmor Mines, Limited	Haileybury	May 2	1,000,000
Camabie Mines, Limited	Toronto	Nov. 20	3,000,000
Caman Gold Mines, Limited	Toronto	Apr. 26	3,000,000
Camlachie Oils Explorations, Limited	Toronto	Aug. 3	3,000,000
Campbell Island Mines and Explorations, Limited	Toronto	Nov. 7	3,500,000
Camwe Snow Lake Mines, Limited	Toronto	Apr. 27	3,000,000
Canadian Mining and Exploration Company, Limited	Toronto	Nov. 15	100,000
Canaska Explorations, Limited	Toronto	Mar. 12	100,000
Candego Mines, Limited	Toronto	Jan. 5	3,500,000
Canus Mines and Exploration, Limited	Toronto	Apr. 21	3,000,000
Caramora Porcupine Mines, Limited	Toronto	Dec. 10	3,500,000
Carlmac Gold Mines, Limited	Toronto	Sept. 8	3,000,000
Carmel Pershing Mines, Limited	Toronto	Mar. 7	3,000,000
Carscor Porcupine Gold Mines, Limited	Toronto	June 23	2,000,000
Carshaw Porcupine Gold Mines, Limited	Windsor	Apr. 4	3,000,000
Casteck Mining Syndicate, Limited	Kirkland Lake	Oct. 11	35,000
Cavan Yellowknife Mines, Limited	Toronto	May 31	3,000,000
Cedar Rapids Mines, Limited	Toronto	Oct. 22	3,000,000
Chalcor Mining Corporation, Limited	Toronto	Dec. 29	1,000,000
Charm Yellowknife Gold Mines, Limited	Toronto	Feb. 19	3,000,000
Chennault Gold Mines, Limited	Toronto	June 7	3,000,000
Chesgo Mines, Limited	Fort Erie	May 15	3,000,000
Cheskirk Mines, Limited	Toronto	Oct. 4	3,000,000
Childs Red Lake Gold Mines, Limited	Toronto	June 27	3,500,000

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorporation	Capital
Chimo Gold Mines, Limited	Toronto	Feb. 3	$3,500,000
Christo Quebec Gold Mines, Limited	Toronto	May 14	4,000,000
Chukuni Gold Mines, Limited	Toronto	June 28	4,000,000
Cinderella Gold Mines, Limited	Toronto	Nov. 29	3,500,000
Clarnor Malartic Mines, Limited	Toronto	Mar. 7	3,000,000
Clavos Porcupine Mines, Limited	Toronto	Feb. 10	3,000,000
Clicker Red Lake Mines, Limited	Toronto	Mar. 21	3,500,000
Clinger Gold Mines, Limited	Toronto	Feb. 16	3,000,000
Clodan Gold Mines, Limited	Toronto	June 1	3,000,000
Colomac Yellowknife Mines, Limited	Toronto	July 25	3,500,000
Colossal Gold Mining Syndicate, Limited	Toronto	Mar. 22	35,000
Comara Mining and Milling Company, Limited	Toronto	Feb. 17	1,500,000
Commander Red Lake Mines, Limited	Toronto	June 14	5,000,000
Conaldan Yellowknife Mines, Limited	Toronto	May 15	3,000,000
Conger Feldspar Mining Company, Limited	Toronto	Sept. 4	100,000
Conjo Yellowknife Mines, Limited	Toronto	Apr. 12	3,000,000
Conlee Red Lake Gold Mines, Limited	Toronto	Nov. 15	3,500,000
Convoy Red Lake Mines, Limited	Toronto	Mar. 1	3,000,000
Cooper Lake Gold Mines, Limited	Toronto	Feb. 1	3,000,000
Copper-Hill Mining Company, Limited	Toronto	May 31	3,000,000
Cordell Gold Mines, Limited	Toronto	Dec. 8	3,500,000
Cotor Porcupine Mining Syndicate, Limited	Toronto	Apr. 30	35,000
Courtmont Gold Mines, Limited	Toronto	Mar. 16	3,000,000
Crangold Mines, Limited	Toronto	June 7	3,000,000
Creole Snow Lake Mines, Limited	Toronto	Sept. 20	3,000,000
Crestaurum Mines, Limited	Toronto	Oct. 12	3,000,000
Croskery Mines, Limited	North Bay	July 9	300,000
Croydon Rouyn Mines, Limited	Toronto	Apr. 21	3,500,000
Cunigold Mines, Limited	Toronto	Nov. 19	3,500,000
Cunigold Mining Syndicate, Limited	Toronto	Jan. 10	35,000
Cuzzola Gold Mines, Limited	Windsor	May 28	50,000
Cyprus Mines, Limited	Toronto	Apr. 14	3,500,000
Dajaty Mines, Limited	Geraldton	July 3	3,000,000
Dal Duverny Gold Mines, Limited	Toronto	Dec. 12	3,000,000
Dale Gold Mines, Limited	Toronto	Mar. 24	3,000,000
Dallas Yellowknife Gold Mines, Limited	Toronto	Mar. 23	3,000,000
Dalray Yellowknife Gold Mines, Limited	Toronto	Sept. 25	3,000,000
Danrod Malartic Mines, Limited	Toronto	Nov. 7	3,000,000
D'Aragon Mines, Limited	Toronto	May 5	3,000,000
Darmac Gold Mines, Limited	Toronto	June 5	3,500,000
Dassen Gold Mines, Limited	Toronto	Nov. 23	3,000,000
Dastur Gold Mines, Limited	Toronto	Aug. 20	3,000,000
Davidson Tisdale Mines, Limited	Toronto	Apr. 17	4,000,000
Deb Yellowknife Gold Mines, Limited	Toronto	Mar. 12	3,000,000
Deep-Ore Gold Mines, Limited	Toronto	Nov. 12	4,000,000
Denallan Gold Mines, Limited	Toronto	Jan. 6	3,500,000
Denbros Mines, Limited	Toronto	Dec. 20	3,500,000
Deseronto Mines, Limited	Toronto	May 25	3,000,000
Destorada Mines, Limited	Toronto	Nov. 12	3,500,000
Destorbelle Mines, Limited	Toronto	Nov. 23	3,000,000
Detta Red Lake Mines, Limited	Toronto	May 18	3,500,000
Discovery Yellowknife Mines, Limited	Toronto	Feb. 12	3,000,000
Dolmor Gold Mines, Limited	Toronto	June 27	3,000,000
Don Cameron Exploration Company, Limited	Toronto	May 10	300,000
Donard Gold Mines, Limited	Toronto	Nov. 15	3,000,000
Don-X Mines, Limited	Toronto	Apr. 14	3,500,000
Doonson Gold Mines, Limited	Toronto	May 25	4,000,000
Dorion Red Lake Mines, Limited	Toronto	June 22	3,000,000
Doris Yellowknife Gold Mines, Limited	Toronto	Oct. 24	3,000,000
Dow Yellowknife Gold Mines, Limited	Toronto	Jan. 24	3,500,000
Draco Mines, Limited	Toronto	Apr. 11	3,000,000
Duclere Mines, Limited	Toronto	Sept. 22	3,500,000
Dukel Gold Mines, Limited	Toronto	June 14	3,000,000
Duluth Red Lake Gold Mines, Limited	Toronto	May 31	3,500,000

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorporation	Capital
Dumar Gold Mines, Limited	Toronto	July 24	$3,000,000
Dumbarton Mining Syndicate, Limited	Tisdale	Apr. 10	35,000
Dunn Yellowknife Mines, Limited	Toronto	Nov. 28	3,000,000
Du Questo Gold Mines, Limited	Toronto	Apr. 28	3,000,000
Durham Red Lake Gold Mines, Limited	Toronto	Sept. 25	5,000,000
Du Reine Mines, Limited	Toronto	July 13	3,000,000
Dyke Lake Mines, Limited	Toronto	July 31	3,000,000
East Lun Gold Mines, Limited	Toronto	Dec. 21	3,000,000
Eastchester Mines, Limited	Toronto	Apr. 12	3,000,000
Eastview Mines, Limited	Toronto	Dec. 14	3,000,000
Echo-Indin Mines, Limited	Toronto	Apr. 3	3,000,000
Elcor Gold Mines, Limited	Toronto	Mar. 13	3,000,000
Elderidge Gold Mines, Limited	Toronto	May 30	4,000,000
Elmac Malartic Mines, Limited	Toronto	Apr. 30	3,000,000
Elvir Gold Mines, Limited	Toronto	May 31	4,000,000
Emil Oil and Mining, Limited	Toronto	June 15	3,000,000
Emory Gold Mines, Limited	Toronto	June 15	3,000,000
Eskimo Pete Yellowknife Gold Mines, Limited	Toronto	Dec. 27	3,000,000
Fairbanks Yellowknife Gold Mines, Limited	Windsor	Jan. 31	3,000,000
Felstead Mines, Limited	Toronto	Jan. 2	40,000
Filion Gold Mines, Limited	Toronto	Oct. 18	3,000,000
Finlay Mining Company, Limited	Windsor	Mar. 19	150,000
Flagro Mines, Limited	Hamilton	Apr. 17	3,000,000
Flicka Red Lake Mines, Limited	Toronto	Oct. 31	3,000,000
Flynn-Ber Gold Mines, Limited	Toronto	Mar. 1	3,500,000
Follansbee Red Lake Gold Mines, Limited	Toronto	July 25	4,000,000
Forbes Yellowknife Gold Mines, Limited	Toronto	July 24	3,000,000
Fortune Yellowknife Mines, Limited	Toronto	Mar. 19	3,000,000
Frebert Snow Lake Mines, Limited	Toronto	Mar. 17	3,000,000
Frederick Yellowknife Mines, Limited	Toronto	Mar. 13	100,000
Fresnor Mines, Limited	Toronto	Apr. 3	3,500,000
Fulbro Red Lake Gold Mines, Limited	Toronto	Sept. 28	3,000,000
Fummerton Mining and Development Company, Limited	Toronto	July 16	3,500,000
G. S. Eplett Mining and Development Company, Limited	New Liskeard	Nov. 9	3,000,000
Gallagher Red Lake Gold Mines, Limited	Toronto	Sept. 14	3,000,000
Gallant Gold Mines, Limited	Toronto	May 7	3,000,000
Garthack Mining Company, Limited	Toronto	Nov. 14	3,500,000
Gaymont Mines, Limited	Toronto	Nov. 15	3,000,000
Gerald Red Lake Gold Mines, Limited	Toronto	July 23	3,000,000
Glencona Mining Company, Limited	Toronto	Apr. 17	3,000,000
Glenlivet Gold Mines, Limited	Toronto	June 19	3,000,000
Glenray Pershing Mines, Limited	Toronto	Apr. 3	3,000,000
Glenwood Gold Mines, Limited	Toronto	Apr. 24	3,000,000
Globe Diamond Drilling Company, Limited[1]	Timmins	July 17	20,000
Gloucester Mines, Limited	Sarnia	July 30	500,000
Gogita Mining Syndicate, Limited	Toronto	Apr. 25	35,000
Golar Mines, Limited	Toronto	Jan. 4	3,000,000
Gold City Porcupine Mines, Limited	Toronto	Mar. 6	4,000,000
Gold Pan Mines (1945), Limited	Kenora	Oct. 23	3,000,000
Gold Rapids Mines, Limited	Toronto	Jan. 25	3,500,000
Goldbow Mining Company, Limited, The	Toronto	Nov. 16	3,000,000
Goldknife Mines, Limited	Toronto	Jan. 11	3,500,000
Goldpac Yellowknife Mines, Limited	Toronto	Oct. 6	3,000,000
Gothic Gold Mines, Limited	Toronto	Mar. 5	3,500,000
Grancour Gold Mines, Limited	Toronto	May 9	3,000,000
Grand Calumet Mines, Limited	Toronto	Nov. 24	3,000,000
Grand Chibougamau Mines, Limited	Toronto	Oct. 20	3,500,000
Grande Terre Gold Mines, Limited	Toronto	May 31	3,000,000
Granton Mining Syndicate, Limited	Timmins	May 18	35,000
Graydel Malartic Gold Mines, Limited	Toronto	Aug. 31	3,500,000
Graystone Gold Mines, Limited	Toronto	Apr. 24	3,000,000

[1]The capital of this company also includes 20,000 shares of no par value.

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorpor-ation	Capital
Great Yellowknife Mines, Limited	Toronto	Jan. 26	$3,500,000
Greatlakes Copper Mines, Limited	Toronto	Dec. 3	4,000,000
Grengold Mines, Limited	Kirkland Lake	Apr. 3	3,000,000
Greyhawk Porcupine Mining Syndicate, Limited	Toronto	Mar. 8	35,000
Grompo Red Lake Mines, Limited	Toronto	Aug. 3	3,000,000
Grovenor Mines, Limited	Hamilton	June 4	3,000,000
Gubby Mines, Limited	Toronto	Apr. 11	3,500,000
Gui-Por Gold Mines, Limited	Toronto	Dec. 11	3,000,000
Gwillim Lake Gold Mines, Limited	Toronto	June 28	3,000,000
Habitant Gold Mines, Limited	Toronto	Mar. 22	3,000,000
Harlight Gold Mines, Limited	Toronto	Aug. 24	5,000,000
Harmony Gold Mines, Limited	Toronto	Aug. 3	3,000,000
Hay Gold Mines, Limited	Toronto	June 29	3,000,000
Hearne Yellowknife Mines, Limited	Toronto	Feb. 3	3,500,000
Henry Mining Syndicate, Limited	Toronto	Nov. 20	35,000
Herblet Hudson Mines, Limited	Hamilton	Apr. 30	3,000,000
Hexagon Mining Syndicate, Limited	Kearns	May 4	35,000
Highstake Mines, Limited	Dome	Oct. 9	100,000
Hub Yellowknife Mines, Limited	Toronto	Apr. 3	3,000,000
Hubert Balboa Mines, Limited	Toronto	Oct. 23	3,000,000
Huclif Porcupine Mines, Limited	Toronto	Feb. 22	3,000,000
Hudson Diamond Drilling Company, Limited	Virginiatown	Mar. 5	40,000
Hughie Gold Mines, Limited	Matachewan	Sept. 7	100,000
Humlin Red Lake Mines, Limited	Toronto	Jan. 8	3,000,000
Ina Yellowknife Gold Mines, Limited	Toronto	June 29	3,500,000
Indian Lake Gold Mines, Limited	Toronto	Mar. 1	3,000,000
Indyke Gold Mines, Limited	Toronto	July 31	3,000,000
Ingray Yellowknife Mines, Limited	Toronto	Feb. 2	3,000,000
Inore Gold Mines, Limited	Toronto	May 26	3,000,000
International Ceramic Mining, Limited	Toronto	July 31	3,000,000
Jacaranda Gold Mines, Limited	Leaside	Nov. 19	3,500,000
Jack Lake Mines, Limited	Toronto	Aug. 14	3,500,000
Jackie Mines, Limited	Toronto	July 19	3,000,000
Jackmay Lead Mines, Limited	Toronto	Oct. 17	3,000,000
Jacomat Mines, Limited	Toronto	July 23	3,500,000
Janet Red Lake Mines, Limited	Toronto	Dec. 29	3,500,000
Jimjon Gold Mines, Limited	Toronto	Oct. 6	3,000,000
Kalgold Mines, Limited	Toronto	Sept. 15	3,000,000
Karat Yellowknife Mines, Limited	Toronto	Feb. 23	3,000,000
Katie Red Lake Mines, Limited	Toronto	Dec. 15	3,000,000
Ken-Bay Gold Mines, Limited	Toronto	Oct. 19	3,000,000
Kenridge Red Lake Mines, Limited	Toronto	Apr. 11	3,000,000
Kenroy Malartic Mines, Limited	Toronto	Jan. 5	3,000,000
Kensull Gold Mines, Limited	Toronto	Dec. 11	3,000,000
Kenville Gold Mines, Limited	Toronto	Mar. 10	3,500,000
Kerr-Wood Oil Company, Limited	Waterloo	July 3	40,000
Kerromac Mining Company, Limited	Ottawa	June 12	3,000,000
Kilbarry Red Lake Gold Mines, Limited	Toronto	Oct. 20	3,500,000
Kilbine Long Lac Gold Mines, Limited	Toronto	Mar. 10	4,000,000
Kiltie Red Lake Mines, Limited	Toronto	June 26	3,500,000
Kinart Yellowknife Mines, Limited	Toronto	Apr. 19	3,000,000
Kiska Gold Mines, Limited	Toronto	Jan. 16	3,000,000
Klondyke Yellowknife Mines, Limited	Toronto	Jan. 15	3,000,000
Knobhill Gold Mines, Limited	Toronto	Oct. 1	4,000,000
Kyle Gold Mines, Limited	Toronto	Sept. 14	4,000,000
K-Zone Fault Mines, Limited	Toronto	Mar. 16	3,000,000
Lac D'Or Mines, Limited	Toronto	Nov. 16	3,000,000
Laddie Gold Mines, Limited	Toronto	Oct. 30	3,000,000
Lake Macamic Mines, Limited	Hamilton	Mar. 1	3,000,000
Lake Rowan (1945) Mines, Limited	Toronto	July 26	3,500,000
Landson Gold Mines, Limited	Timmins	Aug. 30	3,500,000
Lapexco Gold Mines, Limited	Toronto	Apr. 11	3,000,000
Lasidon Gold Mines, Limited	Toronto	Nov. 22	3,000,000
Lassie Red Lake Gold Mines, Limited	Toronto	June 22	3,000,000
Latomic Red Lake Gold Mines, Limited	Toronto	Aug. 20	3,000,000

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorporation	Capital
Laurence-Lee Gold Mines, Limited	Toronto	Sept. 28	$5,000,000
Leader Yellowknife Gold Mines, Limited	Toronto	Sept. 20	3,000,000
Lebon Gold Mines, Limited	Toronto	Apr. 24	3,000,000
Leedoro Snow Lake Mines, Limited	Toronto	Oct. 1	3,000,000
Leemac Red Lake Mines, Limited	Toronto	Nov. 10	3,500,000
Lennie Red Lake Gold Mines, Limited	Toronto	Nov. 23	3,500,000
Lepine Lake Gold Mines, Limited	Toronto	Sept. 10	3,500,000
Lexindin Gold Mines, Limited	Toronto	Feb. 27	3,000,000
Lingkey Gold Mines, Limited	Kenora	Sept. 27	3,500,000
Lingman Lake Mines, Limited	Toronto	Feb. 9	3,000,000
Lingnora Gold Mines, Limited	Toronto	May 3	3,000,000
Lingside Gold Mines, Limited	Toronto	Oct. 20	3,500,000
Lloyd (1945) Gold Mines, Limited	Toronto	July 23	4,000,000
Lochabie Mines, Limited	Toronto	July 5	3,000,000
Lodestar Yellowknife Gold Mines, Limited	Toronto	Dec. 13	3,500,000
Loisan Red Lake Gold Mines, Limited	Toronto	Nov. 23	3,500,000
Lorie Mines, Limited	Toronto	Oct. 4	3,000,000
Louvibec Mines, Limited	Toronto	Feb. 7	3,000,000
Lucille Yellowknife Mines, Limited	Toronto	May 28	3,500,000
Ludlow Gold Mines, Limited	Toronto	Apr. 24	3,000,000
Lunday Yellowknife Mines, Limited	Toronto	Mar. 21	3,500,000
Luzon Yellowknife Gold Mines, Limited	Toronto	Apr. 25	3,000,000
Lynalda Gold Mines, Limited	Toronto	Oct. 25	3,500,000
Macbart Mines, Limited	Toronto	Aug. 31	3,000,000
Macclare Mines, Limited	Toronto	May 5	3,000,000
Macfie Red Lake Mines, Limited	Toronto	Nov. 7	3,500,000
McGinn Gold Mines, Limited	Toronto	Feb. 6	3,000,000
Mackbuck Red Lake Gold Mines, Limited	Toronto	May 1	4,000,000
MacVay Red Lake Mines, Limited	Toronto	July 11	3,000,000
Mada Yellowknife Gold Mines, Limited	Toronto	Jan. 20	3,000,000
Madonna Mines, Limited	Toronto	May 7	3,000,000
Magnor Gold Mines, Limited	Toronto	June 6	3,000,000
Magnum Gold Mines, Limited	Toronto	Mar. 16	3,000,000
Mainbreak Gold Mines, Limited	Toronto	Jan. 24	3,000,000
Malbec Gold Mines, Limited	Toronto	May 25	3,000,000
Malpich Quebec Gold Mines, Limited	Toronto	June 2	3,500,000
Manataw Gold Mines, Limited	Toronto	Aug. 16	3,000,000
Mandarin Gold Mines, Limited	Toronto	May 29	3,000,000
Manhattan Yellowknife Mines, Limited	Toronto	Jan. 26	3,000,000
Marillac Rouyn Mines, Limited	Toronto	Jan. 8	3,500,000
Marjas Red Lake Gold Mines, Limited	Toronto	May 31	3,000,000
Marshall Red Lake Mines, Limited	Toronto	Oct. 31	3,000,000
Massive Yellowknife Mines, Limited	Toronto	Mar. 15	3,000,000
Matona Golds, Limited	Toronto	July 23	3,000,000
Mayfair Mines, Limited	Toronto	May 30	3,000,000
Megiscane Mines, Limited	Toronto	Dec. 21	3,500,000
Merino Yellowknife Mines, Limited	Toronto	June 21	3,000,000
Merr Yellowknife Gold Mines, Limited	Toronto	May 2	3,000,000
Midas Gold Mines, Limited	Toronto	Mar. 23	4,000,000
Mildale Gold Mines, Limited	Toronto	Feb. 26	3,000,000
Milerlaun Rouyn Gold Mines, Limited	Toronto	May 1	3,500,000
Miles (Red Lake) Mines, Limited	Toronto	Apr. 16	3,000,000
Milo Larder Mining Syndicate, Limited	Timmins	July 3	35,000
Mining Geophysics Corporation, Limited[1]	Toronto	Aug. 14	20,000
Mink Gold Mines, Limited	Toronto	Apr. 16	3,000,000
Mirival Gold Mines, Limited	Toronto	Mar. 17	3,000,000
Mitto Pershing Mines, Limited	Toronto	Apr. 3	3,000,000
Mogul Gold Mines, Limited	Toronto	May 29	3,000,000
Moher Yellowknife Gold Mines, Limited	Toronto	Oct. 29	3,000,000
Monitor Gold Mines, Limited	Toronto	Dec. 12	4,000,000
Montdono Gold Mines, Limited	Toronto	Apr. 25	3,000,000
Morwick Mining Developments, Limited	Toronto	Apr. 30	40,000

[1]The capital of this company also includes 20,000 shares of no par value.

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorporation	Capital
Mount Cheminis (1945) Mining Company, Limited	Kirkland Lake	May 4	$3,000,000
Mozart Gold Mines, Limited	Toronto	Dec. 7	3,000,000
Murto Red Lake Mines, Limited	Toronto	Oct. 3	3,000,000
My-Ritt Red Lake Gold Mines, Limited	Toronto	Dec. 8	3,000,000
Mystery Lake Mines, Limited	Toronto	Apr. 25	3,000,000
Nareco Gold Mines, Limited	Toronto	Sept. 22	3,000,000
Narrow Lake Gold Mines, Limited	Toronto	Sept. 28	3,000,000
Natjo Gold Mines, Limited	Toronto	Dec. 6	3,000,000
Naybob (1945) Gold Mines, Limited	Toronto	Jan. 3	3,000,000
Neill Gold Mines, Limited	Toronto	Feb. 22	3,000,000
Newnorth Gold Mines, Limited	Toronto	Apr. 7	3,000,000
Norlee Red Lake Gold Mines, Limited	Toronto	Oct. 2	3,500,000
Normanco Gold Mines, Limited	Toronto	July 9	3,000,000
Norocona Gold Mines, Limited	Toronto	July 3	3,000,000
Norpick Gold Mines, Limited	Toronto	Nov. 9	3,000,000
Northern Inca Gold Mines, Limited	Toronto	Oct. 30	3,000,000
Nyco Yellowknife Mines, Limited	Toronto	July 25	3,000,000
Onwatin Placer Mining Syndicate, Limited, The	Toronto	Oct. 17	35,000
Opawica Gold Mines, Limited	Toronto	Aug. 1	3,000,000
Oren Gold Mining Syndicate, Limited	Toronto	Feb. 17	35,000
Orofino Mines, Limited	Toronto	Dec. 29	3,000,000
Osulake Mines, Limited	Kirkland Lake	Oct. 19	3,500,000
Ouillette Mines, Limited	Toronto	Apr. 14	2,000,000
Pacific (Eastern) Gold Mines, Limited	Toronto	Jan. 24	3,000,000
Packard Pershing Mines, Limited	Toronto	Mar. 26	3,000,000
Papoose Yellowknife Mines, Limited	Toronto	Jan. 17	3,000,000
Para Red Lake Mines, Limited	Toronto	Feb. 9	3,500,000
Partridge Yellowknife Mines, Limited	Toronto	Apr. 18	3,000,000
Patnora Gold Mines, Limited	Toronto	Feb. 8	3,000,000
Payne Yellowknife Gold Mines, Limited	Toronto	Jan. 15	3,000,000
Pellaire Mines, Limited	Toronto	Feb. 13	3,000,000
Penguin Yellowknife Mines, Limited	Toronto	Dec. 4	3,500,000
Penrose Gold Mines, Limited	Toronto	May 9	3,500,000
Pepmont Gold Mines, Limited	Toronto	May 22	3,500,000
Perma Gold Mines, Limited	Toronto	Jan. 8	3,000,000
Pershland Gold Mines, Limited	Toronto	Nov. 22	3,000,000
Pershon Gold Mines, Limited	Toronto	Mar. 1	3,500,000
Petitclerc Mines, Limited	Toronto	Mar. 24	3,000,000
Philmore Yellowknife Gold Mines, Limited	Toronto	Feb. 27	3,000,000
Piccadilly Porcupine Gold Mines, Limited	Toronto	June 11	4,000,000
Pierpont Gold Mines, Limited	Toronto	May 19	3,000,000
Pink Lake Mica Mines, Limited	Toronto	Sept. 20	1,000,000
Pinnacle Gold Mines, Limited	Toronto	Apr. 6	3,000,000
Piper Red Lake Mines, Limited	Toronto	June 19	3,000,000
Pitt Gold Mining Company, Limited	Toronto	Jan. 23	5,000,000
Plexore Rouyn Gold Mines, Limited	Toronto	Nov. 24	4,000,000
Pontibi Gold Mines, Limited	Toronto	Sept. 13	3,000,000
Portland Yellowknife Gold Mines, Limited	Toronto	Feb. 16	3,000,000
Primus Yellowknife Gold Mines, Limited	Toronto	Apr. 18	3,000,000
Prow Yellowknife Gold Mines, Limited	Toronto	Mar. 8	3,000,000
Quedor Mines, Limited	Toronto	Nov. 30	3,500,000
Queenston Gas and Oil Company, Limited	Toronto	May 9	200,000
Quejo Mines, Limited	Toronto	Mar. 21	3,000,000
Quesabe Mines, Limited	Toronto	July 6	3,500,000
Quest Yellowknife Mines, Limited	Toronto	Jan. 23	3,500,000
Quevay Gold Mining, Limited	Toronto	June 21	100,000
Quintal Quebec Gold Mines, Limited	Toronto	May 14	3,000,000
Quyta Yellowknife Mines, Limited	Toronto	Dec. 12	3,000,000
Quytangle Yellowknife Mines, Limited	Toronto	Dec. 28	3,000,000
Raindor Gold Mines, Limited	Toronto	June 28	3,000,000
Rainier Red Lake Gold Mines, Limited	Toronto	Aug. 7	3,000,000
Raleigh Red Lake Mines, Limited	Toronto	Sept. 13	3,000,000
Randall Yellowknife Mines, Limited	Toronto	Apr. 20	3,000,000
Ranger Red Lake Mines, Limited	Toronto	Aug. 9	3,000,000

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorporation	Capital
Ranrouyn Mines, Limited	Toronto	Nov. 15	$3,000,000
Rawn Iron Mines, Limited	Toronto	Mar. 24	3,500,000
Raybell Gold Mines, Limited	Toronto	July 19	5,000,000
Ray-Lac Gold Mines, Limited	Toronto	Mar. 22	3,000,000
Record Rouyn Mines, Limited	Toronto	May 25	3,000,000
Red Island Gold Mines, Limited	Toronto	July 30	3,000,000
Redmont Yellowknife Mines, Limited	Toronto	Feb. 27	3,000,000
Redpat Mining Syndicate, Limited	Toronto	Apr. 27	35,000
Redpointe Gold Mines, Limited	Toronto	Oct. 1	3,000,000
Redwolf Gold Mines, Limited	Toronto	June 26	3,000,000
Resenor Gold Mines, Limited	Toronto	June 11	3,000,000
Rexterra Gold Mines, Limited	Toronto	Jan. 6	3,000,000
Rey-Indin Yellowknife Mines, Limited	Toronto	Nov. 29	3,000,000
Rhynus Ramore Mines, Limited	Toronto	Nov. 22	3,000,000
Ricenor Gold Mines, Limited	Haileybury	June 8	4,000,000
Rich Group Yellowknife Mines, Limited	Toronto	Jan. 30	3,000,000
Richcour Gold Mines, Limited	Toronto	Apr. 4	3,000,000
Riverdale Gold Mines, Limited	Toronto	Apr. 24	3,000,000
Robin Red Lake Mines, Limited	Toronto	July 9	3,000,000
Rocket Indin Mining Company, Limited	Toronto	Oct. 12	3,000,000
Rockridge Gold Mines, Limited	Toronto	July 10	3,000,000
Rolland Mines, Limited	Toronto	Apr. 3	3,000,000
Ronal Red Lake Gold Mines, Limited	Toronto	June 27	3,000,000
Roulette Gold Mines, Limited	Toronto	May 11	3,000,000
Rozak Porcupine Mines, Limited	Toronto	May 15	3,000,000
Rual Porcupine Mines, Limited	Toronto	Mar. 26	3,000,000
Rugby Red Lake Gold Mines, Limited	Toronto	Mar. 8	3,000,000
Rugged Red Lake Mines, Limited	Toronto	Sept. 17	3,500,000
Rupununi Gold Mining Company (Canada), Limited, The	Toronto	Dec. 21	5,000,000
Ruscana Mines, Limited	Toronto	June 22	3,000,000
Rush Lake Gold Mines, Limited	Toronto	Feb. 23	3,000,000
Rushmore Mining Syndicate, Limited	Kenora	May 23	35,000
Russian Mining Company, Limited, The	Toronto	Mar. 14	4,000,000
Ryanor Mining Company, Limited	Toronto	Mar. 8	3,000,000
Sabourin Creek Mines, Limited	Toronto	Apr. 6	3,000,000
Sahtram Gold Mines, Limited	St. Catharines	May 29	3,000,000
St. George Red Lake Gold Mines, Limited	Toronto	Apr. 5	3,000,000
Salmita Northwest Mines, Limited	Toronto	Aug. 16	3,000,000
Samar Yellowknife Gold Mines, Limited	Toronto	July 11	3,000,000
Santa Maria Mines, Limited	Toronto	Nov. 23	2,000,000
Scar Porcupine Mines, Limited	Oshawa	Feb. 13	3,000,000
Scott Red Lake Gold Mines, Limited	Toronto	June 1	3,000,000
Sencon Gold Mines, Limited	Toronto	May 25	3,000,000
Sevcour Gold Mines, Limited	Toronto	July 23	3,500,000
Shawkey (1945) Mines, Limited	Toronto	Apr. 4	3,000,000
Silanco Mining and Refining Company, Limited	Toronto	Nov. 26	3,000,000
Silver Chief Mines, Limited	Toronto	Dec. 12	5,000,000
Silverny Gold Mines, Limited	Toronto	June 8	3,000,000
Simon Lake Mines, Limited	Toronto	Mar. 2	3,008,000
Slemon Yellowknife Mines, Limited	Toronto	Oct. 11	3,500,000
Snare River Mines, Limited	Toronto	Nov. 19	3,000,000
Snowden Yellowknife Mines, Limited	Toronto	June 14	3,000,000
Sooneyaw Gold Mines, Limited	Toronto	Jan. 9	3,000,000
South Shore Gold Mines, Limited	Toronto	June 21	3,000,000
Southvue Gold Mines, Limited	Toronto	Nov. 30	3,000,000
Sovereign Yellowknife Mines, Limited	Toronto	Apr. 30	3,000,000
Springpole Mines, Limited	Toronto	June 20	3,500,000
Star Drilling and Exploration, Limited[1]	Toronto	Nov. 14	30,000
Starcourt Gold Mines, Limited	Toronto	June 5	3,000,000
Starratt Olsen Gold Mines, Limited	Toronto	June 8	3,000,000
Stormont Gold Mines, Limited	Toronto	Apr. 3	3,000,000
Sudonta Gold Mines, Limited	Toronto	Oct. 18	3,000,000
Sunset Yellowknife Mines, Limited	Toronto	Mar. 28	3,500,000

[1]The capital of this company also includes 10,000 shares of no par value.

MINING COMPANIES WITH SPECIFIED CAPITAL INCORPORATED IN ONTARIO IN 1945—*Continued*

Name of company	Head office	Date of incorporation	Capital
Tag-Alder Mines, Limited	Toronto	Jan. 27	$5,000,000
Tanmount Larder Gold Mines, Limited	Toronto	Sept. 21	3,000,000
Tartan Lake Gold Mines, Limited	Toronto	June 29	3,000,000
Templor Mines, Limited	Toronto	Apr. 24	4,000,000
Teno-Boston Gold Mines, Limited	Toronto	July 27	3,000,000
Thormac Porcupine Mines, Limited	Toronto	Nov. 5	3,500,000
Thorn Hill Gold Mines, Limited	Toronto	Jan. 27	4,000,000
Thunderhead Gold Mines, Limited	Toronto	Dec. 27	3,000,000
Tiblemaco Gold Mines, Limited	Toronto	Nov. 30	3,500,000
Tiblemont Goldfields, Limited	Toronto	May 22	3,000,000
Ticonda Gold Mines, Limited	Toronto	June 29	3,000,000
Transbec Mining Company, Limited	Toronto	May 31	5,000,000
Transterra Mines, Limited	Toronto	Jan. 31	5,000,000
Traynor Diamond Drilling Company, Limited	Toronto	Sept. 15	40,000
Tredway Gold Mines, Limited	Toronto	June 4	3,000,000
Trimac Porcupine Gold Mines, Limited	Toronto	Dec. 28	3,000,000
Tromac Mines, Limited	Toronto	Apr. 11	3,500,000
Trueborn Gold Mines, Limited	Toronto	May 2	3,000,000
Try-Shine Gold Mining Syndicate, Limited	Toronto	July 25	35,000
Tuckahoe Gold Mines, Limited	Toronto	Apr. 24	3,000,000
Twin Fault Mines, Limited	Toronto	Mar. 23	3,000,000
Tyneside Red Lake Mines, Limited	Toronto	Dec. 11	3,000,000
Upland Mining and Exploration, Limited	Toronto	Dec. 21	500,000
Upnorth Gold Mines, Limited	Kirkland Lake	Dec. 6	3,000,000
Utah Larder Gold Mines, Limited	Toronto	Nov. 28	3,500,000
Vaisbelle Mines, Limited	Toronto	May 25	3,000,000
Valrita Mines, Limited	Toronto	July 27	3,000,000
Van Tassel Silver Mining Syndicate, Limited	Haileybury	Mar. 10	35,000
Vanacor Gold Mines, Limited	Toronto	Apr. 12	3,000,000
Vandyke Snow Lake Gold Mines, Limited	Toronto	Oct. 10	3,500,000
Vanvelsor Mines, Limited	Toronto	June 28	1,000,000
Vaqcourt Gold Mines, Limited	Toronto	June 7	3,000,000
Velvet Larder Mines, Limited	Kirkland Lake	June 8	3,000,000
Verny Gold Mines, Limited	Toronto	Nov. 24	3,000,000
Vicour Mines, Limited	Toronto	Mar. 27	5,000,000
Vilaroi Gold Mines, Limited	Toronto	Apr. 16	3,000,000
Villaur Gold Mines, Limited	Toronto	Apr. 5	3,000,000
Villbona Gold Mines, Limited	Toronto	Mar. 21	3,000,000
Villebec Gold Mines, Limited	Toronto	Oct. 1	3,500,000
Violamac Mines, Limited	Toronto	June 7	5,000,000
Vive Yellowknife Gold Mines, Limited	Toronto	Dec. 5	3,500,000
Wairiri Gold Mines, Limited	Toronto	Feb. 14	3,000,000
Waller Red Lake Mines, Limited	Toronto	Oct. 22	3,000,000
Wallingford Mining Syndicate, Limited	Timmins	Oct. 17	35,000
Wembley Gold Mines, Limited	Toronto	June 15	3,000,000
Wendmar Gold Mines, Limited	Toronto	Nov. 2	3,000,000
West Lake Mining Company, Limited	Toronto	Sept. 24	3,000,000
Westland Mining Company, Limited	Toronto	June 20	5,000,000
Westville Mines, Limited	Toronto	June 20	3,500,000
White Marl Mines, Limited	Toronto	Sept. 10	1,000,000
Wilbec Gold Mines, Limited	Toronto	June 5	3,000,000
Wilnora-Malartic Gold Mines, Limited	Toronto	May 5	3,000,000
Winora Gold Mines, Limited	Toronto	May 26	3,000,000
Wolverton Lake Gold Mines, Limited	Toronto	Mar. 22	4,000,000
Wool Bay Gold Mines, Limited	Toronto	Mar. 7	3,500,000
Wynn Yellowknife Gold Mines, Limited	Toronto	May 31	3,000,000
Wynnrock Gold Mines, Limited	Toronto	Sept. 11	3,000,000
Yalta Gold Mines, Limited	Toronto	May 5	3,000,000
Yank Yellowknife Gold Mines, Limited	Toronto	Apr. 24	3,500,000
Yellow Pan Gold Mines, Limited	Toronto	Oct. 19	4,000,000
Yeoman Gold Mines, Limited	Toronto	July 4	3,000,000
Zakor Gold Mines, Limited	Toronto	Feb. 12	3,000,000
Total (567 companies)			$1,651,580,000

MINING COMPANIES INCORPORATED IN ONTARIO IN 1945 HAVING SHARES WITHOUT NOMINAL OR PAR VALUE

Name of company	Head office	Date of incorporation	No. of shares
Abangarez Gold Mines, Limited	Toronto	June 15	3,500,000
American Nepheline, Limited	Lakefield	Jan. 24	2,500,000
Ancon Mining and Exploration, Limited	Toronto	July 13	3,000,000
Anson-Cartwright Mines, Limited	Toronto	June 7	3,000,000
Anvil Porcupine Gold Mines, Limited	Timmins	June 4	3,000,000
Apex Consolidated Resources, Limited	Toronto	June 13	5,000,000
Bancroft Feldspar Mines, Limited[1]	Hamilton	Dec. 15	50,000
Banner Porcupine Mines, Limited	Toronto	June 6	3,000,000
Bidd Yellowknife Exploration Company, Limited	Toronto	June 14	200,000
Boycon Pershing Gold Mines, Limited	Toronto	Apr. 3	3,500,000
Buckhill Minerals, Limited	Toronto	July 16	300,000
Canaska Explorers, Limited	Toronto	Aug. 24	1,000,000
Capblue Exploration, Limited	Toronto	Mar. 9	40,000
Captain Yellowknife Gold Mines, Limited	Toronto	Jan. 17	3,000,000
Chemical Lime, Limited	Hamilton	Nov. 2	10,000
Consolidated Diamond Drill Corporation, Limited	Toronto	Oct. 1	400
Continental Diamond Drilling and Exploration Company, Limited	Toronto	June 4	3,000,000
Cuagau Exploration Company, Limited	Toronto	Nov. 14	40,000
Diversified Mining Interest, Limited	Toronto	Mar. 19	3,000,000
Domnic Concentrating and Mining Corporation, Limited	Toronto	Mar. 14	1,000,000
Emjay Mines, Limited	Toronto	Jan. 23	20,000
Enrich Mines (1945), Limited	Toronto	Oct. 1	3,000,000
Ferro Chemical Industries, Limited	Toronto	July 26	3,000,000
Ford Highwood Collieries, Limited	Toronto	Nov. 13	3,000,000
Frobrican Exploration Company, Limited	Toronto	July 30	100,000
Geo-Technical Development Company, Limited	Toronto	Apr. 17	300,000
Globe Diamond Drilling Company, Limited, The[2]	Timmins	July 17	20,000
Grosse Pointe Exploration Company, Limited	Toronto	Jan. 31	3,000,000
Hill North-West Explorations and Mining, Limited	Toronto	Apr. 14	10,000
Kalbrook Mining Company, Limited	Toronto	Mar. 20	4,000,000
Kelwren Gold Mines, Limited	Toronto	May 9	4,000,000
Kingson Exploration Company, Limited	Toronto	Dec. 6	250,000
Lamarr Gold Mines, Limited	Ottawa	Apr. 17	3,500,000
Land'Or Exploration, Limited	Toronto	Mar. 19	3,000,000
Laurentian Feldspar Corporation, Limited	Ottawa	Mar. 9	1,500,000
Lynrock Oils, Limited	Hamilton	May 18	1,000,000
Macdor Quebec Mines, Limited	Toronto	Apr. 25	3,000,000
Merrex, Limited	Teck Tp.	Jan. 12	50,000
Midd-Pershing Gold Mines, Limited	Toronto	Mar. 2	3,000,000
Mining Geophysics Corporation, Limited[3]	Toronto	Aug. 14	20,000
Minor Metals, Limited	Toronto	Apr. 9	400
Mistassini Explorations, Limited	Toronto	May 10	100,000
Newfield Developments, Limited	Toronto	Jan. 20	50,000
Nugget Yellowknife Gold Mines, Limited	Toronto	May 11	3,000,000
Ralco Exploration Company, Limited	Toronto	Mar. 15	100,000
Ronayne Explorations, Limited	Toronto	Jan. 19	3,000,000
Sagaminas, Limited	Toronto	July 6	3,000,000
Seminole Exploration, Limited	Toronto	June 21	100,000
Sioux Petroleums, Limited	Toronto	Oct. 20	3,500,000
Stanmac, Limited	Toronto	Sept. 26	500,000
Star Drilling and Exploration, Limited[4]	Toronto	Nov. 14	10,000
Trident Porcupine Gold Mines, Limited	Timmins	June 4	3,000,000
Tril Pulverous Products, Limited	Toronto	Aug. 30	100,000
Welsh-Mac Mines, Limited	Toronto	Jan. 9	3,000,000
West Wasa Mines, Limited	Toronto	Mar. 21	3,000,000
Total (55 companies)			96,370,800

[1]This company also has specified capital of $50,000.
[2]This company also has specified capital of $20,000.
[3]This company also has specified capital of $20,000.
[4]This company also has specified capital of $30,000.

INCORPORATED COMPANIES WHOSE NAMES WERE CHANGED DURING 1945

New name	Old name
Abuck Gold Mines, Limited	Big-Bell Mines, Limited.
Akaitcho Yellowknife Gold Mines, Limited	Akaicho Yellowknife Gold Mines, Limited.
Blue-Chip Gold Mines, Limited	Blue-Chip Yellowknife Mines, Limited.
Cassidy Yel owknife Mines, Limited	Caen Yellowknife Mines, Limited.
Garisle Red.Lake Gold Mines, Limited	Creamar Moly Mines, Limited.
Kinart Gold Mines, Limited	Kinart Yellowknife Mines, Limited.
Lingman Lake Gold Mines, Limited	Lingman Lake Mines, Limited.
Maral Gold Mines, Limited	Lamarr Gold Mines, Limited.
Marbeau Yellowknife Mines, Limited	Red Cedar Lake Gold Mines, Limited.
Naylor Mines, Limited	Naybob Mines, Limited.
Norhill Gold Mines, Limited	Dorcana Gold Mines, Limited.
Omnitrans Exploration, Limited	Transcontinental Oil Company, Limited.
Stonada Mines, Limited	Foxright Mines, Limited.
Tanaur Yellowknife Mines, Limited	Northern Tin Mines, Limited.

Mining Revenue and Expenditures

The revenue of the Department of Mines for the fiscal year ending March 31, 1946, was $2,396,117.12, as compared with $1,821,394.37 in the previous year. Expenditures were $491,371.42. The following table gives details of the revenue for the year:—

REVENUE, DEPARTMENT OF MINES, APRIL 1, 1945, TO MARCH 31, 1946

ORDINARY:		
Licenses:		
Sand and gravel	$1,170.00	
Unwrought Metal Sales Act	111.00	
Refinery	101.00	
Miners	74,032.32	
Gas	2,380.95	
		$77,795.27
Mining claims:		
Recording fees	$148,262.66	
Abstracts and miscellaneous	8,134.24	
		156,396.90
Rentals:		
Gas leases	$14,395.00	
Mining leases	13,961.27	
Licenses of occupation	16,913.02	
		45,269.29
Royalties:		
Sand and gravel		38,600.58
Taxes:		
Acreage	$71,137.42	
Profit	1,820,834.39	
Gas	32,820.23	
		1,924,792.04
Laboratories:		
Cable-testing	$10,285.04	
Chemical and assay	2,277.88	
Sampling and assaying	21,304.23	
		33,867.15
Services:		
Blue-printing	$5,377.11	
Record books	447.75	
Sale of gold ore	7,947.44	
Miscellaneous	4,812.85	
		18,585.15
CAPITAL:		
Mining land sales		100,810.74
Total revenue		$2,396,117.12

A comparative statement of mining licenses and renewals issued, claims recorded, profit tax, and total revenue during the past five years appears on page 59.

STATEMENT OF MONIES RECEIVED FROM MINING RECORDERS FOR THE FISCAL YEAR ENDING MARCH 31, 1946

Mining division	Purchase price	Licenses of occupation	Mining leases	Blue-prints	Miscellaneous fees	Miner's licenses	Recording fees	Total
Head office	$18,354.96	$1,595.00	$100.54	$1,991.11	$319.01	$46,796.97	$9,844.81	$79,002.40
Fort Frances	2,563.58	14.38	−[1]14.38	112.75	161.00	519.00	2,353.00	5,709.33
Kenora	2,122.23	82.52	....	248.87	261.86	1,566.00	2,924.15	7,205.63
Larder Lake	26,664.52	382.93	....	753.55	1,034.53	5,535.00	27,516.25	61,886.78
Montreal River	347.86	....	1,205.85	195.75	467.08	1,661.00	8,497.00	12,374.54
Porcupine	13,627.38	81.07	102.01	411.25	1,037.56	3,819.00	17,008.45	36,086.72
Kowkash and Port Arthur	4,885.83	281.61	550.01	439.25	889.62	2,641.00	16,350.00	26,037.32
Red Lake	19,324.14	584.30	30.78	443.13	2,321.45	4,785.00	30,071.00	57,559.80
Sault Ste. Marie	2,017.38	342.41	....	98.75	274.70	1,210.00	3,399.00	7,342.24
Sudbury	9,387.42	569.02	403.00	549.50	1,035.60	3,869.00	23,866.00	39,679.54
Timiskaming	1,515.44	17.54	159.55	133.20	331.83	1,630.35	6,433.00	10,220.91
Total	$100,810.74	$3,950.78	$2,537.36	$5,377.11	$8,134.24	$74,032.32	$148,262.66	$343,105.21

[1]Amounts received in previous years and credited to mining leases were later transferred to the credit of licenses of occupation, resulting in a net debit of $14.38 in the former account.

MINING CLAIMS RECORDED IN THE SEVERAL MINING DIVISIONS, 1907 AND 1926–1945

Mining division	1907	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
Coleman[1]	291	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Fort Frances	....	....	....	....	70	75	175	98	137	313	237	198	292	342	258	166	145	265	130	124	261
Gowganda[2]	....	96	24	40	34	244	377	114	122	207	205	....	....	....	....	....	....	....	....	....	....
Kenora	....	935	140	520	348	194	109	203	329	933	874	1,773	1,161	252	347	234	114	55	213	884	363
Kowkash[3]	....	28	250	368	319	12	56	40	84	231	84	153	143	70	55	37	19	29	27	17	....
Larder Lake	3,813	1,532	3,141	1,781	891	424	628	790	1,730	2,611	1,258	1,982	3,567	1,562	1,209	609	639	489	1,291	3,036	2,807
Montreal River	866	290	126	156	48	661	1,127	156	444	627	276	380	292	204	242	206	106	167	275	1,266	721
Parry Sound[4]	102	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Porcupine	....	1,297	3,127	611	650	135	307	387	613	785	729	2,443	1,720	1,216	731	539	529	439	477	1,739	1,999
Port Arthur	317	1,278	982	1,269	691	338	609	475	900	6,842	1,815	3,420	1,983	1,319	648	965	491	482	496	999	1,734
Red Lake	....	5,827	2,018	1,100	973	305	298	185	343	1,036	754	2,045	1,600	826	710	225	586	61	281	2,044	3,230
Sault Ste. Marie	291	395	735	702	487	318	276	92	450	532	429	1,076	1,023	698	280	260	345	381	677	424	370
Sudbury	456	1,367	3,351	6,424	2,164	807	1,597	1,986	2,362	1,549	2,013	1,540	1,814	1,840	1,508	702	667	676	893	1,592	2,824
Timiskaming	7,860	438	875	499	346	202	78	63	256	688	290	745	512	379	227	155	141	260	254	327	796
At Toronto	....	203	795	1,576	1,186	171	142	356	307	534	476	1,540	1,185	339	557	1,051	799	331	263	381	1,257
Total	13,996	13,496	15,564	15,046	8,207	3,886	5,779	4,945	8,077	16,888	9,440	17,295	15,292	9,047	6,772	5,149	4,581	3,635	5,277	12,833	16,362

[1]Joined with Timiskaming since 1911. [2]Joined with Montreal River in 1936.
[3]In 1945 the records for Kowkash were transferred to Port Arthur, and their figures are combined.
[4]The office at Parry Sound was closed in 1921, and records are now kept at the Department of Mines, Toronto.

SUMMARY OF BUSINESS TRANSACTED IN THE SEVERAL MINING DIVISIONS DURING 1945

Schedule item	Fort Frances	Sudbury	Porcupine	Larder Lake	Sault Ste. Marie	Port Arthur and Kowkash	Timiskaming	Montreal River	Kenora	Red Lake	Total
1. Letters received	993	5,884	4,641	3,448	2,434	1,745	1,195	1,147	2,211	4,500	28,198
2. Letters written	1,055	5,138	4,039	4,135	2,250	1,903	970	1,316	2,873	4,350	28,029
3. Miner's Licenses issued[1]	33	403	333	435	110	336	112	82	168	466	2,478
4. Miner's Licenses renewed	60	289	433	497	125	320	136	128	182	318	2,488
5. Mining claims recorded[2]	261	2,824	1,999	2,807	370	1,734	796	721	363	3,230	15,105
6. Mining claims cancelled	71	706	528	566	275	444	150	307	494	116	3,657
7. Agreements, transfers, etc., recorded	283	1,349	2,327	1,698	226	1,013	373	500	216	2,358	10,343
8. Receipts for Miner's Licenses, Permits, Recording Fees, etc.	$2,917.29	$22,847.55	$22,093.84	$27,678.67	$4,628.37	$17,031.39	$6,633.31	$7,259.19	$4,417.42	$30,477.15	$145,984.18
9. Receipts as Purchase Money or Rental	$1,270.15	$7,248.58	$13,545.75	$23,403.93	$2,849.35	$9,184.73	$1,768.57	$802.47	$1,890.57	$16,880.81	$78,844.91
10. Total remitted to Department	$4,187.44	$30,096.13	$35,639.59	$51,082.60	$7,477.72	$26,216.12	$8,401.88	$8,061.66	$6,307.99	$47,357.96	$224,829.09
11. Claims of which surveyors' plans were filed	67	85	92	67	22	84	13	14	3	188	662
12. Disputes entered	....	9	2	19	....	5	2	....	....	21	58
13. Disputed cases decided by Recorders	....	1	....	....	....	4	....	....	....	4	9
14. Appeals to Mining Court	....	....	....	....	....	....	....	....	....	17	17
15. Extension of time granted	514	3,125	3,709	859	1,003	2,763	437	1,172	1,141	709	25,432
16. Certificates of Record granted	12	69	106	213	29	84	24	17	20	223	797
17. Certificates of Performance of Work granted	14	69	141	238	29	89	21	17	20	152	790
18. Claims for which papers were forwarded to the Department for issue of title	10	66	127	187	29	84	26	5	20	158	712
19. Substitute Miner's Licenses issued	....	7	4	7	1	9	5	3	7	10	53
20. Abstracts issued	696	2,573	3,915	3,749	1,440	2,426	667	1,236	467	5,196	22,365
21. Blue-prints sold	176	1,846	1,530	2,489	337	1,203	379	553	536	1,225	10,274

[1]Miner's licenses issued and renewed at the Department in Toronto were 2,130, making a total of 7,096 for the Province, as compared with 4,234 in 1941, 4,402 in 1942, 3,314 in 1943, and 5,607 in 1944.

[2]In addition, the claims recorded at the Department of Mines in Toronto were 1,257, making a total of 16,362 for the Province, as compared with 4,254 in 1941, 3,593 in 1942, 5,232 in 1943, and 12,527 in 1944.

The following is a comparative statement of mining licenses and renewals issued, claims recorded, profit tax, and total revenue during the past five years:—

PROSPECTING ACTIVITY, PROFIT TAX, AND TOTAL REVENUE, 1941–1945

Year	Calendar year				Fiscal year	
	New miner's licenses issued	Miner's licenses renewed	Total licenses and renewals	Mining claims recorded	Profit tax	Total mining revenue
1941	1,009	3,225	4,234	4,254	$2,392,285.97	$2,772,302.07
1942	1,178	3,224	4,402	3,593	2,263,698.72	2,596,649.19
1943	1,341	2,073	3,414	5,232	1,850,628.30	2,192,739.88
1944	2,734	2,873	5,607	12,527	1,422,297.53	1,821,394.37
1945	3,275	3,821	7,096	16,362	1,834,335.61	2,396,117.12

The following statement, prepared by the Accounts Branch of the Department, gives details of the profit tax as assessed by A. R. Crozier, Mine Assessor, for the fiscal year ending March 31, 1946.

DETAILS OF PROFIT TAX

Gold:		
Aunor Gold Mines, Limited	$29,485.21	
Bidgood Kirkland Gold Mines, Limited	84.58	
Central Patricia Gold Mines, Limited	2,584.89	
Coniaurum Mines, Limited	2,907.46	
Dome Mines, Limited	56,468.41	
Hallnor Mines, Limited	17,789.40	
Hollinger Consolidated Gold Mines, Limited	17,966.01	
Kirkland Lake Gold Mining Company, Limited	885.52	
Lake Shore Mines, Limited	43,528.57	
Leitch Gold Mines, Limited	7,290.24	
Macassa Mines, Limited	6,129.46	
McIntyre Porcupine Mines, Limited	61,377.93	
Madsen Red Lake Gold Mines, Limited	5,284.19	
Pamour Porcupine Mines, Limited	621.96	
Paymaster Consolidated Mines, Limited	917.25	
Pickle Crow Gold Mines, Limited	16,154.32	
Preston East Dome Mines, Limited	5,120.16	
Sylvanite Gold Mines, Limited	6,392.14	
Teck-Hughes Gold Mines, Limited	2,791.52	
Upper Canada Mines, Limited	5,101.13	
Wright-Hargreaves Mines, Limited	42,198.86	
Young-Davidson Mines, Limited	3,944.43	
		$335,023.64
Nickel-Copper:		
Falconbridge Nickel Mines, Limited	$22,261.13	
International Nickel Company of Canada, Limited	1,458,661.03	
		1,480,922.16
Iron:		
Algoma Ore Properties, Limited		11,718.33
Silver-Cobalt:		
Cross Lake Lease		1,308.45
Mica:		
Purdy Mica Mines, Limited		5,363.03
Total		$1,834,335.61

The amount of profit tax shown in the revenue statement on page 56 is $1,820,834.39, which is $13,501.22 less than the amount shown above. The difference is brought about by refunds of tax paid in previous years.

The amounts shown for licenses of occupation and mining leases are respectively $12,962.24 and $11,423.91 less than shown in the revenue statement. The differences in both cases are annual rentals collected by the Accounts Branch.

Provincial Assay Office

As an aid in the development of the mineral resources of Ontario, the Government established a Provincial Assay Office in Belleville in 1898. This was for the purpose of making assays of the various ores found in the Province and to assist the prospector in the development of claims. This office is now established in the East Block of the Parliament Buildings, Toronto.

The Provincial Assayer and Chemist, D. A. Moddle, reports as follows:—

ASSAY RETURNS FOR 1945

Assays for	Free assays under Mining Act	General custom work	Departmental work	Total
Gold	1,945	899	155	2,999
Silver	164	71	23	258
Copper	97	43	6	146
Lead	11	2	7	20
Zinc	22	7	1	30
Nickel	35	24	2	61
Iron	13	23	7	43
Cobalt	11	3	1	15
Molybdenum	9	....	....	9
Platinum	14	4	....	18
Tungsten	7	2	3	12
Silica	....	7	6	13
Sulphur	....	2	....	2
Titanium	1	....	1	2
Arsenic	2	....	....	2
Chromium	3	3	1	7
Tin	10	6	....	16
Uranium	....	1	....	1
Miscellaneous	3	12	32	47
Total	2,347	1,109	245	3,701

Identifications were reported on 280 rocks and minerals. In numerous cases samples were brought directly to the Laboratory and identifications given "over the counter." No record was kept of these.

One complete rock analysis was made.

The fees received for custom work amounted to $1,975.35.

A comparative statement of work done during the years 1943, 1944, and 1945 follows:—

	1943	1944	1945
Free coupon samples	1,218	2,002	2,347
Custom work samples	1,063	843	1,109
Departmental samples	231	125	246
Identifications	196	174	280
Total	2,708	3,144	3,982
Fees received for custom work	$2,045.30	$1,590.35	$1,975.35

There has been a marked increase in the number of assays made and in the number of free assay coupons used.

Free assays may be obtained as provided by the Mining Act of Ontario, R.S.O. 1937, Chapter 47, section 67, as amended in 1943, as follows:—

Every licensee who stakes out and records a mining claim shall be given by the recorder two free assay coupons on recording it and two additional free assay coupons on recording each forty days' work thereafter, and on forwarding or delivering, charges prepaid, samples from the mining claim to the Provincial Assayer, Toronto, together with the required number of coupons, he shall be entitled to have such samples assayed without charge.

Some assays require one coupon in payment, and some require two or more, as indicated on the coupons now being distributed. The number of coupons received during 1945 was 2,549, an increase of 402 from the total of 1944.

Minerals and rocks not requiring chemical analysis are identified free of charge, and tests for radioactivity are also free. All other work requires a fee, as outlined in the schedule of charges of this Department.

In connection with the "Sulphur Fumes Investigation in the Sudbury Area," by agreement with the Department of Lands and Forests and in collaboration with the Sulphur Fumes Arbitrator, Department of Mines, work was begun in 1944 on determinations for sulphur on a large number of samples of pine, birch, and poplar leaves. In 1945 approximately 600 determinations of total sulphur and moisture were made.

LIST OF QUARRIES AND WORKS FOR STRUCTURAL MATERIALS AND CLAY PRODUCTS, 1945

STRUCTURAL MATERIALS

Company	Location	Manager	Address
CEMENT			
Canada Cement Co., Ltd.	Thurlow tp., Hastings co.; Humberstone tp., Welland co.		Box 290, Station B, Montreal, Que.
St. Mary's Cement Co., Ltd.	St. Marys		357 Bay St., Toronto.
LIME			
Bell, Cecil	Lot 23, con. XII, Sullivan tp., Grey co.		R.R. 4, Chesley.
Brunner Mond Canada, Ltd.	Anderdon tp., Essex co.		Bank of Commerce Bldg., Toronto.
Canada and Dominion Sugar Co., Ltd.	Chatham; Wallaceburg		Chatham.
Canadian Gypsum Co., Ltd.	Guelph tp., Wellington co.	B. S. Barns	170 Bloor St. W., Toronto.
Carleton Lime Products, Ltd.	Lot 8, con. IV, Ramsay tp., Lanark co.	S. J. Neilson	Box 26, Carleton Place.
Chemical Lime Co., Ltd.	Con. III, Oxford co.	J. D. Campbell	Beachville.
Gypsum, Lime and Alabastine, Canada, Ltd.	Beachville; Lots 3 and 4, con. VI, VII, Nassagaweya tp., Halton co.; Glen Christie		Paris.
Jamieson Lime Co.	Renfrew		Renfrew.
North American Cyanamid, Ltd.	Niagara Falls		Fourth Avenue, Niagara Falls.
Rockwood Lime Co.	Con. V, Eramosa tp., Wellington co.		Box 46, Rockwood.
Shane Lime and Charcoal Co., Ltd.	Grattan tp., Renfrew co.		Eganville.
SAND AND GRAVEL (LICENSED DREDGING OPERATORS)			
Beach, Norman	Beach operation		Sherkston.
Dobie, Mrs. Draper	Beach operation		Box 300, Port Colborne.
Farrell, E., and Beammer, J.	Beach operation		Grimsby.
Harwich, Municipality of the Township of	Beach operation		Blenheim.

Hill, Walter E.	Beach operation		Box 243, Merlin.
McGovern, C. L.	Beach operation		Olean, N.Y.
McLean, A. B., and Son	Lake Superior		Brock St., Sault Ste. Marie.
Malahide, Township of	Beach operation		Aylmer.
Morris, Philip R.	Beach operation		26 John St. N., Hamilton.
National Sand and Material Co., Ltd.	Lakes Ontario, Erie, and Huron		402 Harbour Commission Bldg., Toronto.
Neff, Robert, and Creighton	Beach operation		Port Colborne.
Nicholson Transit Co., Ltd.	St. Clair river		P. O. Box 66, River Rouge 18, Mich.
Sarnia Board of Parks Management	Beach operation		184½ N. Front St., Sarnia.
Scott, T. J.	Lake Superior		489 Bay St., Sault Ste. Marie.
United Towing and Salvage Co., Ltd.	Lake Superior		635 Common St., Montreal, Que.

SAND AND GRAVEL[1] (PIT OPERATIONS)

A. E. Jupp Construction Co., Ltd.	Medonte tp., Simcoe co.		56 Blake St., Toronto.
C. Smythe, Limited	Mount Dennis		Box 8, Postal Sta. D, Toronto.
Coleman, Gordon T.	Moulinette		235 Sidney St., Cornwall.
Consolidated Sand and Gravel, Ltd.	Waterford Fuller Paris		402 Harbour Commission Bldg., Toronto.
Cooper, Alfred, and Co.	Lot 8, con. A, Paipoonge tp., Thunder Bay dist.	Alfred Cooper	212 N. May St., Fort William.
Curran and Briggs, Ltd.	Bancroft, Hagar, Gravenhurst, Burwash, and Whitefish.		61 Haverson Blvd., Toronto.
Dibblee Construction Co., Ltd.	Charlotteburgh tp., Glengarry co.		248 Albert St., Ottawa.
Ellins Brothers	Toronto		304 Scarlett Rd., Toronto.
Fewster, Stanley	Lot 29, con. VIII, E. Nissouri tp., Oxford co.		R.R. 4, St. Marys.
Forwell Sand and Gravel, Ltd.	Waterloo		31 Whitney Place, Kitchener.
Foster, R. R.	Britannia Heights		86 Spadina Ave., Ottawa.
Foy, George C.	Lot 13, range III, Mosa tp., Middlesex co.		R.R. 2, Wardsville.
Fraser, Brace, Limited	Buchanan tp., Renfrew co.		360 St. James St. W., Montreal, Que.
Gauthier, J. T.	Whitney tp., Cochrane dist.	G. C. Gauthier	Porcupine.
Goodreau, Charles E., Estate of	Harwich tp., Kent co.		R.R. 3, Northwood.
Grandmaitre, Donat	Rockcliffe		71 Montreal Rd., Eastview.
Guelph Sand and Gravel, Ltd.	Guelph tp., Wellington co.		Inkerman St., Guelph.
Highland Creek Sand and Gravel, Ltd.	Highland Creek		Highland Creek.
Hollinger Consol. Gold Mines, Ltd.	Tisdale tp., Cochrane dist.		Timmins.
Howard Sand and Gravel Co., Ltd.	Lot 7, con. I, E. Flamborough tp., Wentworth co.		Aldershot.

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

Company	Location	Manager	Address
SAND AND GRAVEL—Pit Operations—*Continued*			
Kingston Sand and Gravel, Ltd.	R.R. 5, Kingston		235 Wellington St., Kingston.
Quigley's Foundry Sands	Waterdown		Bartonville.
Speiran, George A.	Lot 28, con. XIV, Grey tp., Huron co.		R.R. 2, Brussels.
Spratt, G. H.	Gloucester tp., Carleton co.		Billing's Bridge.
Wm. R. Barnes Co., Ltd.	Waterdown		243 Cumberland Ave., Hamilton.
Woollatt Fuel and Supply Co., Ltd.	Leamington		2171 Ottawa St., Walkerville.
Yundt, William	Ellice tp., Perth co.		29 Downie St., Stratford.
SAND-LIME BRICK			
Harbour Brick Co., Ltd.	Toronto		565 Fleet St. W., Toronto.
Toronto Brick Co., Ltd.	Toronto		897 Bay St., Toronto.
STONE (Granite and Trap)			
Building Products, Ltd.	Havelock (crushing plant)	H. Michaelson	Box 6063, Montreal, Que.
	Madoc	A. G. de Wolfe	
City of Fort William Corporation	Fort William	City Engineer	City Hall, Fort William.
Curran and Briggs, Ltd.	Kohler tp., Cochrane dist.		61 Haverson Blvd., Toronto.
Hewitson Construction Co., Ltd.	McIntyre tp., Thunder Bay dist.		509 Public Utilities Bldg., Port Arthur.
Ontario Rock Co., Ltd.	Lots 6 and 7, con. VI, Belmont tp., Peterborough co.	H. L. Scott	2 College St., Toronto.
STONE (Limestone and Marble)			
Bonter, W. F.	Malone		Malone.
Bonter Marble and Calcium Co., Ltd.	Lot 9, con. X, Marmora tp., Hastings co.	J. W. Bonter	Box 61, Marmora.
Brunner Mond, Canada, Ltd.	Anderdon tp., Essex co.	R. G. Zimmer	Bank of Commerce Bldg., Toronto.
Canada and Dominion Sugar Co., Ltd.	Brockville		Chatham.

Canada Cement Co., Ltd.	Thurlow tp., Hastings co.	J. H. Legate	Box 290, Station B, Montreal, Que.
Canada Crushed Stone, Ltd.	Hagersville	G. R. Gilbertson	Sun Life Bldg., Hamilton.
	Dundas	R. W. Cunningham	
Carleton Lime Products Co.	Ramsay tp., Lanark co.		Box 26, Carleton Place.
Chemical Lime Co., Ltd.	Beachville		Beachville.
Chem-Ore Mines, Ltd.	Bobcaygeon	O. N. Spiers	156 Yonge St., Toronto.
Cook, J. S.	Lot 7, con XXIV, Amabel tp., Bruce co.		Wiarton.
Gypsum, Lime and Alabastine, Canada, Ltd.	Lots 3 and 4, con. VI and VII, Nassagaweya tp., Halton co.	R. S. Adams	Paris.
	Glen Christie	J. J. Power	
	Beachville	T. F. Robinson	
Hagersville Quarries, Ltd.	Hagersville	J. S. Beck	Hagersville.
Haldimand Quarries and Construction, Ltd.	Hagersville	C. F. Anderson	137 Wellington St. W., Toronto.
Jamieson Lime Co.	Renfrew	J. A. Jamieson	Renfrew.
Johnson Bros. Co., Ltd.	Lot 7, con. III, Walpole tp., Haldimand co.		37 Market St., Brantford.
Kingston Penitentiary	Portsmouth	C. Foley	Box 22, Kingston.
Kirkfield Crushed Stone, Ltd.	Kirkfield	J. Barker	2700 Dufferin St., Toronto.
Lapierre, M. C.	Owen Sound		1949 8th Ave., Owen Sound.
Limestone Products, Ltd.	Orillia tp., Simcoe co.	F. Latondresse	1109 Millwood Rd., Toronto.
McDonald, A. G.	Bronte		Bronte.
McGinnis and O'Connor	Pittsburgh tp., Frontenac co.	T. A. McGinnis	394 King St. E., Kingston.
Marlhill Mines, Ltd.	Marlbank	W. H. Hubbard	Allenburg Rd., Thorold.
Noranda Mines, Ltd.	Haileybury		Royal Bank Bldg., Toronto.
North American Cyanamid, Ltd.	Ingersoll		Niagara Falls.
Queenston Quarries, Ltd.	near St. David's	A. Michie	Sun Life Bldg., Hamilton.
R. E. Law Crushed Stone, Ltd.	Port Colborne	R. E. Law	Port Colborne.
Stockloser, K., Marble Quarries	Eldorado and Madoc		Madoc.
Town of Pembroke	Pembroke	Town Engineer	Pembroke.
Verona Rock Products, Ltd.	Verona	C. H. Dann	330 Bay St., Toronto.
Walker Brothers	Stamford tp., Welland co.	J. G. Walker	Box 586, Thorold.
Welland Canals, Department of Transport	Welland canal		St. Catharines.
Welland Crushed Stone and Building Co., Ltd.	Stamford tp., Welland co.	A. Kovacs	R.R. 2, Niagara Falls.
White Star Mines	Haliburton	P. H. Bolender	Haliburton.

STONE (SANDSTONE)

Campbell Sandstone Quarries, Ltd.	Bell's Corners	A. Campbell	Box C19, Westboro'.
Corner, Austin	Inglewood		Inglewood.
Martin, E.	Glen Williams		Glen Williams.
Norton, A. W.	Limehouse		Limehouse.
Sinfield, E. W.	Terra Cotta		Terra Cotta.
Sykes Quarries	Georgetown	Thos. Sykes	Georgetown.

CLAY PRODUCTS

Company	Location	Manager	Address
Brampton Pressed Brick Co., Ltd.	Chinguacousy tp., Peel co.		Main St. N., Brampton.
Broadwell, B.	Lot 12, con. IV, Gosfield S. tp., Essex co.		Kingsville.
Canadian Pressed Brick Co., Ltd.	Hamilton		Kenilworth Ave. S., Hamilton.
Central Tile Brick Corp., Ltd.	Tilbury		Tilbury.
Construction Materials, Ltd.	Lot 7, con. II, Etobicoke tp., York co.	F. N. Booth	Drawer 70, New Toronto.
Cooksville Co., Ltd.	Cooksville		46 Bloor St. W., Toronto.
Coultis, Geo., and Son	Lot 23, con. III, Bosanquet tp., Lambton co.		Thedford.
Curtin, Frank, Estate of	Lot 15, con. V, Ops tp., Victoria co.	John Curtin	R.R. 4, Lindsay.
Curtis Bros.	Lot 32, con. XII, Otonabee tp., Peterborough co.		Box 809, Peterborough.
Deller, Albert, and Son	Dereham tp., Oxford co.	Edward Deller	Brownsville.
Dochart Brick, Tile and Terra Cotta Works	Arnprior		Arnprior.
Donaldson, Thomas G.	Lot 19, con XIV, Culross tp., Bruce co.		R.R. 1, Greenock.
E. and E Seegmiller, Ltd.	Kitchener		525 Wendell Ave., Kitchener.
Elliott, James, Jr.	Korah tp., Algoma dist.		519 Wellington St. W., Sault Ste. Marie.
Elliott, Wm. J.	Lot 11, con. I, Culross tp., Bruce co.		R.R. 1, Glenannan.
F. B. McFarren, Ltd.	Streetsville		120 Wellington St. W., Toronto.
Fletcher Brick and Tile	Lot 1, con. VIII, Tilbury E. tp., Kent co.		Fletcher.
Foster Pottery Company	Hamilton		Main and Frid Sts., Hamilton.
Fred. W. Howlett and Sons, Ltd.	Petrolia		Box 849, Petrolia.
Frid Bros., Ltd.	Hamilton		790 Main St. W., Hamilton.
Hamilton Pressed Brick Co., Ltd.	Wentworth co.		211 Kensington Ave. S., Hamilton.
Hill, A. W., and Sons	Lot 15, con. XIII, Tilbury E. tp., Kent co.		R.R. 1, Coatsworth.
Huntsville Brick Works	Lot 8, con. I, Chaffey tp., Muskoka dist.		Box 219, Huntsville.
Interprovincial Brick Co., Ltd.	Chinguacousy tp., Peel co. Lots 1-46, Nassagaweya tp., Halton co.		46 Bloor St. W., Toronto.
Jas. Cornhill Sons, Ltd.	Harwich tp., Kent co.	John F. Cornhill	Chatham.
Koebel Bros.	Lot 2, con. VII, Wellesley tp., Waterloo co.	Charles Koebel	Box 3, St. Clements.
Lindsay, Earl, and Sons	Lot 24, con. II, and lot 23, con. III, Chatham gore, Kent co.	Geo. C. Lindsay	R.R. 2, Wallaceburg.
McFarlane, W. J.	Bosanquet tp., Lambton co.		Forest.
Martin, Amos C.	Lot 20, con. I, Peel tp., Wellington co.		R.R. 3, Wallenstein.
Milton Brick Co., Ltd.	Lot 1, con. I and II, Esquesing tp., Halton co.		170 Bloor St. W., Toronto.
Napanee Brick and Tile Works	Lot 13, con. VI, N. Fredericksburgh tp., Lennox and Addington co.	R. L. Chapman	R.R. 3, Napanee.

National Fire Proofing Co. of Canada, Ltd.	Lot 10, con. I, E. Flamborough tp., Wentworth co.		57 Bloor St. W., Toronto.
National Sewer Pipe Co., Ltd.	Lots 2, 3, 4, con. II, E. Flamborough tp., Wentworth co.		Aldershot.
	Swansea		
Norwich Brick and Tile Works	Lots 11 and 12, con. III, N. Norwich tp., Oxford co.		R.R. 2, Norwich.
Ontario Reformatory	Etobicoke tp., York co.	J. R. Elliott	Dept. Prov. Sec., Reformatories and Prisons Branch, Parliament Bldgs., Toronto.
Ottawa Brick and Terra Cotta Co., Ltd.	Billing's Bridge		Billing's Bridge.
Owen Sound Brick Co., Ltd.	Owen Sound		928 Second Ave. E., Owen Sound.
Paxton, Fred R.	St. Catharines		70 Herrick Ave., St. Catharines.
Phinn Brick Co.	London tp., Middlesex co.		238 Briscoe St., London.
Phippen and Son	East York		390 Dawes Road, Toronto.
Sproat and Sproat	Lot 6, con. IV, Tuckersmith tp., Huron co.	Wm. M. Sproat	R.R. 4, Seaforth.
Superior Brick and Tile Co., Ltd.	Lots 11 and 12, con. I, Paipoonge tp., Thunder Bay dist.		426 Victoria Ave., Fort William.
Taylor Bros.	Thorah tp., Ontario co.		Beaverton.
Thomson, Ralph	Lot 24, con. VIII, Grey tp., Huron co.		R.R. 4, Atwood.
Toronto Brick Co., Ltd.	Greenwood Ave., Toronto		897 Bay St., Toronto.
	Lots 13 and 14, con. II, York tp., York co.		
Wallace, R., and Son	Widdifield tp., Nipissing dist.	R. K. Wallace	92 First Ave. E., North Bay.
Wm. R. Barnes Co., Ltd.	Waterdown		243 Cumberland Ave., Hamilton.
Wright, F. M.	Lot 7, Tilbury W. tp., Essex co.		Comber.

MINING ACCIDENTS IN 1945

By

Chief Inspector of Mines, W. O. Tower, Toronto; Inspectors, R. L. Smith, Kencra; W. E. Bawden, Port Arthur; D. F. Cooper, Sudbury; J. B. Taylor, L. K. Walkom, E. S. Little, Kirkland Lake; E. B. Weir, Timmins; D. P. Douglass, J. L. Ward, Toronto.

Accidents during 1945

During the year 1945 at the mines, metallurgical works, quarries, and clay, sand, and gravel pits regulated by the Mining Act there were 2,067 accidents to employees reported to the Department of Mines up to January 16, 1946. Forty-one fatalities, arising out of 25 separate accidents, and 2,026 non-fatal accidents were recorded. There was an average of 27,052 persons employed throughout the year.

The returns represent a decrease of 103 (4.5 per cent.) in the total number of accidents reported and an increase of 9 in the number of fatalities recorded over the preceding year. The number of accidents involving fatalities is 25, which is 6 less than the preceding year. There were 23 accidents in which one man was killed, one accident in which 2 men were killed, and one accident in which 16 men were killed.

The report shows a fatality rate of 1.52 persons killed per thousand persons employed, which is an increase of 0.4 per thousand over the preceding year and is 0.47 per thousand lower than the average for the last 25 years.

There were 75 non-fatal accidents per thousand persons employed, which is a decrease of 4 (5 per cent.) from the rate of 1944 and is 19 lower than the average for the last 25 years.

The percentage of non-fatal accidents followed by infection increased from 4.1 in 1944 to 6.5 in 1945.

The employment figures show a decrease from 1944 in all branches of the industry.

In December, the Orders-in-Council issued in 1942 under the authority of The War Measures Act, Chapter 206, Revised Statutes of Canada, 1927, which permitted the employment of women at certain occupations on surface at mines, were rescinded. The situation reverts to that existing before the war, when no women other than those engaged in technical, clerical, or domestic capacities could be employed in or about a mine.

Fatal Accidents

A comparison of fatal accidents for the past five years is given below:—

Distribution	1941	1942	1943	1944	1945
Mines, underground	50	27	21	22	17
Mines, surface	2	5	5	4	4
Metallurgical works	6	5	5	3	2
Quarries	....	5	1	1	2
Clay, sand, and gravel pits	3	3	2	1	0
Contract diamond-drilling	1	....	....	....	0
Total	62	45	34	31	25

ANALYSIS OF FATALITIES AT MINES, 1941-1945

Cause	1941	1942	1943	1944	1945
	per cent.	per cent.	per cent.	per cent.	per cent.
Fall of ground	27	43	41	33	14
Rock burst	6	8	....	4	0
Run of ore or rock	11	14	7	8	14
Shaft accidents	13	8	4	....	47
Explosives	13	....	15	14	3
Miscellaneous, underground	25	13	15	26	11
Surface	5	14	18	15	11

By months the fatal accidents occurred as follows:—

Month	No. accidents	No. men killed
January	4	4
February	4	19
March	1	1
April	2	2
May	3	3
June	2	3
July	0	0
August	2	2
September	1	1
October	3	3
November	2	2
December	1	1
Total	25	41

Classifying the fatalities according to industries gives the following:—

Gold mines	28
Nickel mines	5
Iron mines	3
Metallurgical works	3
Quarries	2
Total	41

The comparative fatality rate per thousand persons employed at mines metallurgical works, quarries, and clay, sand, and gravel pits is as follows:—

	Persons employed[1]			No. killed			Rate per thousand
	Men	Women	Total	Men	Women	Total	
Mines[2]	17,944	292	18,236	36	....	36	1.97
Metallurgical works	7,059	568	7,627	3	....	3	.39
Quarries	782	12	794	2	....	2	2.52
Clay, sand, and gravel pits	389	6	395	......	....	......	....
Total	26,174	878	27,052	41	....	41	1.52

[1]Average number for year.
[2]Includes contract diamond-drilling at mines.

The ages of the persons killed were as follows:—

17-20	21-25	26-30	31-35	36-40	41-45	46-50	Over 50	Total
4	6	3	3	5	10	5	5	41

The occupations of the persons killed at mines, metallurgical works, quarries and clay, sand, and gravel pits are set out in the following table:—

Occupation	Men	Women	Total
Block-holer	1	....	1
Cagetender	3	....	3
Carpenter boss	1	....	1
Chute blaster	2	....	2
Chute puller	1	....	1
Deckman	1	....	1
Drill helper	1	....	1
Driller	11	....	11
Hoistman (underground)	1	....	1
Labourer (surface)	4	....	4
Mechanical-loader operator	1	....	1
Pit foreman	1	....	1
Sampler	2	....	2
Shaftman	1	....	1
Shoveller	3	....	3
Timberman	4	....	4
Truck driver	1	....	1
Welder	2	....	2
Total	41	....	41

Summary of Fatal and Non-fatal Accidents

The following table is a summary for the past twenty-five years of the number of persons injured per thousand employed at mining operations:—

TABLE OF ACCIDENTS TO EMPLOYEES IN MINES, METALLURGICAL WORKS, QUARRIES, AND CLAY, SAND, AND GRAVEL PITS, 1921–1945

Year	Persons injured			Persons employed at all operations			Persons injured per 1,000 employed	
	Fatally	Non-fatally	Total	Producing operations	Non-producing operations	Total	Fatally	Non-fatally
1921	24	1,262	1,286	8,436	1,000	9,436	2.54	140
1922	30	1,398	1,428	9,500	1,500	11,000	2.72	127
1923	30	2,120	2,150	10,500	1,500	12,000	2.5	177
1924	40	2 130	2,170	11,000	1,500	12,500	3.2	170
1925	42	2,224	2,266	11,500	1,500	13,000	3.23	171
1926	32	2,220	2,252	11,500	1,500	13,000	2.46	171
1927	33	2,244	2,277	13,311	2,000	15,311	2.1	147
1928	85	2,516	2,601	15,787	2,000	17,787	4.76	142
1929	55	2,389	2,444	17,145	1,849	18,994	2.89	126
1930	56	2,167	2,223	18,217	317	18,534	3.02	117
1931	37	1,813	1,850	17,820	447	18,267	2.03	99
1932	25	1,452	1,477	14,378	431	14,809	1.69	98
1933	25	1,514	1,539	15,080	804	15,884	1.57	95
1934	34	1,913	1,947	19,302	1,254	20,556	1.65	93
1935	36	2,048	2,084	21,444	1,528	22,972	1.57	89
1936	65	2,359	2,424	25,725	2,547	28,272	2.30	83
1937	52	2,721	2,773	28,938	3,220	32,158	1.62	85
1938	62	2,147	2,209	29,434	1,421	30,855	2.01	70
1939	47	2,246	2,293	32,444	897	33,341	1.41	67
1940	42	2,128	2,170	35,137	438	35,575	1.18	60
1941	64	2,240	2,304	35,317	618	35,935	1.78	62
1942	50	2,167	2,217	33,336	431	33,767	1.48	64
1943	36	2,101	2,137	29,083	394	29,477	1.22	71
1944	32	2.238	2,270	28,032	444	28,476	1.12	79
1945	41	2,026	2,067	25,639	1,413	27,052	1.52	75
Average	43	2,071	2,114	20,720	1,238	21,958	1.99	94

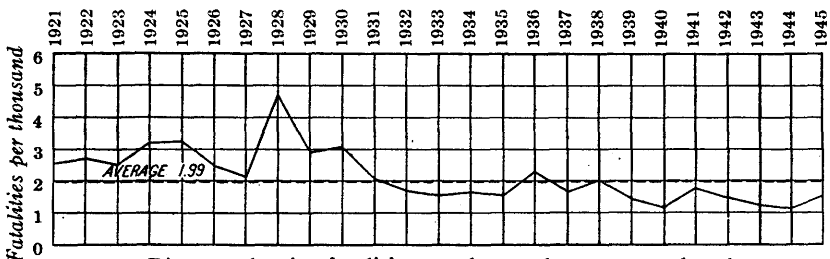

Diagram showing fatalities per thousand persons employed between the years 1921 and 1945.

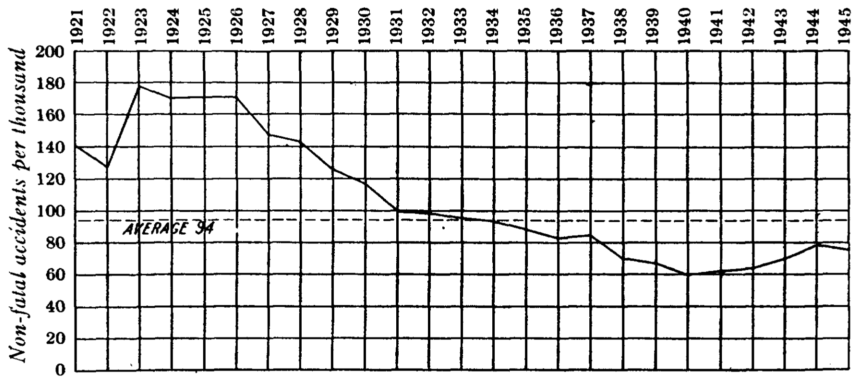

Diagram showing non-fatal accidents per thousand persons employed between the years 1921 and 1945.

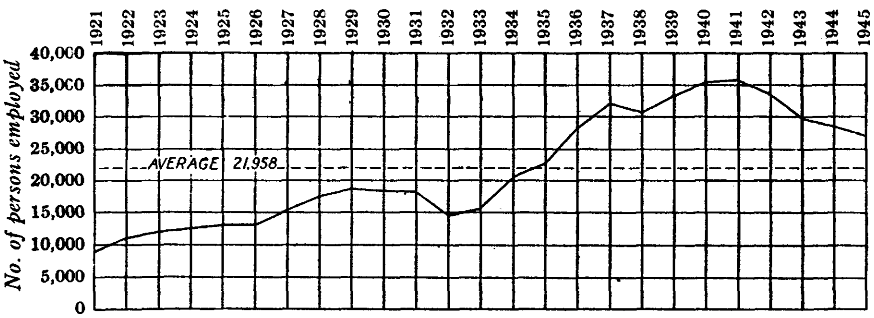

Diagram showing the number of persons employed between the years 1921 and 1945.

The following table shows the number of persons employed underground and on surface at mines from 1935 to 1945. The figures do not include contract diamond-drilling.

Year	Surface		Underground		Total
	No.	Per cent.	No.	Per cent.	
1935	7,314	42	9,879	58	17,193
1936	7,339	34	14,035	66	21,374
1937	11,229	47	12,558	53	23,787
1938	11,471	49	11,963	51	23,434
1939	8,795	34	16,847	66	25,642
1940	8,238	31	18,088	69	26,326
1941	8,285	32	17,744	68	26,029
1942	8,205	34	15,679	66	23,884
1943	7,148	37	12,396	63	19,544
1944	6,914	38	11,184	62	18,098
1945	6,687	39	10,535	61	17,222
Average	8,329	38	13,719	62	22,048

Non-fatal Accidents

Mines

There were 17,222 persons employed at mines in Ontario in 1945. During the year, 1,472 were injured, giving a non-fatal accident rate of 86 per thousand. The causes of these accidents are shown in the following table:—

Cause	Surface			Underground	Total
	Men	Women	Total		
Fall of persons	62	1	63	143	206
Crushed between two objects	32		32	142	174
Strain while lifting	39		39	111	150
Falling objects	38		38	78	116
Rock or ore at chute				107	107
Handling rock or ore	5		5	99	104
Flying objects, sledging, etc.	28		28	65	93
Fall of rock or ore, drilling, scaling, etc.				93	93
Hand tools	20		20	56	76
Drilling-machines				69	69
Fall of rock or ore at face				60	60
Machinery	21		21	23	44
Transportation	5		5	38	43
Running into or striking objects	13	1	14	23	37
Tramming	1		1	32	33
Nails or splinters	9		9	18	27
Burns	12	1	13	1	14
Cage, skip, or bucket				11	11
Explosives				9	9
Rock burst				4	4
Falls down shaft, winze, or stope				1	1
Gas (natural)				1	1
Electricity	1		1		1
Poisoning from cyanide powder	1		1		1
Unclassified	2		2	3	5
Total	289	3	292	1,187	1,479

Metallurgical Works

There were 7,627 persons employed at metallurgical works in Ontario in 1945. During the year, 379 were injured, giving a non-fatal accident rate of 50 per thousand. The causes of these accidents are shown in the following table:—

Cause	Men	Women	Total
Fall of persons	60	6	66
Strain while lifting	62	1	63
Handling materials	45	....	45
Falling objects	35	1	36
Crushed between two objects	32	1	33
Burns	28	1	29
Burned by slag, matte, or scrap	23	....	23
Hand tools	18	1	19
Flying objects, sledging, etc.	18	....	18
Running into or striking objects	17	....	17
Machinery	14	3	17
Transportation	6	....	6
Nails or splinters	3	....	3
Explosion in fume vent-pipe	....	3	3
Gas (chlorine)	1	....	1
Total	362	17	379

Quarries

There were 794 persons employed at quarries in Ontario in 1945. During the year, 16 were injured, giving a non-fatal accident rate of 20 per thousand. The causes of these accidents were:—

Flying objects, sledging, etc.	4	Strain while lifting	1
Fall of persons	2	Explosives	1
Crushed between two objects	2	Hand tools	1
Machinery	2	Transportation	1
Handling material	1		
Falling objects	1	Total	16

Clay, Sand, and Gravel Pits

There were 395 persons employed at clay, sand, and gravel pits in Ontario during 1945. During the year, 30 were injured, giving a non-fatal accident rate of 76 per thousand. The causes of these accidents were:—

Machinery	9	Hand tools	2
Fall of material	4	Burns	2
Fall of persons	3	Flying objects, sledging, etc.	1
Strain while lifting	3	Running into or striking objects	1
Falling objects	3		
Nails or splinters	2	Total	30

Contract Diamond-Drilling

There were 1,014 persons employed in contract diamond-drilling in Ontario in 1945. During the year, 122 were injured, giving a non-fatal accident rate of 120 per thousand. The causes of these accidents were:—

Nails or splinters	23	Falling objects	7
Crushed between two objects	16	Caught in feed-screw	5
Hand tools	16	Burns	4
Flying objects, sledging, etc.	14	Gasoline explosions	2
Strain while lifting	10	Unclassified	2
Fall of persons	9		
Running into or striking objects	7	Total	122
Caught in moving parts	7		

Infection

Records show that infection followed in 132 cases out of a total of 2,026 accidents.

Location	No. accidents	Accidents followed by infection	Per cent. infection
Mines, underground	1,187	58	4.9
Mines, surface	292	21	7.2
Metallurgical works	379	19	5
Quarries	16	.....	0
Clay, sand, and gravel pits	30	2	6.7
Diamond-drilling	122	31	25.4
Total	2,026	132	6.5

Accidents from Explosives

Cause	Non-fatal		Fatal		Total	
	No. accidents	Men injured	No. accidents	Men injured	No. accidents	Men injured
Delayed too long at blast	2	2	1	1	3	3
Did not take sufficient cover	3	3	.....	.....	3	3
Struck by the blast when partner drilled into explosive	1	1	.....	.....	1	1
Drilled into explosive and struck by the blast	1	1	.....	.....	1	1
Too close when hole was sprung	1	1	.....	.....	1	1
Concussion from blast caused fall of timber	1	1	.....	.....	1	1
Total	9	9	1	1	10	10

Electric Accidents

The following table shows the fatal accidents due to the use of electricity at mines, metallurgical works, quarries, and clay, sand, and gravel pits during the last ten years:—

1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	Total
.....	.....	.....	1	1	.....	.....	.....	1	1	4

The following table shows the total number of non-fatal electric accidents during the last ten years:—

1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	Total
4	2	8	7	3	5	6	5	2	1	43

Classification of Non-fatal Accident Rates at Producing Mines

In the following table the producing mines employing more than 50 men are arranged in order, according to their rate of non-fatal accidents per thousand persons employed:—

0–50	Omega
	Frood-Stobie open pit (International Nickel)
	Creighton (International Nickel)
	Garson (International Nickel)
	Levack (International Nickel)
	Wright-Hargreaves
	Hollinger
	Chesterville
	Lake Shore
51–100	McIntyre-Porcupine
	Black Donald (graphite mine)
	Frood mine (International Nickel)
	Kerr-Addison
	Young-Davidson (Hollinger)
	Central Patricia
	Preston East Dome
	Berens River
	Coniaurum
	Ross (Hollinger)
	Teck-Hughes
	Average—83.8 accidents per 1,000 persons
	Sylvanite
	Pickle Crow
	Hard Rock
101–150	Helen (mine, Algoma Ore Properties)
	Josephine (Michipicoten Iron Mines)
	Matachewan Consolidated
	Delnite
	Falconbridge
	Madsen Red Lake
	Dome
	MacLeod-Cockshutt
	Steep Rock
	Toburn
	Hallnor
151–200	Bidgood
	Buffalo Ankerite
	Little Long Lac
	Pamour
	Macassa
	Cochenour Willans
	Paymaster Consolidated
	Hasaga
201–250	Broulan and Bonetal
	Kirkland Lake Gold
	Aunor
	Silanco
	Upper Canada
251–300	Leitch
	McKenzie Red Lake

Fires

Dome Mines, Limited

At 1.05 P.M. on October 22, an alarm was sounded for a fire discovered in the headframe of the No. 3 shaft at the Dome mine.

Boiler-makers, making repairs on the ore bins, were burning out a piece of plate with an oxy-acetylene torch. Apparently a piece of hot metal fell on to a partition between the ore and waste chutes and ignited it. The fire was immediately discovered and put out with fire-extinguishers. No damage was done.

International Nickel Company of Canada, Limited

A small electrical fire occurred on the 1,400-foot level of the Frood mine about 8.20 P.M. on July 31.

A short circuit took place in the power cable of a battery locomotive operating in No. 25 crosscut, setting fire to the cable insulation. Level Boss J. Scott put out the fire with a Pyrene extinguisher.

An electrical fire occurred in the pump station on the 2,000-foot level of the Garson mine about 11.30 A.M. on February 7.

A 200 h.p., 60-cycle, 2,200-volt motor was seriously damaged when the direct-connected, 200 g.p.m. centrifugal pump seized. The motor caught fire.

G. Secker, chief electrician, discovered the fire and put it out with a Pyrene extinguisher.

A small electrical fire occurred on the 14th level of the Levack mine about 7.30 P.M. on July 3.

A short-circuit took place in the charging-cable attached to a locomotive battery in the west charging-station, which burned the cable through in two places about 8 inches apart. The cable had apparently been pinched under the battery frame. A tramming crew noticed smoke coming from the charging-station. They opened the switch and put out the fire with a Pyrene extinguisher.

Lake Shore Mines, Limited

A small underground fire occurred at the Lake Shore mine at approximately 1.30 P.M. on May 22.

The fan motor on the 5,825-foot level of No. 4 shaft became overheated owing to a power surge at 1.15 P.M. and set fire to a piece of rubber hose.

The smell was noticed by the shift boss at the 5,325-foot level station. He immediately telephoned and had an investigation made. The smouldering piece of rubber was extinguished by the use of a 1-quart Pyrene extinguisher. No damage resulted and no smoke was seen.

Madsen Red Lake Gold Mines, Limited

A small fire occurred in the secondary crusher building at the Madsen Red Lake mine, on August 2. The fire started about 6.20 P.M., when the Texrope belts driving the Symons crusher stretched enough to allow the crusher to stop while the driving-motor continued to run. The friction caused by the motor sheave running on the stationary belts generated enough heat to set the belts on fire.

Four sprinkler-heads in the vicinity of the motor opened up and extinguished the blaze before any of the timber in the building was more than slightly charred. The set of Texrope belts, however, was destroyed. The motor was soaked with water, but apparently was not damaged; it was dried out and put into service again.

Sylvanite Gold Mines, Limited

A small fire occurred at the 500-foot-level pump station of the Sylvanite gold mine at 5.00 P.M. on January 31.

George Snyder, the cagetender, started the pump and then went to one of the pumps on a lower level. On passing the 500-foot level immediately afterward, he smelled smoke and on investigation discovered that the 8-inch rubber belt driving the pump and a board guard were burning. The fire was immediately put out with a hose. An 8-foot length of the board guard was charred.

The 5- by 8-inch, vertical, triplex Worthington pump was driven at 200 r.p.m. by a belt from a 25 h.p. electric motor. The motor pulley was of perforated steel. The pulley on the pump was also steel. It is thought that slipping of the belt on the motor pulley generated sufficient heat to ignite the rubber. About 3 feet of belt was completely burned.

Prosecutions

Rex *vs.* Vaino Aho

A charge was laid against Vaino Aho, a driller at the Frood mine of the International Nickel Company of Canada, Limited, as follows:—

That Vaino Aho, at the Frood mine of the International Nickel Company, Limited, on or about the 23rd day of July, 1945, did drill within 6 inches of the remnant of a hole that had been charged and blasted (so-called bootleg), contrary to Section 160, subsection 73(a), of the Mining Act of Ontario.

Aho pleaded guilty before Magistrate W. M. Cooper at Sudbury on July 27. A fine of $10.00 and costs or 10 days in jail was imposed. The fine and costs, amounting to $13.00, were paid.

Rex *vs.* Peter Boroto

A charge was laid against Peter Boroto, a conveyer helper at the Copper Cliff smelter of the International Nickel Company of Canada, Limited, as follows:—

That Peter Boroto, at the town of Copper Cliff, on or about the 16th day of March, 1945, while under the influence of liquor did enter a mine, to wit, the Copper Cliff smelter of the International Nickel Company, contrary to Section 160, subsection 343, of the Mining Act of Ontario.

Boroto pleaded guilty before Magistrate W. Golden at Sudbury on March 23. A fine of $10.00 and costs or 10 days in jail was imposed. The fine and costs, amounting to $15.50, were paid.

Rex *vs.* John Haupstein

A charge was laid against John Haupstein, a driller at the Creighton mine of the International Nickel Company of Canada, Limited, as follows:—

That John Haupstein, at the Creighton mine of the International Nickel Company, Limited, on or about the 20th day of June, 1945, did drill within 6 inches of the remnant of a hole that had been charged and blasted (so-called bootleg), contrary to Section 160, subsection 73(a), of the Mining Act of Ontario.

Haupstein pleaded guilty before Magistrate W. F. Woodliffe at Sudbury on June 27. A fine of $10.00 and costs or 10 days in jail was imposed. The fine and costs, amounting to $19.00, were paid.

Rex *vs.* Marc Ouellet

Two charges were laid against Marc Ouellet, an employee of Pamour Porcupine Mines, Limited, as follows:—

1. That Marc Ouellet on or about the last day of September, 1945, did commit a careless act (or acts) with explosives, to wit, did attempt to burn powder with a match, and did attempt to detonate powder by concussion, contrary to Section 160, subsection 53(c), of the Ontario Mining Act.
2. That Marc Ouellet, on or about October 1, 1945, on the 14th level of the Pamour mine did light a fire, contrary to Section 160, subsection (5a) of the Ontario Mining Act.

Ouellet pleaded guilty before Magistrate S. Atkinson on October 9 at South Porcupine. A fine of $10.00 and costs of $11.70 on each count or 30 days in jail was imposed. Ouellet elected to serve the jail term.

Ouellet, who was 20 years of age, was employed at the Pamour mine from September 11 to October 3, 1945. He had previously worked in the Sudbury district. Ouellet was attempting to prove that dynamite was not dangerous. The fire referred to in the second charge was lit about 5 feet from dynamite. Information received by the Department of Mines indicated that Ouellet had driven a 12-inch spike into a case of 40 per cent. powder on one occasion and on another had lighted a capped fuse and thrown it about 6 feet from a case of powder, where it exploded.

Rex *vs.* Steve Ribar

As a result of an incident at the Omega gold mine on December 17, when R. Pineau, mine captain, walked into an unguarded blast in the ore-pass chute on the 550-foot level, the following charge was laid against Steve Ribar, the miner doing the blasting:—

> That Steve Ribar, of Larder Lake, in the district of Timiskaming, on the 17th day of December, 1945, in the township of McVittie, in the district of Timiskaming, did unlawfully, being a workman engaged in blasting in a mine, neglect to cause all the entrances to the place where the blasting was to be done to be effectively guarded before blasting, contrary to the Mining Act, R.S.O. 1937, Chapter 47, Section 16, subsection 75(a).

Ribar pleaded guilty before Magistrate S. Atkinson in Kirkland Lake Police Court on January 17, 1946. A fine of $10.00 and costs of $12.25 were imposed. The fine and costs were paid.

Mine Rescue Stations

NORTHWESTERN ONTARIO

Geraldton, Red Lake, Berens River, and Pickle Lake

Complete equipment for a 12-machine station at Geraldton, a 12-machine station at Red Lake, a 3-machine substation at Berens River, and a 6-machine station at Pickle Lake was obtained.

Lack of labour and materials delayed the completion of the permanent station-buildings, and for the greater part of the year it was necessary to continue the use of temporary quarters. At Geraldton, however, the station garage was completed in December. The site of the garage and the future station is just south of the hospital on the property of Little Long Lac Gold Mines, Limited. At Red Lake, the station, although not entirely completed, went into use late in the year. The building for this station was moved early in the year from its original site on the property of the old Howey gold mine to its present site near the hospital on the property of Hasaga Gold Mines, Limited, and the necessary alterations are now practically complete. At Berens River, the equipment is housed in space made available by the Berens River Mines, Limited. No separate building is contemplated. At Pickle Lake, a building was moved from its original site at the No. 2 Operation of the Central Patricia Gold Mines, Limited, to its present site, west of the bunk-houses at the No. 2 Operation. The necessary alterations are partly completed.

Regular classes in rescue training and first aid are being held at all stations. Eleven teams have completed the preliminary training course: five at Geraldton, three at Red Lake, one at Berens River, and two at Pickle Lake. John Lang is superintendent.

NORTHEASTERN ONTARIO

Sudbury

At the Sudbury station, normal rescue-training and fire-drills were carried on during the year. Eighty fully-trained rescue teams were maintained. T. J. Fee is superintendent.

Kirkland Lake

During the year, normal rescue training, with special attention to the working out of the problems set in competitions, was carried on at the Kirkland Lake station. Fifteen fully trained rescue teams were maintained. P. C. Smith is superintendent.

Timmins

At the Timmins station, normal rescue-training activities were carried on during the year. Twenty-eight fully-trained rescue teams were maintained. Austin Neame is superintendent.

Summary of Rope Tests

The following is a summary of the tests made in the Wire Rope Testing Laboratories of the Department of Mines during 1945:—

Classification	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Tests for Ontario mines...	45	50	50	34	48	46	36	48	44	39	28	55	523
Special informative tests..	20	25	17	29	24	11	44	29	34	55	74	.....	362
Tests for wire-rope manufacturers..............	13	12	17	17	13	27	40	16	13	8	5	3	184
Tests for mines outside Ontario...............	6	5	11	8	7	10	2	5	12	15	4	.....	85
Tests for industries other than mining..........	.....	.....	2	3	.....	.....	.....	.....	.....	1	.....	.....	6
Total..............	84	92	97	91	92	94	122	98	103	118	111	58	1,160

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NOTE.—All places referred to are in Ontario, unless otherwise designated.

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Area	Ore raised	Material discarded (sorted)	Ore milled	Bullion produced				Total value of bullion, Canadian funds
				Gold content		Silver content		
				Quantity	Value, Canadian funds	Quantity	Value	
	tons	tons	tons	ounces		ounces		
PORCUPINE BELT								
Aunor	143,390		143,390	56,143.170	$2,161,495	4,554	$1,796	$2,163,291
Bonetal	25,828	1,836	23,992	4,380.530	168,650	437	176	168,826
Broulan	102,470	13,078	89,392	16,966.283	653,202	1,727	727	653,929
Buffalo Ankerite	200,253	2,562	197,691	32,531.696	1,252,471	3,396	1,358	1,253,829
Coniaurum	98,210		98,210	26,275.000	1,010,852	5,065	2,826	1,013,678
Delnite	66,283		66,120	9,421.561	362,730	828	333	363,063
Dome	527,100		527,100	126,676.730	4,877,058	26,385	10,205	4,887,263
Hallnor	95,436		95,436	44,756.964	1,723,145	3,434	1,360	1,724,505
Hollinger	936,596		933,748	219,212.880	8,439,316	45,549	19,371	8,458,687
McIntyre Porcupine	566,171		565,320	161,043.627	6,200,184	33,160	14,234	6,214,418
Pamour	417,914		417,914	38,006.083	1,463,235	4,723	1,872	1,465,107
Paymaster Consolidated	126,386		130,793	27,298.985	1,051,012	10,754	4,247	1,055,259
Preston East Dome	221,598		222,359	56,327.722	2,168,619	6,759	2,682	2,171,301
Ross (Hollinger)	73,605		73,538	11,619.002	448,208	24,491	10,468	458,676
Miscellaneous[1]				246.794	9,502	47	18	9,520
Total	3,601,240	17,476	3,585,003	830,907.027	$31,989,679	171,309	$71,673	$32,061,352
KIRKLAND LAKE AREA								
Bidgood	32,617		32,608	10,859.090	$418,075	2,365	$941	$419,016
Golden Summit (clean-up)				53.155	2,047	7	3	2,050
Kirkland Lake Gold	85,358		85,358	28,179.103	1,084,897	3,340	1,315	1,086,212
Lake Shore	291,854		291,854	117,249.357	4,514,104	25,183	9,997	4,524,101
Macassa	71,988		71,988	28,154.453	1,083,948	5,801	2,354	1,086,302
Sylvanite	114,102		114,227	37,647.601	1,449,434	7,397	2,926	1,452,360
Teck-Hughes	106,006		106,006	28,505.559	1,097,465	2,621	1,067	1,098,532
Toburn	41,655	897	41,655	12,647.942	486,946	4,151	1,678	488,624
Upper Canada	83,708		83,708	26,859.041	1,034,074	12,641	4,876	1,038,950
Wright-Hargreaves[2]	156,320		156,320	79,589.813	3,064,211	12,922	5,157	3,069,368
Miscellaneous[1]				246.795	9,502	48	18	9,520
Total	983,608	897	983,724	369,991.909	$14,244,703	76,476	$30,332	$14,275,035
LARDER LAKE AREA								
Barry-Hollinger (clean-up)				139.595	$5,375	18	$8	$5,383
Chesterville	153,416		153,416	16,912.518	651,133	1,091	430	651,563
Kerr-Addison	429,367		430,065	80,675.058	3,105,812	4,650	1,903	3,107,715
Omega	104,724		104,724	11,625.793	447,594	1,638	664	448,258
Total	687,507		688,205	109,352.964	$4,209,914	7,397	$3,005	$4,212,919
MATACHEWAN AREA								
Matachewan Consolidated	161,311		161,361	15,593.476	$600,350	6,217	$2,654	$603,004
Young-Davidson	206,511		206,556	19,493.729	750,486	4,185	1,685	752,171
Total	367,822		367,917	35,087.205	$1,350,836	10,402	$4,339	$1,355,175
SUDBURY DISTRICT								
Alkins, A., claims				3.849	$148			$148
Bousquet				3.451	133			133
Ensign (Shakespeare)				3.451	133			133
Total				10.751	$414			$414
ALGOMA DISTRICT								
Alden-Goudreau (Regnery Metals)				3.947	$152	1	$1	$153
Shenango (clean-up)				35.877	1,381	5	2	1,383
Total				39.824	$1,533	6	$3	$1,536
THUNDER BAY DISTRICT								
Bankfield (clean-up)				18.974	$731			$731
Hard Rock	6,337		6,337	1,338.041	51,515	107	$50	51,565
Leitch	22,350	2,200	20,089	17,745.474	683,201	623	251	683,452
Little Long Lac	86,005	13,888	72,117	21,152.770	814,382	1,976	801	815,183
MacLeod-Cockshutt	41,945	11,645	30,000	9,551.256	367,724	158	61	367,785
Theresa (clean-up)				21.576	831	1	1	832
Total	156,637	27,733	128,543	49,828.091	$1,918,384	2,865	$1,164	$1,919,548
KENORA DISTRICT								
Van Houten				25.147	$968	4	$2	$970
Total				25.147	$968	4	$2	$970
PATRICIA PORTION								
Berens River[3]	72,880		72,880	17,805.000	$685,493	684,134	$321,543	$1,007,036
Central Patricia	89,301		89,301	27,796.682	1,070,173	2,640	1,073	1,071,246
Cochenour Willans	31,672		31,445	9,138.878	351,847	363	145	351,992
Hasaga	124,338	19,595	105,068	11,734.923	451,795	4,868	1,936	453,731
Howey (clean-up)				67.175	2,586	9	4	2,590
McKenzie Red Lake	76,296	12,836	63,460	12,761.460	491,317	3,154	1,266	492,583
Madsen Red Lake	101,663		101,663	25,958.603	999,407	5,590	2,254	1,001,661
Pickle Crow	64,170	3,863	60,227	33,489.124	1,289,333	4,674	1,848	1,291,181
Total	560,320	36,294	524,044	138,751.845	$5,341,951	705,432	$330,069	$5,672,020
Total for gold mines	6,357,134	82,400	6,277,436	1,533,994.763	$59,058,382	973,891	$440,587	$59,498,969
Nickel-copper refining				91,369.000	$3,517,707			
Total gold output, 1945				1,625,363.763	$62,576,089			
CALENDAR YEAR 1944								
Porcupine Belt	3,790,907	18,039	3,788,313	873,063.242	$33,612,286	163,634	$66,705	$33,678,991
Kirkland Lake Area	1,011,840	924	1,011,225	383,237.964	14,754,693	82,201	31,771	14,786,464
Larder Lake Area	753,215		752,954	115,021.903	4,428,348	7,896	3,057	4,431,405
Matachewan Area	342,585		341,359	28,634.932	1,102,296	9,233	3,581	1,105,877
Sudbury District				49.792	1,917	3	1	1,918
Algoma District				37.518	1,443			1,443
Thunder Bay District	399,140	71,117	305,276	100,827.553	3,881,859	3,572	1,379	3,883,238
Patricia Portion	646,825	45,439	601,441	175,659.491	6,762,893	353,475	150,780	6,913,673
Total for gold mines, 1944	6,944,512	135,519	6,800,568	1,676,532.395	$64,545,735	620,014	$257,274	$64,803,009
Nickel-copper refining and silver-lead-zinc concentrates				55,305.587	2,129,265			
Total gold output, 1944				1,731,837.982	$66,675,000			

[1]High-grade.
[2]Concentrates shipped also contained 792 pounds copper.
[3]Concentrates shipped also contained 668,762 pounds lead and 237,799 pounds zinc.

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. LESLIE M. FROST, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FIFTY-FIFTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LV, PART II, 1946

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MINES OF ONTARIO IN 1945

By

Chief Inspector of Mines, W. O. Tower, Toronto; Inspectors, R. L. Smith, Kenora; W. E. Bawden, Port Arthur; D. F. Cooper, Sudbury; J. B. Taylor, L. K. Walkom, E. S. Little, Kirkland Lake; E. B. Weir, Timmins; D. P. Douglass, J. L. Ward, Toronto.

APATITE

Ontario Phosphate Industries, Limited

Ontario Phosphate Industries, Limited, was incorporated in June, 1944, with an authorized capitalization of 1,000,000 shares of no par value, of which 477,505 have been issued. The company succeeded the Ontario Phosphate Company, Limited. The officers and directors are: J. D. Cameron, president; Henry Armstrong, vice-president; J. H. King, secretary-treasurer; A. L. Ainsworth, director; R. V. Anderson, director and consulting engineer. The head office is at 62 Richmond Street West, Toronto. The mine address is Box 220, Westport.

The company holds lot 25, concession IX, and lots 27, 28, and 29, and the east half of lot 31, concession X, Bedford township, Frontenac county, known as the McLaren phosphate property.

There is a vertical, 3-compartment shaft on the property, 175 feet deep,[1] with a level at 150 feet.

Underground operations were carried on from January 5 to March 31. A mining plant was installed to replace the one that had been supplied by the Inspiration Mining and Development Company, Limited, in 1944. At the end of March the workings were allowed to fill.

The mine was dewatered again in June, and the operation continued until September 1, when the compressor and hoist were removed. The following table shows the development work done during 1945 and the total:—

	1945	Total
	feet	feet
Drifts	411	411
Crosscuts	81	245
Raises	25	25

Wm. L. Shelest was engineer-in-charge for the company. An average force of 16 men were employed for 8 months. At the end of the year arrangements were being made to have the La Salle Equipment and Excavation Company carry on development underground and do surface-mining on a tonnage basis.

ASBESTOS

L. M. Carswell

L. M. Carswell, of Renfrew, carried on further examinations for about three months in 1945 on the asbestos showing on lot 22, concession IV, Blithfield township, Renfrew county. A cut about 30 feet long and 8 feet wide had been made in the side of a limestone ridge in 1944. In 1945, a 7- by 7-foot tunnel was extended into the ridge from the cut for a distance of 20 feet.

Two men were employed during the period of operation.

[1]Wrongly reported as 190 feet in Ont. Dept. Mines, Vol. LIV, 1945, pt. 2, p. 1

BARITE

Woodhall Mines, Limited

Woodhall Mines, Limited, was incorporated in December, 1943, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,312,000 have been issued. The officers and directors are: H. R. Hall, president; W. J. Cawood, vice-president; W. E. Jarrett, secretary-treasurer; A. Arnold and M. A. Powell, directors. The head office address is 347 Bay Street, Toronto. The mine address is South Porcupine.

The company holds a lease on 7 claims, approximately 256 acres, in the southern part of Langmuir township, Night Hawk Lake area, district of Timiskaming. These claims were formerly held by Canada Baryte Mines, Limited.

Some surface operations were carried on from the early part of January to the middle of March. About 30 feet of trenching 6 feet deep was done.

B. R. Shortt was manager during the period of operation, and an average of 5 men was employed.

CORUNDUM

Craigmont Corundum Project

Operations at the Craigmont corundum mine on lots 4 and 5, concession XVIII, Raglan township, Renfrew county, were continued throughout 1945. The work was done under the direction of Wartime Metals Corporation until September. The corporation was then disbanded, and the direction of the work was taken over by the Department of Reconstruction, Ottawa.

The operation consisted of milling the tailings discarded from previous operations. An additional 385 feet of conveyer belt was installed for handling the tailings from the dump. The mill treated 64,482 tons of material and produced 1,316 dry tons of crude corundum concentrates.

A. G. Roach was manager, employing an average force of 23 men. The mine address is Craigmont.

FELDSPAR

Bancroft Feldspar Mines, Limited

Some work was done between September 1 and October 31, 1945, by two partners, Arthur Shore and Roy Munnings, on a feldspar showing on lot 6, concession XII, Monteagle township, Hastings county. A small compressor outfit was installed and 100 tons of feldspar were shipped for trial purposes.

Three men were employed during the period of operation. The mine address is Bancroft.

In December, 1945, Bancroft Feldspar Mines, Limited, was incorporated with an authorized capitalization of 5,000 preferred shares of $10 each, and 50,000 common shares of no par value; 3,275 preferred shares and 22,005 common shares have been issued. The officers and directors are: H. T. Hand, president; Edgar White, vice-president; A. R. Douglas, secretary-treasurer; Adam Zimmerman and Edward Reeves, directors; Arthur Shore, managing director. The head office is at Cooksville. At the end of the year arrangements were being made to purchase the property with a view to continuing operations.

Bathurst Feldspar Mines, Limited

Bathurst Feldspar Mines, Limited, was incorporated in April, 1927, with an authorized capitalization of 40,000 preferred shares of $5 par value, of which

26,525 have been issued, and 40,000 common shares of no par value, all of which have been issued. The officers are: B. Day, president; B. S. Hyde, secretary-treasurer and general manager. The head office is at 21 King Street East, Toronto. The mine address is Perth.

The company owns the Bathurst feldspar property on the south half of lot 16 and the north half of lot 15, concession VIII, Bathurst township, Lanark county.

Operations continued throughout 1945. The south end of the pit was deepened and the cross-pillar in the pit was undercut.

A total of 2,316 tons of ore was mined and sold.

Robert McVeigh was foreman until the end of March and was succeeded by James Bowes. An average of 12 men was employed.

Canspar Mines, Limited

Canspar Mines, Limited, was incorporated in June, 1944, with an authorized capitalization of 100,000 shares of $1 par value, of which 25,505 have been issued. The officers and directors are: Denison Denny, president; M. B. Smith, secretary-treasurer; J. D. Smith and A. B. Mortimer, directors; J. G. Pierdon, director and manager. The head office is at 100 Adelaide Street West, Toronto. The mine address is Madawaska.

From April 1 to November 30 the company carried on operations on a feldspar showing on the north half of lot 17, concession VIII, Dickens township, district of Nipissing. This property is sometimes called the Five-Mile mine. About 1,047 tons of feldspar were shipped.

Seven men were employed.

Conger Feldspar Mining Company, Limited

The Conger Feldspar Mining Company, Limited, was incorporated in September, 1945, with an authorized capitalization of 100,000 shares of $1 par value, of which 50,003 have been issued. The officers are John Paul Jones, president; John Laing, secretary; H. B. Jones, treasurer. The officers are all directors. The head office is at 10 Adelaide Street East, Toronto. The mine address is Box 541, Parry Sound.

The company holds under lease parts of lots 6, 7, and 8, concession X, Conger township, district of Parry Sound, about 18 miles from the town of Parry Sound. A siding has been constructed on the Canadian Pacific railway, and a road about a mile long leads from it to the property.

Operations were carried on from August 20 to December 31, 1945. A compressor was installed, and trestles, a track, and bins were built. About 417 tons of feldspar was mined from an old pit on lot 8 and shipped. A small amount of diamond-drilling was done.

T. W. Page was in charge of the work, employing an average force of 8 men during the period of operation.

FLUORSPAR

Bassett Fluorspar Mining Syndicate, Limited

The Bassett Fluorspar Mining Syndicate, Limited, was incorporated in September, 1942, with an authorized capitalization of 35,000 shares of $1 par value, of which 26,281 have been issued. The officers are: M. Abraham, president and director; Charles Beilby, vice-president; J. L. Lennon, secretary-treasurer. The head office is at 36 Toronto Street, Toronto. The mine address is Madoc.

Operations were carried on from May 1 to November 15, 1945, at the George Lee property on lot 2, concession III, Madoc township, Hastings county. No. 3 shaft was dewatered to the bottom or 40-foot level, and a drift was driven 138 feet northwest. A total of 153 tons of fluorspar was mined and shipped.

Five men were employed under the direction of R. H. Binch.

Fluoroc Mines, Limited

Fluoroc Mines, Limited, was incorporated in March, 1944, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 300,000 have been issued. The officers and directors are: H. R. Cory, president; H. J. Smith, vice-president; D. Bolster, secretary-treasurer; R. Goodman, director. The head office address is Trenton. The mine address, when operations are in progress, is Madoc.

Operations were carried on from June 1 to September 30 on the Johnson property on the west half of lot 14, concession XI, Huntingdon township, Hastings county.

There is a shaft 62 feet deep on the property, with a level at 55 feet, on which about 38 feet of drifting had been done by previous operators. About 30 feet of drifting was done in 1945.

W. Badgley was foreman at the property, employing 5 men during the period of operation.

Millwood Fluorspar Mines, Limited

Millwood Fluorspar Mines, Limited, was incorporated in August, 1943, with an authorized capitalization of 100,000 shares of $1 par value, of which 40,003 have been issued. The officers and directors are: E. L. O'Reilly, president; D. C. R. Miller, secretary-treasurer; S. D. Miller, director. John G. Harris was manager in 1945. The head office is at 19 Melinda Street, Toronto. The mine address is Madoc.

Operations at the Bailey property on lot 1, concession IV, Madoc township, Hastings county, were resumed on March 7, 1945, and continued to the end of the year. A 3-compartment, vertical shaft was sunk to a depth of 100 feet and a level was established at the bottom, on which 337 feet of drifting, 98 feet of crosscutting, and 80 feet of raising was done.

A dry-house, shop, and timber headframe were built, and the ore bins and sorting plant were covered. A 42-inch, single-drum Allis-Chalmers electric hoist and a 75 h.p. motor were purchased.

A total of 4,800 tons of ore was mined by open stoping above the 100-foot level. About 3,555 tons were sold after sorting.

An average force of 36 men was employed.

Reliance Fluorspar Mining Syndicate, Limited

The Reliance Fluorspar Mining Syndicate, Limited, was incorporated in December, 1940, with an authorized capitalization of 35,000 shares of $1 par value, of which 20,005 have been issued. The syndicate's charter was renewed for a further three years in December, 1944. The officers are: W. J. Symon, president and manager; Frank Dafoe, vice-president; Mrs. W. J. Symon, secretary-treasurer. The head office and mine office are at Madoc.

Mining operations at the Rogers fluorspar mine on lot 10, concession XIV, Huntingdon township, Hastings county, were resumed on March 5 and continued for the rest of the year. The mill ran from April 25 to December 31.

A Gardner Denver vertical air compressor was installed to supply air to the mine. Two store-rooms and an office were built.

The following table shows the development work done during 1945 and the total:—

	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
No. 1 SHAFT (123 feet deep):						
120-foot level	165	240	30	93	50	50
No. 2 SHAFT (87 feet deep):						
70-foot level	425	585	....	....	....	50

Six diamond-drill holes, totalling 944 feet in length, were drilled from surface.

A total of 4,725 tons of ore was mined; after sorting, 3,092 tons were shipped and 885 tons were stock-piled.

An average force of 26 men was employed for nine months.

Charles A. Stoklosar

Charles A. Stoklosar, of Madoc, carried on intermittent operations during 1945 at the Blakely fluorspar mine on the east half of lot 10, concession XII, Huntingdon township, Hastings county.

The shaft was dewatered to a depth of 85 feet, and a new level was established at 75 feet. The following table shows the development work done in 1945 and the total:—

Level	Drifts		Raises	
	1945	Total	1945	Total
	feet	feet	feet	feet
45-foot	....	255	....	85
75-foot	50	50	....	....

A total of 580 tons of ore was mined and shipped.

An average of 5 men was employed.

Tops Mining Syndicate, Limited

The Tops Mining Syndicate, Limited, was incorporated in September, 1943, with an authorized capitalization of 35,000 shares of $1 par value, of which 31,307 have been issued. The officers and directors are: Wm. E. Clark, president and manager; D. A. McLeod, vice-president; Chas. W. McCreary, secretary-treasurer; O. J. Suchanek, and John L. Champness, directors. The head office and mine office address is Harcourt.

Operations were carried on intermittently in 1945 in an attempt to develop a fluorspar showing on the north part of lot 13, concession XXII, Cardiff township, Haliburton county. The 8- by 8-foot adit, begun in 1944 in the hillside, was advanced a further 30 feet. There was no production.

Four men were employed.

GOLD

Armistice Gold Mines, Limited

Armistice Gold Mines, Limited, was incorporated in January, 1937, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 3,680,005 have been issued. The officers and directors are: Salter A. Hayden, president; E. D. Levinson, vice-president; A. M. Connelly, secretary-treasurer; H. S. Shannon and R. M. Anderson, directors. The head office is at 100 Adelaide Street West, Toronto. The mine address is Virginiatown.

The property consists of 16 claims, approximately 587 acres, in McGarry township, Larder Lake area, district of Timiskaming.

Operations were carried on from October 1 to December 31, and a 3-compartment, vertical shaft was sunk 528 feet on claim L. 1,886, with levels at 275 and 400 feet. The shaft-sinking was done under contract by Mineshafts, Limited.

An average of 15 men was employed during the period of operation. P. G. Scott is mine manager.

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 of which have been issued. The officers and directors are: Jas. Y. Murdoch, president; J. R. Bradfield, secretary; R. G. Rudolf, treasurer; A. L. Ellsworth, W. S. Mitchell, and N. C. Urquhart, directors. The head office is at 1600 Royal Bank Building, Toronto. The mine office is Box 420, Timmins.

The property consists of 11 claims, containing approximately 360 acres, in Deloro township, Porcupine area, district of Cochrane. Of these, 8 claims are owned by the company, 1 is under option, and 2 are leased.

Mining and milling operations continued throughout 1945. The sinking of the vertical, 3-compartment shaft on claim H.S. 850 was continued for a further 175 feet to a total depth of 2,335 feet from surface. A new level was established at 2,250 feet.

During the year the following work was completed: drifting, 3,218 feet; crosscutting, 359 feet; raising, 1,399 feet. Total development work done to date totals: drifting, 33,400 feet; crosscutting, 9,198 feet; raising, 12,474 feet.

Diamond-drilling consisted of 10 holes, totalling 6,890 feet, from surface and 227 holes, totalling 14,049 feet, from underground.

The following is taken from the manager's report for the year ending December 31, 1945:—

The main shaft was deepened an additional 175 feet, and 53,938 cubic feet of rock was excavated to make provision for stations, sumps, and loading-pockets. Development work was done principally on the 625-, 1,625-, and 1,875-foot levels.

On the 1,625-foot level, development work produced an extremely high grade shoot of ore, 450 feet long, averaging 6.1 feet wide. Muck samples from this shoot averaged 1.2 ounces gold per ton uncut. The west face of this shoot is still in ore. Stoping operations were carried on between the 625- and 1,375-foot levels.

Ore Developed by Drifting

Level	Length	Width	Reduced grade	Tons per vertical foot
	feet	feet	ounces	
625-foot	112	3.5	0.240	32.8
1,500-foot	46	3.6	.183	13.8
1,625-foot	249	4.6	.359	95.5
	68	4.9	.261	27.8
	44	5.6	.320	20.5
	450	6.1	.547	229.3
1,875-foot	138	4.3	.235	49.5

Some 1,107 feet of ore, averaging 0.324 ounces gold per ton, reduced, across a sampled width of 5.1 feet, were developed during the year. At the end of the year, ore reserves in the developed portion of the mine were estimated as follows:—

ORE RESERVES

	Tons	Per cent.	Grade
			ounces
Broken	14,000	2.4	0.306
Proved	425,400	70.6	.350
Probable	162,500	27	.339
Total	601,900	100	0.347

Ore reserves were maintained chiefly because of increased vein widths in the stopes and development work on the 1,625-foot level.

MILLING STATISTICS

	1945	To date
Dry tons milled	143,390	899,968
Average tons per 24 hours	393	414
Calculated head (mine bullion assay) ounces	0.401	0.323
Tailings loss ounces	0.0095	0.0088
Total recovery per cent.	97.64	92.26
Total production	$2,163,291	$10,892,236

SOURCES OF ORE MILLED

	Tons	Per cent.
Development	7,996	5.58
Drawn above 1,000-foot level	4,852	3.38
Drawn above 1,125-foot level	36,814	25.67
Drawn above 1,250-foot level	49,048	34.21
Drawn above 1,375-foot level	44,680	31.16
Total	143,390	100

Below the 1,250-foot level, the presence of talc in the ore zone reduced mill production by affecting the settling in the thickeners. Plans have been made for increasing the thickening capacity of the mill in order that production at the rate of 450 tons per day may be maintained.

Stanley S. Saxton is manager, employing an average force of 267 men, of whom 187 were in the mine, 21 in the mill, and 59 on general surface work.

Berens River Mines, Limited

Berens River Mines, Limited, which was incorporated in July, 1936, has an authorized capitalization of 2,000,000 shares of $1 par value, all of which have been issued. The company is a subsidiary of the Newmont Mining Corporation. The officers and directors are: John Drybrough, president; Philip Kraft and H. De Witt Smith, vice-presidents; H. E. Dodge, secretary-treasurer; J. A. Richardson, A. W. Burt, Gus Mrkvicka, and Carroll Searls, directors. The head office and mine office are at Favourable Lake. The secretary's office is at 14 Wall Street, New York.

The company's main property consists of 39 claims, approximately 1,550 acres, situated some 3½ miles east of South Trout lake, which is 8 miles east of Favourable Lake, in the Patricia portion of Kenora district. Of the thirty-six claims staked in 1944, immediately adjoining the main property on the south, eighteen have been dropped.

Operations were continued throughout 1945. The 3-compartment, vertical shaft on claim Pa. 116 is 1,898 feet deep. The 3-compartment, vertical winze, which is collared at the 1,700-foot level, was sunk a further 149 feet to a depth of 2,324 feet from surface. A new level was cut at 2,300 feet.

During 1945, the following development work was completed: drifting, 2,306 feet; crosscutting, 1,768 feet; raising, 595 feet.

Total development work to December 31, 1945, is as follows: drifting, 17,214 feet; crosscutting, 11,317 feet; raising, 7,196 feet.

Diamond-drilling consisted of 20 holes, totalling 7,648 feet, from surface and 119 holes, totalling 13,639 feet, from underground.

The following is taken from the manager's report for the year ending December 31, 1945:—

Total ore hoisted was 72,880 tons, an average of 6,073 tons per month. Of this tonnage 29,500 tons, or 43 per cent., was mined by diamond-drill blast-hole benching methods at a considerable saving in man-power and cost. In all, 39,834 feet of blast-hole drilling was done.

Ore Reserves

As no new ore was discovered during the year, ore reserves declined to 39,000 tons as of December 31, 1945, at the same grade as of the previous year, namely 0.25 ounces gold and 10.0 ounces silver.

Mill Operation

Tonnage milled was 72,880 tons, an average of 200 tons per calendar day, which is 85 per cent. of capacity. Mill heads averaged 0.25 ounces gold and 10.5 ounces silver per ton, almost exactly the estimated grade of ore reserves as of December 31, 1944.

Metal recoveries were down slightly due to the higher tonnage and consequent decrease in treatment time.

	1944	1945
	per cent.	per cent.
Gold	98.28	97.40
Silver	91.18	90.23

Production

	Quantity	Value
Gold .... ounces	17,805	$683,850.74
Silver .... ounces	684,134	457,084.07
Lead .... pounds	668,762	33,103.85
Zinc .... pounds	237,799	8,930.11
Total value	....	$1,182,968.77

Net recovery per ton milled averaged $15.05 per ton from cyanide precipitate and $1.18 per ton from flotation concentrate, for a total of $16.23 per ton. The production of zinc was discontinued on March 12, 1945.

Costs

Total operating costs were $11.06 per ton as shown below, together with those of 1942, the most recent year of comparable tonnage.

Operating Costs per Ton Milled

	1942	1945
Development	$0.96	$2.69
Mining	5.16	5.50
Milling	1.96	2.32
Mine operating costs	$8.08	$10.51
Transportation and refining charges	.97	.55
Total	$9.05	$11.06

The cost of mining and milling in 1945 was $7.82, an increase of 10 per cent. over corresponding 1942 costs. The amount of development in 1942 was abnormally low, and the 1945 development can be considered as normal.

Capital Expenditures

Addition to doctor's house	$900.00
Mine underground equipment	17,624.68
Total	$18,524.68

An average force of 166 persons were employed during the year. Of these, 84 men were in the mine and 16 in the mill; 56 persons were employed in general surface work. C. W. MacDonald is manager.

Bidgood Kirkland Gold Mines, Limited

Bidgood Kirkland Gold Mines, Limited, was incorporated in March, 1933, with a capitalization of 2,000,000 shares of $1 par value, which was increased to 4,000,000 shares in 1935. All the shares have been issued. The officers and directors are: W. J. Lawson, president; J. M. Macintosh, vice-president and secretary-treasurer; W. Harrison, assistant secretary; A. E. Belcher and S. K. Learie, directors. The head office and mine office are at Kirkland Lake. The executive office is at 357 Bay Street, Toronto.

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

The property is in two sections, known as Nos. 1 and 2 workings. The shafts are about 4,275 feet apart. The No. 1 section has not been operated since June, 1940.[1]

Operations at the main or No. 2 working continued throughout 1945. During the year no further sinking was done on the vertical, 3-compartment No. 2 shaft, on claim No. L. 9882, which had been sunk to a total depth of 1,572 feet. There are three winzes in this section. No. 1 winze, collared at the 500-foot level, 410 feet southeast of the shaft, is 292 feet deep. No. 2 winze, collared at the 775-foot level, 738 feet southeast of the shaft, is 1,278 feet deep. No. 712 winze, also collared at the 775-foot level, about 500 feet southwest of the shaft, runs at an angle of 65 degrees to a depth of 900 feet from surface.

During the year 1945, the following development work was completed: drifting, 2,429 feet; crosscutting, 966 feet; raising, 1,036 feet. Total development on the property to December 31, 1945, is as follows: drifting, 31,726 feet; crosscutting, 14,093 feet; raising, 6,018 feet. The bottom level of the mine is established at 2,025 feet.

Diamond-drilling consisted of 101 holes, totalling 18,482 feet, from underground.

The following is taken from the report of the manager for the 12 months ending December 31, 1945:—

During the year, 32,608 tons of ore were milled, from which were recovered 10,859.09 fine ounces of gold worth $418,075.35 and 2,365.41 fine ounces of silver worth $941.02. Total bullion production amounted to $419,016.37, to which was added miscellaneous income of $4,428.75, making a total gross revenue of $423,445.12, or $12.99 per ton of ore milled.

The area to the north and east of the shaft contains a large mass of diorite, which has proven to be the most favourable host rock in this locality. To date it has only been partially explored on the 1,275-, 1,400-, and 1,525-foot levels. On the levels above the 1,275-foot, it has been practically untouched. This diorite mass has been proven by diamond-drilling to extend at least 400 feet below the 1,525-foot level, where three holes gave encouraging results. We feel, therefore, that the area is very promising and that the chances are good of finding extensions of the No. 21 vein system and also of finding parallel veins of merit, both between the 1,275-foot level and surface and below the 1,525-foot level.

[1]For an account of the work done to that date, see Ont. Dept. Mines, Vol. L, 1941, pt. 1, p. 10.

The area to the south and west of the shaft above the 1,525-foot level has been pretty thoroughly explored by both lateral work and closely spaced diamond-drilling. It is known to contain a few faulted segments of ore shoots, which we are proceeding to mine out. These will produce a few months' ore, but owing to their erratic nature no estimate of ore reserves can be given.

Summary of Ore Hoisted

The figures below are corrected to tons milled and bullion produced.

Vein	Tons	Per cent. tons	Value	Grade	Per cent. value
No. 10	2,265	7	$54,080.00	$23.87	12.1
No. 21	21,771	66.8	360,249.00	16.54	80.7
Nos. 16, 6, 12, and 20	8,572	26.2	32,037.74	3.70	7.2
Total	32,608	100	$446,366.74	$13.69	100

Analysis of Operating Costs

	Total	Per ton milled (32,608 tons)
REVENUE:		
Gross bullion production	$419,016.37	$12.85
Miscellaneous income	4,428.75	.14
Total	$423,445.12	$12.99
EXPENDITURE:		
Development	$110,042.03	$3.37
Stoping	162,098.05	4.97
Milling	68,100.09	2.09
General charges (including Mint charges)	40,897.89	1.26
Total	$381,138.06	$11.69
Mine operating profit	$42,037.06	$1.30

Milling Statement

Ore milled	tons		32,608
Average tons per day			89.3
Per cent. running time			76.7
Average heads, gold (bullion plus tails)			$13.69
Gross value (gold)		$446,366.74	
Tailings loss		28,291.39	
Gold recovered in bullion			$418,075.35
Average tailings per ton			$0.87
Recovery per ton			$12.82
Extraction	per cent.		93.6

MILL SUPPLIES AND REAGENTS PER TON MILLED

Grinding balls	pounds	4.72
Lime	pounds	6.84
Cyanide	pounds	1.19
Litharge	pounds	.59
Zinc (per ton solution precipitated)	ounces	.40

An average force of 106 men was employed, of whom 59 were in the mine and 10 in the mill. F. L. Smith is mine manager.

Bonetal Gold Mines, Limited

Bonetal Gold Mines, Limited, was incorporated in November, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value. In 1945 the capitalization was increased to 4,000,000 shares of $1 par value, of which 3,174,173 have been issued. The mine is operated under the direction of Broulan Porcupine Mines, Limited. The officers and directors are: B. W. Lang, president; W. F. James, vice-president; T. C. Newman, secretary-treasurer; F. G. Lawson and F. J. Bowley, directors. The head office is at 372 Bay Street, Toronto. The mine address is Pamour.

The property consists of 9 claims, approximately 354 acres, adjoining the Hallnor and Broulan mines on the west, in Whitney township, Porcupine area, district of Cochrane.

Operations continued throughout 1945. The vertical, 3-compartment shaft on claim P. 18,523 is 571 feet deep, with levels at 175, 275, 400, and 512 feet. The following table shows the development work on these levels during 1945 and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
175-foot	....	787	....	407	....	159
275-foot	....	1,333	....	458	....	202
400-foot	....	1,496	....	629	....	743
512-foot	....	1,076	148	555	....	105

Some work has also been done from the Hallnor property on extensions from the latter's 321-, 521-, and 2,160-foot levels.

Diamond-drilling in 1945 consisted of 8 holes, totalling 1,643 feet, all from underground.

The following is taken from the mine manager's report for the year ending December 31, 1945:—

Production and Treatment

During the year, 25,828 tons of ore were mined and hoisted, of which 1,836 tons (7.1 per cent.) were removed on the sorting belt, and the remaining 23,992 tons were milled in the cyanide plant of Broulan Porcupine Mines, Limited.

Production totalled $168,826.42, representing 4,380.53 troy ounces of fine gold and 437.42 ounces of silver. Average recovery was $6.54 per ton hoisted, or $7.04 per ton cyanided. Over-all recovery, including sorting, was 95.40 per cent., and recovery in the cyanide plant was 95.57 per cent.

Mining

Of the 25,828 tons treated during the year, 258 tons were obtained from development work, the balance from stoping operations. Approximately 2,233 tons of rock from sorting and development work and 1,269 cubic yards of sand were used as backfill.

General

Stoping in the No. 1 or sedimentary zone above the first level has yielded better widths and extended further west than expected. There is still several months' ore in this area. A small area in the greenstones, which was mined between the second and third levels during the year, is being investigated by diamond-drilling at and above the second level elevation. At the time of writing, results indicate that some further tonnage will be developed here.

Operating Costs

Total operating costs for the year, including head office administration and general expense, amounted to $4.80 per ton mined and hoisted, or $5.17 per ton cyanided.

The number of employees shown for Broulan Porcupine Mines, Limited, includes those at the Bonetal Gold Mines, Limited. Walter F. Brown is mine manager.

Broulan Porcupine Mines, Limited

Broulan Porcupine Mines, Limited, was incorporated in March, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, of which

2,694,005 have been issued. The officers and directors are: B. W. Lang, president; W. F. James, vice-president; D. R. Michener, secretary-treasurer; J. B. Streit and F. G. Lawson, directors. The head office is at 372 Bay Street, Toronto. The mine address is Pamour.

The property now consists of 25 claims, 989 acres, in Whitney and Murphy townships, Porcupine area, district of Cochrane.

The mine and mill continued to operate throughout 1945. The vertical, 3-compartment shaft on claim No. 14,909 is 675 feet deep. The following table shows the development work done during 1945 and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
173-foot	....	2,461	....	916	192	1,561
273-foot	....	2,997	....	794	....	1,383
398-foot	....	1,551	....	918	....	1,685
523-foot	....	7,720	....	482	....	1,050
650-foot	....	242	....	330	264	264

Diamond-drilling during the year amounted to 5 holes, totalling 2,571 feet, from surface and 86 holes, totalling 10,312 feet, from underground.

The following is taken from the report of the mine manager for the year ending December 31, 1945:—

Production and Treatment

During the year, 102,470 tons of ore were mined and hoisted. Of this tonnage, 13,078 tons (12.8 per cent.) were removed on the sorting belt, and the balance of 89,392 tons was milled in the cyanide plant.

Production totalled $653,917.20, representing 16,966.28 troy ounces of fine gold and 1,726.65 ounces of silver. Average recovery was $6.38 per ton hoisted, or $7.32 per ton cyanided. Over-all recovery, including sorting, was 95.49 per cent., and recovery in the cyanide plant was 95.50 per cent.

Total operating costs for the year, including head office administration and general expense, amounted to $4.46 per ton of ore milled and hoisted, or $5.11 per ton cyanided.

During the year 23,992 dry tons of ore were crushed and milled for Bonetal Gold Mines, Limited.

Mining

Of the 102,470 tons of ore hoisted during the year, 655 tons were obtained from development work, the balance from stoping operations. All stoping is done by cut-and-fill methods. Due to flat-lying faults cutting across the ore bodies above the second level, it has become necessary to use considerable timber in the stopes. In addition to the waste rock obtained from sorting and development work, 45,248 cubic yards of sand were obtained for backfill.

Ore Reserves

Ore reserves as at December 31, 1945, are estimated to be 245,000 tons, having an average grade of 0.18 ounces of gold per ton. This figure includes a block of approximately 35,000 tons above the first level, in which sufficient work has not been done to establish definitely tonnage and grade.

General

The supply of labour reached a low point in the month of July. Gradual improvement from then on resulted in a sufficient supply being available at the end of the year.

About 162 men were employed, of whom 101 were underground and 61 on the surface. As the Bonetal mine is operated under the direction of Broulan Porcupine Mines, Limited, these figures include the number of employees at the Bonetal mine. Walter F. Brown is mine manager.

Buffalo Ankerite Gold Mines, Limited

Buffalo Ankerite Gold Mines, Limited, which was incorporated in October, 1932, has an authorized capitalization of 1,000,000 shares of $1 par value, of which 760,000 have been issued. The officers and directors are: E. G. Kinkel, president and managing director; Jacob Betz, vice-president; George R. Feine, secretary; Clarence H. Leo, assistant secretary; Henry Kobler, treasurer; R. P. Kinkel, assistant treasurer and mine manager; A. J. Baldeck, Everett Bristol, Harry J. Carmichael, Henry J. Tiedt, and H. C. Loesch, directors. The head office and mine office are at South Porcupine. A business office is maintained at 2100 Rand Building, Buffalo, N.Y.

The company holds 1,761 acres in Deloro township, Porcupine area, district of Cochrane.

Mining and milling continued throughout 1945. The workings are in two sections, known as the North and South. The old Nos. 1, 2, and 3 shafts and No. 7 winze are no longer used. Operations are carried on through the vertical, 5-compartment No. 5 shaft, which is 3,474 feet deep, in the North section. In the South section the 2-compartment No. 4 winze runs from the 425-foot level to the 1,050-foot level, and the 2-compartment No. 6 winze, which is collared at the 1,050-foot level, goes to a depth of 2,020 feet from surface. No. 6 winze is connected with No. 5 shaft by crosscuts on the 1,050- and 2,000-foot levels.

During the year the following development work was completed: drifting, 2,848 feet; crosscutting, 1,855 feet; raising, 1,672 feet. Total development work on the property to December 31, 1945, is as follows: drifting, 79,318 feet; crosscutting, 41,261 feet; raising, 28,476 feet. The bottom level of the mine is established at 3,450 feet.

Diamond-drilling during 1945 consisted of 14 holes, totalling 4,077 feet, from surface and 150 holes, totalling 24,848 feet, from underground.

The following is taken from the manager's report for the year ending December 31, 1945:—

Production

The mill treated 197,691 dry tons of ore with an average of 541.6 tons per day. This was a decrease of 16.04 per cent. over 1944 and 24.05 per cent. over 1943. The bullion recovery was $1,253,829.02. This was a decrease of approximately 20.77 per cent. over 1944 and 33.80 per cent. over 1943. The amount yielded was 32,531.696 ounces of gold. The average recovery was $6.342 per ton milled, as compared with $6.72 for 1944 and $7.28 for 1943.

The mine operating costs increased to $6.479 per ton. This was an increase of $0.456 per ton over the year 1944. The increase was almost exclusively in the mining of the ore. The mining costs increased $0.391 per ton. The increase was due primarily to labour conditions, shortage of miners, and decrease of tonnage.

Milling

The milling costs increased $0.056 per ton, or 6.8 per cent., which was not unusual with the existing conditions. Because of the lack of ore, no effort was made to complete the extension to the North mill, but work has been resumed this year and it can be completed as soon as additional ore is available for milling.

The following is a summary giving the average data of milling during the year:—

Tons milled		197,691
Tons milled daily		542
Heads (gold, $20.67)		$3.590
Tails (gold, $20.67)		$0.181
Recovery per ton	$3.409	
Premium per ton	2.934	
Total recovery per ton		$6.342
Gold ounces per ton		0.1646
Recovery (gold, $20.67)		$673,847.45
Recovery (present value)		$1,582,580.78

Mining, Development, and Exploration

There was production hoist from the 425- and 3,450-foot horizons. Production hoist from below the 2,000-foot level increased to 18 per cent. of the total.

	Tons
Ore broken in production	161,459
Ore broken in development	28,253
Total ore broken	189,712

The ore and waste broken in production was 163,251 tons, and the cost was $2.306 per ton.

	Feet	Cost per foot
Diamond-drilling	28,925	$1.488
Drifts (linear advance plus slashing)	6,180	19.28
Major and other crosscuts (linear advance plus slashing)	2,313	16.01
Raises	1,526	17.47

Ore Reserves, January 1, 1946

	Tons	Gold at $20.67		Gold at $38.50	
		Assay	Value	Assay	Value
Blocked	228,914	$4.269	$977,230.35	$7.951	$1,820,191.99
Broken	15,642	3.790	59,284.62	7.059	110,423.69
Total	244,556	$4.238	$1,036,514.97	$7.894	$1,930,615.68

The ore reserves have decreased 16.6 per cent. This is not an unusual decrease considering the decrease in miners from 1941 to the end of the war in September was 59 per cent.

Mine Operating Costs

The total mine operating costs are as follows:—

	Total cost	Cost per ton milled
Exploration	$43,446.02	$0.220
Development	182,860.02	.925
Mining	737,213.89	3.729
Milling	173,301.57	.877
General expense	143,954.06	.728
Total	$1,280,775.56	$6.479

Construction and General Improvements

The total capital expenditures for the year were $19,315.71. War-time machine shop work for the Government amounted to a gross of $8,887.66 and was completed in June, 1945.

The only new equipment purchased was a field exploratory diamond-drill. Other expenditures were the usual locomotive batteries and rails, etc. Total mine expenditure was $5,246.89.

Mechanical and surface construction consisted of a new metallizing outfit and new arc welder. A used caterpillar tractor was obtained in trade to be used for bulldozer work and as a heavier snow-plow.

Eight houses located on the mine property were purchased by the company for $8,987.50.

An agreement with the Timmins Mine and Mill Workers' Union, Local 241, was signed November 5, 1945.

An average force of 429 men was employed, of whom 289 were in the mine and 26 in the mill. E. C. Keeley is mine superintendent.

Cathroy Larder Mines, Limited

Cathroy Larder Mines, Limited, was incorporated in July, 1943, with an authorized capitalization of 4,000,000 shares of $1 par value, of which 2,829,432 have been issued. The officers and directors are: W. J. P. Jenner, president;

S. Harpham, secretary-treasurer; Dr. W. Babcock and E. Douglas, directors. The head office is at 171 Yonge Street, Toronto. The mine address is Boston Creek.

The property, which was formerly owned by Yama Gold Mines, Limited, consists of 49 claims, 1,960 acres, in Catharine, McElroy, and Hearst townships, Larder Lake area, district of Timiskaming.

On this property there is a vertical, 3-compartment shaft, 528 feet deep, on claim L. 26,272, McElroy township, sunk by the former operators. The following table shows the development work done during the year and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
125-foot	....	30	....	230	....	140
250-foot	100	1,810	50	750	....	90
375-foot	120	1,820	150	760	....	125
500-foot	101	1,711	48	538	....	108

Diamond-drilling in 1945 consisted of 10 holes, 5,596 feet, from surface and 15 holes, totalling 1,171 feet, from underground.

K. S. Oliver was manager, employing an average of 25 men during the period of operation.

Central Patricia Gold Mines, Limited

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

The main property, which includes the Central Patricia or No. 1 mine and the Springer or No. 2 operation consists of about 5,208 acres in Connell and Ponsford townships, Pickle-Crow area, Patricia portion of Kenora district. No work has been done at the No. 2 operation since June, 1940.

Operations at the No. 1 mine continued throughout 1945. The mine is served by a vertical, 3-compartment shaft, 2,226 feet deep, on claim Pa. 78, and a vertical, 4-compartment winze, which is collared at the 2,050-foot level, about 1,400 feet northeast of the shaft, and runs to a depth of 2,667 feet below surface.

During the year the following development work was completed: drifting, 452 feet; crosscutting, 208 feet; raising, 801 feet. Total development on the property to December 31, 1945, is as follows: drifting, 37,598 feet; crosscutting, 9,949 feet; raising, 19,735 feet. The bottom level of the mine is established at 2,650 feet.

Diamond-drilling consisted of 13 holes, totalling 5,967 feet, from surface and 176 holes, totalling 5,984 feet, from underground.

A total of 89,251 tons of ore and 5,368 tons of waste was hoisted during the year.

The following is taken from the manager's report for the year ending December 31, 1945:—

Production

The mill treated 89,301 tons of ore, from which was recovered 27,796.682 ounces of gold and 2,640.20 ounces of silver, valued at $1,071,245.54, an average recovery of 0.311 ounces of gold, or $12.00 per ton, representing 95.6 per cent. of the calculated mill heads. The average milling rate for the year was 245 tons per day, compared with 250 tons per day during the previous year.

Employment reached the lowest point of the war years during the summer of 1945. Towards the end of the year, the number of men available for underground work improved.

Production will be stepped up as rapidly as possible, and during 1946 the winze will be deepened and an active mine development programme carried on.

Ore Reserves

Ore reserves totalled 415,661 tons, grading 0.34 ounces per ton, compared with 441,912 tons, averaging 0.36 ounces per ton, at the end of 1944.

Ore estimate as of December 31, 1945, was as follows:—

	Tons	Ounces per ton
Developed ore	366,066	0.34
Probable ore	23,111	.28
Pillar ore	13,453	.50
Broken ore	13,031	.25
Total	415,661	0.34

Costs

A comparison of costs on the basis of tons hoisted follows:—

	1945	1944	1943	1942
Surface exploration	$0.01	$0.02	$0.01	$0.08
Development and exploration	.52	.70	1.21	1.45
Mining	3.73	3.22	2.79	3.15
Milling	1.25	1.32	1.25	1.17
Bullion expense	.15	.15	.17	.15
General expense at mine	.84	1.06	.93	.71
Administration expense	.46	.36	.33	.22
	$6.96	$6.83	$6.69	$6.93
Allowance for Dominion and Provincial taxes	1.18	1.32	1.73	1.27
Depreciation	1.11	1.07	1.06	.90
Total	$9.25	$9.22	$9.48	$9.10

General

The local airplane-landing strip referred to in the last annual statement again proved very valuable during the long break-up and freeze-up seasons.

An average force of 189 persons was employed, of whom 93 were in the mine, 9 in the mill, and 85 on general surface work. R. E. Barrett is manager.

Chesterville Larder Lake Gold Mining Company, Limited

The Chesterville Larder Lake Gold Mining Company, Limited, which was incorporated in March, 1907, has an authorized capitalization of 2,000,000 shares of $1 par value. Of the 1,735,559 shares issued, 13,000 are held in trust for the company. The officers and directors are: L. J. Kearns, president and general manager; J. B. Streit, vice-president; E. V. Oag, secretary-treasurer; V. Sutton, assistant secretary-treasurer; W. F. James, H. W. Knight, H. J. Kearns, and W. E. Young, directors. The head office is at 330 Bay Street, Toronto. The mine address is Kearns.

The property consists of 753 acres adjoining the Kerr-Addison mine on the east, in McGarry township, Larder Lake area, district of Timiskaming.

Mining and milling continued throughout 1945. The vertical, 3-compartment main shaft on claim H.F. 404 was sunk a further 333 feet to a total depth of 2,321 feet, with new levels established at 2,036 and 2,288 feet.

During the year, the following development work was completed: drifting, 1,679 feet; crosscutting, 2,725 feet; raising, 1,081 feet. Total development work to December 31, 1945, is as follows: drifting, 15,169 feet; crosscutting, 17,151 feet; raising, 11,498 feet. The bottom level of the mine is established at 2,288 feet.

Diamond-drilling during 1945 consisted of 368 holes, totalling 43,705 feet, all from underground.

The following is taken from the manager's report for the 12 months ending December 31, 1945:—

The results of this year's operation are compared in the following table with the cumulative results since the beginning of operations:—

	1945	1939–1945
Tons milled	153,416	1,305,171
Average tons milled per day	420	546
Total gold recovered ounces	17,025	171,778
Total silver recovered ounces	1,098	4,588
Total value production	$651,563	$6,599,218
Value per ton	4.57	5.53
Tailings loss per ton	.32	.47
Recovery per ton	4.25	5.06
Operating cost per ton	3.83	3.39
Operating profit per ton	.41	1.67

In July last, the number of men on the pay-roll dropped to 166, and the tonnage milled to an average of 350 tons per day. With the reinstatement of many of our men from the armed forces late in the year, the tonnage was increased until, in December, an average of 487 tons per day was milled.

Development

In spite of the shortage of labour, a normal amount of development work was accomplished. The main shaft was deepened, the area to the northeast was further explored, and the "D" and "J" ore bodies were tested in detail.

Mining

Very little ore remains to be removed from the "A" ore body, and nothing was mined in the "B" ore body. While the "C" ore body continues to supply most of the mill feed, no new ore is being found in this ore body and the volume of ore from this source will be reduced in the future. There was an increase in the amount of ore taken from the "D" ore body, and this trend is expected to continue. A moderate amount of ore was taken from the 21 ore body. Mining was started in the "J" ore body. The following table shows the sources of ore milled:—

Zone	Tons	Per cent. of total
A	9,228	6
C	89,859	58.6
D	34,096	22.2
J	4,979	3.3
21	15,254	9.9
Total	153,416	100

Ore Reserves

The assured ore reserves, as estimated at the end of the year, are shown below. These figures include 103,150 tons of broken ore. No allowance has been made for ore below the 12th level.

Zone	Tons	Grade
A	14,880	$7.08
B	25,000	5.78
C	111,385	4.35
D	52,335	4.77
J	76,600	4.73
21	45,000	6.39
Total	325,200	$5.00

The above figures include all the assured ore above the 12th level except in the "D" zone, where nothing is included below the 7th level.

The "D" zone between the 7th and 12th levels is very large, but the distribution of gold is extremely erratic. In spite of the extensive diamond-drilling in this body, it was still impossible to determine the grade with any reasonable degree of accuracy. However, approximately 150,000 tons of this type ore have been mined above the 7th level, with an average grade of $4.54 per ton, and it is probable that the grade of the ore below the 7th level will at least equal that mined above it. Stopes are being laid out in the better portions of the zone as determined by scattered assays, and it is estimated that more than 500,000 tons will be mined.

New Plant and Equipment

New haulage equipment to the value of $5,146.43 was put into service.

An average force of 173 men was employed, of whom 109 were in the mine and 18 in the mill. L. T. Postle is manager.

Cochenour Willans Gold Mines, Limited

Cochenour Willans Gold Mines, Limited, was incorporated in April, 1936, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,961,655 have been issued. The officers and directors are: W. M. Cochenour, president; A. Mackenzie, vice-president; G. M. Huycke, secretary-treasurer; E. C. Cochenour and J. M. Macintosh, directors. The head office is at 801 Dominion Bank Building, Toronto. The mine address is McKenzie Island.

The company's property consists of 25 claims, totalling approximately 706 acres, in Dome township, Red Lake area, Patricia portion of Kenora district.

Mining and milling operations continued throughout 1945. The vertical, 3-compartment No. 1 or main shaft on claim K.R.L. 322 is 688 feet deep, with levels established at 150, 275, 375, 475, 575, and 675 feet from surface. The vertical, 3-compartment No. 2 shaft on claim K.R.L. 462 on the Kelson ground, 1,900 feet northeast of No. 1 shaft, is 446 feet deep, with levels established at 110, 210, 310, and 410 feet from surface. These two shafts are connected on the 375-foot level from No. 1 shaft and on the 310-foot level from No. 2 shaft.

During the year, the following development work was completed: No. 1 shaft: drifting, 3,544 feet; crosscutting, 4,191 feet; raising, 875 feet. No. 2 shaft: drifting, 4,561 feet; crosscutting, 1,941 feet; raising, 586 feet. Total development on the property to December 31, 1945, is as follows: drifting, 22,958 feet; crosscutting, 14,866 feet; raising, 5,341 feet.

Diamond-drilling during the year totalled 44,231 feet, all from underground.

The following is taken from the manager's report for the 12-month period ending May 31, 1946:—

Production[1] and Costs

A total of 39,274 tons of ore were milled for a daily average of 107.6 tons.

Period	Production	Tons	Recovery per ton	Total costs per ton	Tails	Heads
Year ending May 31, 1946.	$542,483.65	39,274	$13.81	$20.48	$0.80	$14.61
Year ending May 31, 1945.	671,563.95	38,766	17.32	19.03	.92	18.25
Year ending May 31, 1944.	1,031,589.70	53,866	19.14	14.66	.78	19.92
Year ending May 31, 1943.	1,188,093.60	57,619	20.62	12.83	1.27	21.89

All-time production amounts to $5,906,979.48 from 340,133 tons. The average grade milled to date is 0.484 ounces, or $18.62 per ton.

Following is a tabulation of the costs per ton and per ounce covering the past two fiscal years:—

[1]The following values are calculated on gold at $38.50 per ounce.

	Cost per ton		Cost per ounce	
	1945–46	1944–45	1945–46	1944–45
Development	$5.367	$4.205	$14.959	$9.345
Slashing	.664	.358	1.851	.795
Stope preparation	.019	.038	.053	.084
Diamond-drilling, underground	1.451	.717	4.046	1.594
Diamond-drilling, surface	.037	....	.102	....
Mining	3.302	3.897	9.203	8.660
Crushing and conveying	.235	.226	.656	.503
Milling	1.968	2.116	5.487	4.703
Flotation	.446	.483	1.244	1.073
General expense	1.267	1.086	3.532	2.413
Total operating, mine	$14.756	$13.126	$41.133	$29.170
Marketing concentrates	1.500	1.967	4.181	4.370
Deferred development	1.492	1.318	4.158	2.928
Depreciation	2.109	2.030	5.878	4.511
Head office	.586	.589	1.633	1.311
Taxes	.043	....	.120	....
Total cost	$20.486	$19.030	$57.103	$42.290

Mining

Ore was drawn from all but the bottom or 675-foot level, with the 375-, 475-, and 575-foot contributing the major proportion. The governing feature was accessibility, due to the acute labour shortage, and grade suffered considerably. Narrow stopes of high-grade were left, and wider zones of much lower grade were mined, as the objective was to keep the mill running in an endeavour to meet current expenses.

The following shows source of ore and grade for the past two years:—

Level	Year ending May 31, 1946		Year ending May 31, 1945	
	Tons	Grade	Tons	Grade
150-foot	2,881	$5.04	4,550	$10.78
275-foot	7,963	7.90	14,896	16.52
375-foot	13,096	16.70	18,097	26.20
475-foot	9,088	20.40	1,201	5.80
575-foot	6,246	17.20	....	....
Total	39,274	$14.61	38,744	$18.22

It is to be noted that the two new levels, the 475- and 575-foot, have graded mine average or better from preliminary development and mining.

Summary and Conclusion

The hope that with the ending of the war an adequate supply of labour would be made available has not been realized. Up to December, 1945, the average daily attendance underground was 22 men, including shift bosses, cage-tenders, etc., and in August, September, and October, the average was 12 men, including all classes. A peak was reached in March when we had an average of 57 men, but with absenteeism of the underground workers running as high as 30 per cent. and a loss of men to other operations, the situation has deteriorated steadily since March and at present is only fair.

An average force of 99 men was employed during the year, of whom 40 were in the mine, 10 in the mill, and 46 on general surface work. W. P. Mackle is manager.

Coniaurum Mines, Limited

Coniaurum Mines, Limited, which was incorporated in July, 1929, has an authorized capitalization of 3,000,000 shares of no par value, of which 2,766,743 have been issued. The officers and directors are: Thayer Lindsley, president;

A. L. Bishop, vice-president; A. G. Fulton, secretary-treasurer; T. H. Rea, Fraser D. Reid, J. Redington, J. M. Cunningham-Dunlop, and Wm. C. Martin, directors. The head office is at 25 King Street West, Toronto. The mine address is Schumacher.

The company is the second of the name. The first company, which was incorporated in 1924 and went into receivership in 1929, had an issued capital of 1,200,000 shares of $5 par value and $800,000 in 7 per cent. bonds. The shares were exchanged on a basis of one new share for two old shares held. Bondholders in the old company were given the option of exchanging the $80 bonds for 120 shares of the new stock or redeeming them at par plus accrued interest.

The main property consists of 19 claims, approximately 760 acres, adjoining the McIntyre-Porcupine mine, in Tisdale township, Porcupine area, district of Cochrane. It includes the former Goldale, Newray, Armstrong-Booth, and Strong Bow properties. The company also holds three additional claims in the same township.

Operations were continuous throughout 1945. The mine is operated through a system of vertical shafts and winzes, as shown in the following table:—

Shaft or winze	No. of compartments	Total depth from surface
		feet
Bishop shaft	3 to 2,000 feet. 4 to 3,666 feet.	3,666
Bishop subshaft (below 3,250-foot level)	2 and 3 to 3,500 feet. 4 below 3,500 feet.	5,641
Goldale shaft	2 to 400 feet. 3 to 1,000 feet.	1,020
No. 1 winze (below 2,000-foot level)	2	2,533
No. 2 winze (below 3,000-foot level)	2 to 3,500 feet. 3 to 5,000 feet.	5,028
No. 3 winze (below 2,000-foot level)	2	2,755

During the year, the following development work was completed: drifting, 2,624 feet; crosscutting, 2,444 feet; raising, 2,269 feet. Total development on the property to December 31, 1945, is as follows: drifting, 69,435 feet; crosscutting, 97,315 feet; raising, 56,626 feet. The bottom level of the mine is established at 5,500 feet.

Diamond-drilling during 1945 consisted of 80 holes, totalling 20,393 feet, all from underground.

The following is taken from the general manager's report for the year ending December 31, 1945:—

Exploration

Exploration has been pursued in many places from the 700-foot level to our deepest level at 5,500 feet. This has been in the nature of stope-raising, drifting, and diamond-drilling, including crosscutting and drifting on several of the main levels. This work has met with fair success in locating new ore bodies. Some of these were indicated in diamond-drill holes and were mentioned in former reports. Not until this year have they become a reality.

Several of the new ore bodies have been partly explored. They occur in the north porphyry mass. All of these promise to be of major importance and will supply considerable mill feed for future operations.

It will be of interest to all to know that 35 per cent. of the footage driven this year in ore is in porphyry. Above the 4,500-foot level many efforts in past years to develop veins in the porphyry proved fruitless. Below the 4,500-foot level, certain sections of the porphyries appear to have fractured more readily and, in part, the dynamic forces that led to fracturing in the schists around the margins of the porphyry bodies higher up have, with depth, reacted on the bodies themselves.

Development

The major portion of development this year has been confined to the lower levels. Ore developed in porphyry is on the following levels: 4,500-, 4,750-, 5,000-, and 5,500-foot.

The No. 60 vein zone at and below the 4,750-foot horizon is one of the most interesting sections explored. On the 4,750-foot level, this vein was drifted over 300 feet in ore grading about half an ounce over a width of 3.5 feet. Over 50 per cent. of the length of this fracture is in porphyry. Potential ground on strike to the west is yet to be explored.

On the 5,000-foot level below this zone and in the same geological environment, No. 60 vein has been drifted 46 feet in average ore at year's end. This work still lies some distance east of the 4,750-foot drifting, and drilling ahead has indicated its continuance.

Another substantial fracture opened up is No. 47 vein on the 5,500-foot level. This lies entirely within the porphyry in the vicinity of the subshaft and out of 371 feet of drifting has yielded 200 feet averaging 4.4 pennyweights over 3.4 feet.

From the west end of M.2 drive on the 5,500-foot level, No. 11.5 crosscut south was driven to explore the ground below and east of No. 2 winze. A limited amount of development was done on No. 36 vein west of the crosscut. The breakage of this drive was used for mill feed. There has been no drifting from the east side of the crosscut. The vein on the east side of the crosscut is from 3 to 4 feet wide and well mineralized. This will be developed later. This new development is directly under the highly productive zone on the levels above. There is every good reason to expect favourable results with further exploration in this section.

Drifting on levels and sublevels in the No. 2 and No. 3 winze areas has continued to open up ore shoots; many of these are extensions and continuations of veins now being mined. Work of this nature returned close to 650 feet of ore, grading mine average, during the year.

Statement of Production by Years[1]

Year	Tons milled	Percentage recovery	Net value of metals recovered	Value per ton	Total operating costs	Operating costs per ton	Operating profit	Profit per ton	Price received per ounce of gold
1929..	103,293	96.60	$666,549.73	$6.45	$641,474.95	$6.21	$25,074.78	$0.24	$20.67
1930..	122,972	96.35	732,473.87	5.96	672,444.52	5.47	60,029.35	.49	20.67
1931..	130,585	96.03	829,970.54	6.36	649,175.52	4.98	180,795.02	1.38	21.96
1932..	144,654	95.70	944,349.13	6.53	728,387.13	5.04	215,962.00	1.49	23.33
1933..	145,657	94.60	934,406.63	6.42	591,035.98	4.06	343,370.65	2.36	28.91
1934..	138,114	95.14	971,760.27	7.04	755,531.29	5.47	216,228.98	1.57	34.51
1935..	151,055	95.94	1,120,873.95	7.42	947,011.68	6.27	173,862.27	1.15	35.17
1936..	168,715	95.73	1,373,388.35	8.14	1,111,986.43	6.59	261,401.92	1.55	35.04
1937..	166,980	95.19	1,444,383.75	8.65	1,194,224.68	7.15	250,159.07	1.50	34.98
1938..	188,975	95.79	1,654,332.13	8.75	1,128,892.26	5.97	525,439.87	2.78	35.19
1939..	187,405	95.89	1,733,106.61	9.25	1,111,246.49	5.93	621,860.12	3.32	36.32
1940..	185,455	96.35	1,849,829.83	9.97	1,087,107.62	5.86	762,722.21	4.11	38.50
1941..	186,885	96.09	1,853,130.39	9.92	1,147,307.80	6.14	705,822.59	3.78	38.50
1942..	162,390	96.30	1,646,068.37	10.14	1,044,575.83	6.43	601,492.54	3.71	38.50
1943..	111,455	97.40	1,176,485.77	10.56	787,442.49	7.07	389,043.28	3.49	38.50
1944..	98,540	97.20	1,026,143.84	10.41	736,979.53	7.48	289,164.31	2.93	38.50
1945..	98,210	97.50	1,002,469.13	10.21	744,359.07	7.58	258,110.06	2.63	38.50

[1]Commencing in 1929 when the new company was formed.

Dividends Paid

	Rate per share	Total
	cents	
1932	3	$80,923.41
1937	10	273,044.70
1938	15	411,381.85
1939	16	442,678.88
1940	18	498,013.74
1941	16	442,678.88
1942	13	359,676.59
1943	10	276,674.30
1944	8	221,339.44
1945	8	221,339.44
Total	....	$3,227,751.23

Operations

During the war years, development was chiefly confined to lateral work. Raising and stope preparations were limited to the most meagre necessities. This did not keep in step with other developments. For this reason, raising at this time is about 4,000 feet behind schedule. Some of this work is now under way, and some time will be required before the mine is back to normal.

Labour

Labour conditions have improved somewhat in the last two months. A number of our former employees have returned. Out of 165 men that left our employ to join the armed forces about 50 have now returned.

Employees' Medical Services Association

The plan this year did not have as good a performance as in 1944. It has been necessary to increase the fees as of January 1, 1946. A married employee will now pay $3.40 per month instead of the former $3.15, and a single employee has had his fee increased from $2.05 per month to $2.15. The company's portion has also been increased from $1.10 per month to $1.20 per month per employee.

The reason for the increased rates is that more medical supplies and nursing services have been required, as well as a greater demand for medical services.

Summary of Development

	Length	Width	Value per ton
	feet	feet	dwt.
Footage driven in ore........................	1,557	3.5	7.5
Raising in ore...............................	961	3.6	5.9

Broken Ore Reserves

Broken ore reserves as at the end of December, 1945, were 81,047 tons, value estimated as 5.9 pennyweights per ton. These are slightly below the previous year, which stood at 82,998 tons.

Milling

During the year the mill treated 98,210 tons of ore with an average recovery of $10.32 per ton, extracting 97.5 per cent. of the total gold content and operating 364 days, or 99.7 per cent. of possible running time.

The average number of men employed was 202, divided as follows: mine, 124; mill, 20; general surface work, 58. John Redington is manager.

Continental Kirkland Mines, Limited

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

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

A further reference to this mine appears on page 76 of this report under Toburn Gold Mines, Limited.

Crowshore Patricia Gold Mines, Limited

Crowshore Patricia Gold Mines, Limited, was incorporated in May, 1944. The authorized capitalization is 3,000,000 shares of $1 par value, of which 2,300,000 have been issued. On incorporation the company acquired the property of Crowshore Gold Mines, Limited. The officers and directors are: H. I. Kurtz, president; F. W. Hipwell, vice-president; J. Knight and F. W. Leech, directors. The head office is at 171 Yonge Street, Toronto. The mine address is Pickle Crow.

The property consists of 8 claims, approximately 320 acres, in McCullagh township, Pickle-Crow area, Patricia portion of Kenora district.

Operations were begun during the year, and a main 3-compartment, vertical shaft was sunk on claim Pa. 2,161 to a depth of 30 feet. Diamond-drilling in 1945 consisted of 13 holes, totalling 5,972 feet, from surface.

An average of 5 persons was employed during the period of operation. C. D. Salkeld is manager.

Delnite Mines, Limited

Delnite Mines, Limited, which was incorporated in October, 1934, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,978,767 have been issued. The officers and directors are: E. L. Koons, president; W. V. Moot, vice-president and managing director; C. L. Ingham, treasurer; W. S. Walton, secretary; Lewis R. Gulick, Harry Yates, Jas. Savage, Alfred H. Sharpe, and K. C. Gray, directors. The company is controlled by Sylvanite Gold Mines, Limited. The head office and mine office are at Timmins. The Toronto office is at 603 Royal Bank Building.

The property consists of 15 claims, containing approximately 536 acres, in Deloro and Ogden townships, Porcupine area, district of Cochrane, three miles southeast of the town of Timmins.

Mining and milling operations continued throughout 1945. There are two vertical shafts on the property, both on claim T.R.S. 825. The 2-compartment No. 1 shaft is 391 feet deep and is connected to No. 2 main shaft on the 250- and 375-foot levels. The first level, developed entirely from No. 1 shaft at a depth of 125 feet, is not directly connected with No. 2 shaft. During 1945, the 3-compartment No. 2 shaft was deepened from 2,638 feet to 2,934 feet. New levels were established at 2,625, 2,750, and 2,875 feet.

During the year, the following development work was completed: drifting, 2,667 feet; crosscutting, 1,920 feet; raising, 497 feet. The total development work to December 31, 1945, is as follows: drifting, 34,402 feet; crosscutting, 13,559 feet; raising, 6,812 feet. Diamond-drilling during 1945 consisted of 77 holes, totalling 13,212 feet, from underground.

The following is taken from the manager's report for the twelve months ending December 31, 1945:—

Production

Ore treated....tons		66,120
Gross value....		$386,414.24
Bullion recovered:		
Gold (9,421.561 ounces at $38.500036)..	$362,730.44	
Silver (827.70 ounces at $0.402259).....	332.95	
Total value....		$363,063.39
Value per ton....		5.844
Recovery per ton....		5.491
Recovery per cent....		93.96

PRODUCTION SINCE MILLING COMMENCED JUNE 1, 1937

Fiscal year ending	Tons milled	Value per ton milled	Gross value	Recovery per ton	Recovery value	Average price per ounce
Mar. 31, 1938[1]......	57,689	$7.01	$404,484.39	$6.41	$369,678.75	$35.17
Mar. 31, 1939.......	91,749	8.56	785,063.52	7.81	716,520.84	35.21
Mar. 31, 1940.......	114,922	7.78	894,640.71	7.12	818,312.96	37.04
Dec. 31, 1940[2]......	99,342	7.22	716,875.50	6.70	665,391.28	38.50
Dec. 31, 1941.......	166,596	7.65	1,274,895.04	7.10	1,183,052.95	38.50
Dec. 31, 1942.......	172,727	7.53	1,299,700.68	7.07	1,220,662.79	38.50
Dec. 31, 1943.......	125,887	7.15	900,064.69	6.51	819,671.83	38.50
Dec. 31, 1944.......	93,112	6.57	612,086.19	6.12	570,247.43	38.50
Dec. 31, 1945.......	66,120	5.84	386,414.24	5.49	363,063.39	38.50

[1]Ten months. [2]Nine months.

SUMMARY OF ORE AND WASTE HOISTED AND BACKFILL PLACED

	Development	Stopes	Total	Backfill placed	
				Waste	Gravel
	tons	tons	tons	tons	tons
Ore	8,720	57,563	66,283	....	....
Waste	12,477	....	12,477	20,467	7,653

Broken Ore Reserves

Broken ore reserves are estimated at 38,055 tons at a grade of 3.24 pennyweights per ton, or $6.24 at $38.50 per ounce of gold.

Costs

	Total costs	Cost per ton milled		Cost per fine ounce gold produced, 1945
		1945	1944	
OPERATING COSTS:				
Development and exploration	$142,448.19	$2.154	$1.120	$15.119
Mining	185,026.18	2.798	2.701	19.639
Milling	116,611.15	1.764	1.432	12.377
General mine charges after deducting sundry revenue	52,435.34	.793	.597	5.565
Administrative expense (partly mine)	23,304.82	.353	.261	2.474
Bullion marketing expense, including Mint handling and refining charges	4,224.37	.064	.068	.448
Total	$524,050.05	$7.926	$6.179	$55.622
OTHER COSTS:				
Provision for depreciation	$71,457.01	$1.081	$0.747	$7.584
Preliminary development (written off)	....	....	.500	....
Shaft-sinking (written off)	12,619.84	.190	....	1.340
Total	$84,076.85	$1.271	$1.247	$8.924
Total costs	$608,126.90	$9.197	$7.426	$64.546

Summary

The underground pay-roll commenced to increase in November as former employees returned from the services. The average daily mill tonnage for the year was 181.

Development work was continued throughout the year and at an increasing rate during the last few months.

No. 2 shaft was deepened from the 2,625- to the 2,875-foot level. The 2,875-foot level will be the bottom level with a loading pocket and sump below. A soft talc schist zone enters the shaft area just below where the shaft will be bottomed.

Drifting was 31.9 per cent. in ore and gave a length of 849.5 feet, which averaged 4.86 pennyweights over a width of 4.69 feet. All except 64 feet of this drifting was done in the south ore zone on levels down to the 1,250-foot.

Crosscuts were started north from the shaft to the main ore zone on the 2,125-, 2,250-, 2,375-, and the 2,500-foot levels. On the 2,500-foot two fairly strong veins were found in the main ore zone, and the 64 feet of drifting was all ore grading 7.08 pennyweights over a width of 4.39 feet. This area would seem to have considerable promise as a producer of ore.

The war years have in many respects been difficult. In the later years man power shortages resulted in decreasing tonnages of ore being milled at a decreasing grade and at an increased cost. Considerable development work, however, has been done, so that the mine should profit by this in the future. Indications, too, are that a slightly better grade of ore may be developed on the lower levels in the main ore zone and in parts of the south ore zone.

An average force of 132 men was employed, of whom 89 were in the mine, 16 in the mill, and 27 on general surface work. John Beattie is manager.

Dome Mines, Limited

Dome Mines, Limited, was incorporated in 1923 under Dominion charter to succeed the Dome Mines Company, Limited. The authorized capitalization is 2,000,000 shares of no par value, all of which have been issued. The officers and directors are: C. W. Michel, president and treasurer; J. H. Stovel, vice-president; C. C. Calvin, secretary; E. P. Goetz, assistant secretary and assistant treasurer; John B. Robinson and H. H. Butterman, assistant secretaries; Morton F. Stern, A. D. McRae, F. Warren Pershing, Byron C. Foy, F. H. Marsh, and H. C. Brunie, directors. The president's office is at 61 Broadway, New York. The secretary's office is at 36 Toronto Street, Toronto. The mine office is at South Porcupine.

The company owns 53 claims and the beds of Porcupine and Simpson lakes in Tisdale and Whitney townships and 5 claims in Shaw township, Porcupine area, district of Cochrane, containing in all 2,857 acres.

The mine has been developed from the vertical shafts and winzes shown in the following table:—

Shaft or winze	No. of compartments	Total depth from surface
		feet
No. 1 shaft	3	105
No. 2 shaft	3	805
No. 3 main shaft	5	2,456
No. 4 internal shaft (below 13th level)[1]	2	2,052
No. 5 internal shaft (below 16th level)[1 2]	3	3,137
No. 6 internal shaft (below 16th level)[2]	5	4,061
No. 1,802 winze (below 18th level)[1]	2	2,870
No. 2,309 winze (below 23rd level)[1 3]	3	3,775

[1]Not being used for hoisting.
[2]Also connected with the main shaft on the 18th level.
[3]This winze was originally 722 feet deep below the collar, but has been partially stoped out.

During the year, the following development work was completed: drifting, 6,886 feet; crosscutting, 1,914 feet; raising, 4,881 feet. The total development on the property to December 31, 1945, is as follows: drifting, 215,829 feet; crosscutting, 97,001 feet; raising, 105,816 feet.

The following is taken from the general manager's report for the year ending December 31, 1945:—

OPERATING STATEMENT

for the year ended December 31, 1945

EARNINGS:		
Bullion production		$4,887,263.32
OPERATING AND MAINTENANCE EXPENDITURE:		
Development and exploration	$393,403.95	
Mining, including hoisting	1,083,745.85	
Crushing and conveying	101,683.59	
Milling	438,632.51	
Refining and marketing	55,729.62	
Fire protection	9,051.41	
Warehouse expense	23,454.11	
Auditing expense	5,029.51	
Administrative expense:		
Mine office	153,049.41	
Executive office	99,488.95	
Registrar and transfer fees and expenses	20,420.23	
Insurance	12,674.48	
Taxes other than income	20,838.45	
Current contributions to pension fund	38,804.81	
		2,456,006.88
NET OPERATING PROFIT (before depreciation, income taxes, and outside exploration written off)		$2,431,256.44

During the year 527,100 tons of ore was treated in the mill. In the course of mining operations 50,800 tons of waste rock was excavated, all of which was used as fill underground. The 527,100 tons of ore milled yielded 126,677 ounces of gold, the yield being 0.2403 ounces, or 4.806 pennyweights per ton.

All values of ore, etc., will be expressed in pennyweights (dwts.) throughout this report. One pennyweight equals one-twentieth of an ounce, troy weight. At $38.50 per ounce of gold, one pennyweight is equal to $1.92½ in Canadian funds.

Source of Ore

The following figures, with which are included 50,900 tons of development ore of an average grade of 3.66 pennyweights per ton, show the source and grade of the ore milled:—

Source	Tons	Dwts. per ton
5th level to surface, including approximately 8,600 tons of ankerite ore	41,723	3.87
Ankerite veins below the 5th level	153,744	4.53
23rd level and below	Nil	Nil
Remainder of mine, including approximately 69,600 tons from the Schumacher area	331,633	5.34
Total	527,100	4.99

Development

As in the immediate past, much of the diamond-drilling accomplished was done to serve as a guide to stoping operations. During the year the programme was expanded somewhat in order to keep well ahead of excavational exploratory work which will be required. A total of 48,649.5 feet of diamond-drilling was done, exclusive of blast-holes.

We continue to use the diamond-drill for blast-holes in connection with the removal of ore not readily accessible by the percussion drill alone. During the year a total of 15,570.5 feet of diamond-drilling was done for this purpose.

Ore Production

During the year the mine produced 527,100 tons of ore, which averaged 4.99 pennyweights per ton. Of this, 476,200 tons, averaging 5.13 pennyweights per ton, came from the stopes and 50,900 tons, averaging 3.66 pennyweights per ton, came from development work.

Ore Reserves

The ore reserves are estimated at 2,412,000 tons, an increase of 59,000 tons from the tonnage shown last year. The ore reserves are classed as follows:—

	Per cent.
Ankerite veins	22.9
23rd level and below	20.3
Remainder of mine	56.8

Mill

The following are the milling results:—

Ore treated	tons	527,100
Average grade treated	dwts. per ton	4.99
Recovery	per cent.	96.45

Costs

The expenditure on mining was $1,083,745.85, or $2.06 per ton, as compared with $1.89 per ton milled in 1944. The expenditure on development was $393,403.95, or $0.75 per ton, as compared with $0.56 per ton milled in 1944. The total operating charges for the year were $4.66 per ton, as compared with $4.28 per ton milled in 1944.

The company employed an average of 574 men during the year, of whom 279 were in the mine and 54 in the mill. Robt. E. Dye is general manager.

Golden Gate Mining Company, Limited

The Golden Gate Mining Company, Limited, was incorporated in July, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value. In June, 1940, the capitalization was increased to 5,000,000 shares of $1 par value and the property of Crescent Kirkland Gold Mines, Limited, was purchased for 500,000 shares. The number of shares issued at December, 1945, was 4,560,005. The officers and directors are: W. J. Lawson, president; Dr. T. B. Armstrong, vice-president; Fred Rose, secretary-treasurer; T. M. Mungovan, W. G. Chipp, and F. N. Rosar, directors. The head office is at 371 Bay Street, Toronto. The mine office, when operations are in progress, is Swastika.

The combined Golden Gate and Crescent Kirkland properties consist of 18 claims in Teck and Otto townships, Kirkland Lake area, district of Timiskaming.

The Golden Gate section has been developed from two shafts. The 2-compartment No. 1 shaft on claim L. 2,696 was sunk at an angle of 65 degrees to a depth of 370 feet below surface. The 3-compartment, vertical No. 2 or main shaft on claim L. 2,692, 467 feet northeast of No. 1 shaft, is 971 feet deep. The shafts are connected on the 225- and 350-foot levels. The 3-compartment, vertical shaft sunk by the former operators on claim L. 9,592 of the Crescent section is 420 feet deep. It is known as No. 3 shaft.

Operations were resumed in October, 1945, after the mine had been idle for three and a half years.

No development work was done on the Golden Gate section. The following table shows the development work done on the Crescent section during 1945 and the total:—

Development Work on the Crescent Section

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
100-foot	....	380	106	551	....	150
200-foot	....	649	....	544	....	69
300-foot	....	624	210	1,566	....	358
400-foot	....	60	118	668	....	....
Adit	....	224	....	416	....	....

Five diamond-drill holes, totalling 4,800 feet, were drilled from surface during 1945.

There was no production during the period, the only material hoisted being 1,413 tons of waste rock.

S. A. Pain was manager, employing an average force of 17 men during the period of operation.

Goldhawk Porcupine Mines, Limited

Goldhawk Porcupine Mines, Limited, was incorporated in September, 1944, with an authorized capitalization of 4,000,000 shares of no par value, of which 2,272,005 have been issued. The officers and directors are: J. D. Barrington, president; J. H. C. Waite, vice-president; H. B. Clearihue, secretary-treasurer; B. W. Lang, G. W. Bowcock, and E. K. Fockler, directors. The head office is at 67 Yonge Street, Toronto. The mine address is South Porcupine.

The company owns 13 claims, 481 acres, and holds a license of occupation on 1,008 acres in Cody and Macklem townships, Porcupine area, district of Cochrane. Some of the claims have also been known as the Gold Island and Lakefield claims.

The present operators began work on September 15, 1945. There are several shafts on the property sunk by former operators. One of these, a vertical, 2-compartment shaft on claim No. 9,333, is 184 feet deep. It was dewatered, and a new level was established at a depth of 170 feet, on which 18 feet of crosscutting was done. A new vertical, 3-compartment shaft, known as the Main, was collared at a point about 190 feet west and slightly south of the No. 2 shaft. About 31 feet of sinking had been accomplished at the end of the year.

Diamond-drilling consisted of one hole, 998 feet in depth, from surface.

The following buildings were erected during the year: bunk-house, cookery, office, hoist-house, dry-house, shop, boiler-house, pump-house, and 55-foot headframe.

The following plant equipment was delivered at the property before the end of the year and preparations were being made for its installation: a 48- by 36-inch Canadian Ingersoll-Rand electric double-drum hoist; a 19½- by 12- by 10-inch Canadian Ingersoll-Rand angle compound compressor; a locomotive-type, 50 h.p. boiler; and 2 oil-type, 200 k.v.a. Ferranti transformers.

E. B. Gillanders was manager, and an average of 17 men was employed during the period of operation.

Hallnor Mines, Limited

Hallnor Mines, Limited, was incorporated in April, 1936, with an authorized capitalization of 2,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: Jas. Y. Murdoch, president; J. R. Bradfield, secretary; R. G. Rudolf, treasurer; F. M. Connell, A. L. Ellsworth, Leo H. Timmins, and J. E. Perrault, directors. The head office and mine office are at Pamour. The executive office is at 1600 Royal Bank Building, Toronto.

The property consists of 160 acres in the north half of lot 7, concession V, Whitney township, Porcupine area, district of Cochrane, adjoining the west boundary of the property of Pamour Porcupine Mines, Limited.

The mine and mill continued to operate throughout 1945. The mine is operated from a vertical, 3-compartment shaft. During 1945 this shaft was sunk a further 118 feet to a depth of 2,362 feet. The only development work done during the year was 149 feet of drifting on the 760-foot level. The total development on the property to December 31, 1945, is as follows: drifting, 26,968 feet; crosscutting, 6,820 feet; raising, 7,590 feet. The bottom level of the mine is established at 2,160 feet.

Diamond-drilling during the year amounted to 58 holes, totalling 2,262 feet, from underground.

The following is taken from the manager's report for the year ending December 31, 1945:—

Mining

The work here consisted of drifting, raising, shaft-sinking, diamond-drilling, and stoping.

The ore produced came entirely from cut-and-fill stopes, with the production from the various levels as follows:—

	Tons
2nd level	184
3rd level	10,861
4th level	20,113
5th level	44,129
6th level	19,302
Miscellaneous	344
Total	94,933
Broken reserve	7,953
Backfill placed in stopes	69,230

Ore Reserves

With 94,933 tons of ore taken from the stopes and only a very small amount of new ore put in sight, the ore reserves are somewhat below last year and now stand at 515,352 tons, with an average cut grade of 0.37 ounces per ton, compared with 550,375 tons and a cut grade of 0.35 ounces per ton at the end of 1944. Increased mining widths in practically all the stopes accounts for the additional tonnage mined.

Mill

The mill has been in continuous operation throughout the year with short shut-downs for repairs, inspections, and power failures. The 8- by 8-foot ball mill was in operation 8,679.2 hours, or 99.08 per cent. of possible running time. Tonnage milled varied from 250 to 300 tons per day, with an average of 261 tons per day. The mill treated 95,436 dry tons of ore and produced bullion to the value of $1,724,504.97, or an average of $18.07 per ton, compared with $15.43 per ton in 1944.

General

The last three months of the year saw a decided improvement in the labour situation, partially due to men returning from the services. We were able to get a full crew for the shaft and bring the rest of the mine nearly up to full strength.

An agreement with the Timmins Mine and Mill Workers Union, Local 241, was signed and put in force on September 20.

An average of 141 men was employed during 1945, of whom 84 were in the mine, 19 in the mill, and 37 on general surface work. A. L. Sharp is manager.

Hard Rock Gold Mines, Limited

Hard Rock Gold Mines, Limited, which was incorporated in January, 1934, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,990,074 have been issued. The officers and directors are: T. H. Rea, president; G. W. Rayner, vice-president; W. S. Walton, secretary-treasurer; A. B. Gordon, H. R. Aird, and Wm. W. Smith, directors. The head office and mine office are at Geraldton. The secretary's office is at 603 Royal Bank Building, Toronto.

The main property consists of 845 acres in Ashmore township, Little Long Lac area, district of Thunder Bay. It is accessible by automobile road from Geraldton, 4½ miles north of the property on the Longlac–Port Arthur branch of the Canadian National Railways. In 1944 the company acquired the major interest in 13 claims in Midlothian township, Matachewan area, district of Timiskaming.

Work in the No. 2 shaft area of the main property was continued throughout 1945. The No. 1 shaft workings have not been operated since 1939. The vertical, 3-compartment No. 2 shaft on claim T.B. 9,991 is 1,410 feet deep. The vertical, 3-compartment No. 2 winze, which is collared at the 475-foot level about 1,300 feet northwest of the shaft, runs to a depth of 800 feet from surface.

During the year the following development work was completed in the No. 2 shaft section: drifting, 4,040 feet; crosscutting, 256 feet; raising, 637 feet. The total development work on No. 2 shaft section to December 31, 1945, is as follows: drifting, 26,725 feet; crosscutting, 8,866 feet; raising, 4,464 feet.

Diamond-drilling consisted of 126 holes, totalling 24,160 feet, from underground.

The following is taken from the general manager's report for the twelve months ending December 31, 1945:—

Mining and Development

Commencing immediately after the closing of the mill in January, all available men fit for underground work were employed in development headings. During the first six months an average of 596 feet of development work was completed each month, but during the last six months the average was only 225 feet per month. The underground force reached a low in August, when an average of only 34 man-shifts per day were available.

During the year a total of 13,000 tons of ore was broken, of which 8,000 tons was sulphide ore, which was stored underground, and the remaining 5,000 tons was quartz ore similarly stored until the quartz mill was reopened in November.

Development on the fifth level (625-foot level) included further outlining the limits of a block of free-milling ore, which was previously reported and estimated to contain 15,000 tons of an average value of $8 per ton. Although this work disclosed several high-grade zones within the ore reserve block, these occurrences are not considered of sufficient importance to materially affect the average value or tonnage previously estimated. An additional lens of ore, approximately 75 feet long, 10 feet wide, and averaging $8 per ton, was developed on the fifth level. This is a free-milling ore in a structure similar to the block mentioned above.

Development on and above the sixth level (775-foot level) was confined to investigation of the downward extension of the fifth level ore structures. Erratic values were encountered in this zone; and although insufficient work has been done on which to base an estimate of grade of the ore, it is apparent that the average grade will be lower and the tonnage per vertical foot less than the same occurrence above the fifth level.

The east drift on the tenth level (1,375-foot level) was advanced 1,200 feet on a line south of and parallel to the main iron formation band. Flat diamond-drill holes at regular intervals and several up and down inclined holes from this drift through the iron formation did not disclose any ore structures. The drift was stopped at a point approximately 4,300 feet east of No. 2 shaft. A similar exploration drift was driven 1,100 feet west on the tenth level from No. 2 shaft and stopped within 100 feet of the west boundary line. Diamond-drill holes north from this drift disclosed some scattered values in sulphides over narrow widths in the main iron formation. These sulphides have not as yet been explored by drifting and crosscutting. Approximately 460 feet of drifting was completed in exploration of values occurring in diamond-drill holes south of the east drift on the tenth level, where work was temporarily discontinued in October, 1944. Although scattered values were obtained in this structure the average values were below ore grade.

Ore Treatment

Milling operations were suspended at the end of December, 1944, and the mill circuits were cleaned up during the first two weeks in January. The value of the bullion produced from this clean-up was $16,395.02.

The mill was reopened on November 19, and from that date to the end of the year a total of 6,337 tons of quartz ore, averaging $6.02 per ton, were milled. Bullion valued at $35,169.79 was produced from this ore. The low value of this quartz ore milled was due to the fact that a large percentage of the ore hoisted was development rock, which had previously been stored underground. The grade of development rock is usually less than "stoping grade" because development openings are extended beyond the subsequent stoping limits. If the value recovered from the treatment of development rock is more than the cost of milling such rock, then it is economical to treat such rock as ore.

Ore Reserves

Although exploration work during the year did not disclose any important new ore, it did confirm previous estimates and in several areas indicated some minor extensions to previously estimated ore reserve blocks. The total sulphide ore reserve in the North vein system is estimated to be 215,000 tons of an average value of $7.46 per ton, of which 80,000 tons is broken and in reserve in the stopes. According to previous experience after sorting, this is estimated to be equivalent to 149,000 tons of an average value of $10.42 per ton.

The total quartz ore reserve in the No. 2 shaft area is estimated to be 16,000 tons of an average value of $8 per ton, which experience has indicated cannot be beneficially sorted.

Plant and Equipment

No additions of importance were made during the year to plant buildings or equipment. During the period in which the milling plant was closed, the entire mill and roaster were overhauled and all necessary replacements and repairs to machinery were completed. This should reduce the normal repair shut-down time for some months after the mill and roaster resume full-scale operations. No stored concentrates were treated during the year.

General

The "statement of operations" which has appeared in the manager's previous reports has been omitted due to the fact that the mill was closed for most of the year.

An average force of 81 persons was employed during the year. Of these 46 were in the mine and 32 on general construction work. About 13 men were employed in the mill during the time of operation. R. G. McKelvey is general manager.

Hasaga Gold Mines, Limited

Hasaga Gold Mines, Limited, was incorporated in October, 1938, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 2,875,006 have been issued. The officers and directors are: J. E. Hammell, president; C. S. Hamilton, vice-president; G. M. Huycke, secretary-treasurer; John Bland, assistant secretary-treasurer; A. G. Hattie, director of mining; Eola Hammell, director. The head office and mine office are at Red Lake. The executive office is at 25 King Street West, Toronto.

The company's holdings consist of 32 claims, approximately 1,474 acres, in the Red Lake area, Patricia portion of Kenora district. The holdings consist of the former J. E. Hammell property, now known as No. 1 operation, and the former Red Lake Gold Shore mine in Dome and Heyson townships. No development work has been done on the Red Lake Gold Shore mine since the company was formed, but the mill is used to treat the ore from the No. 1 operation. The Starratt-Olsen claims in Baird township were sold to Starratt Olsen Gold Mines, Limited, in 1945.

There are two shafts on the No. 1 property; No. 2 shaft on claim K.R.L. 1,380 and No. 1 shaft some 2,500 feet to the east on claim K.R.L. 1,374. No underground work has been done on the No. 2 shaft since January, 1939.

Operations in the No. 1 shaft area continued throughout 1945. The vertical shaft, which is 1,080 feet deep, has three compartments from surface to 500 feet and four compartments below that point. The vertical, 3-compartment winze, known as No. 3 internal shaft, which is collared at the 850-foot level, 220 feet northwest of No. 1 shaft, was deepened from 1,673 feet to 1,798 feet from surface.

During the year 1,106 feet of drifting, 514 feet of crosscutting, and 320 feet of raising were accomplished. The total development work to date is as follows: drifting, 13,666 feet; crosscutting, 5,838 feet; raising, 6,840 feet.

Diamond-drilling during the year consisted of 32 holes, totalling 15,952 feet, from surface and 91 holes, totalling 20,640 feet, from underground.

The following is taken from the report of the manager for the year ending December 31, 1945:—

Development

The development programme instituted in the previous year was continued, but due to the acute shortage of labour this was accomplished with considerable sacrifice to production and broken ore reserves.

Mining

Some 44,420 tons of ore was broken in stopes and 124,338 tons hoisted, of which 1,711 tons came from development work. There was 10,126 tons of waste hoisted. A summary of the source and grade of ore hoisted follows:—

Level	Stope	Tons	Grade	Production
250-foot	220	241	$2.53	$611
375-foot	305	550	2.98	1,640
	330	21,413	3.97	85,100
500-foot	515	1,748	2.57	4,500
	550	1,005	2.65	2,665
850-foot	815	6,239	1.89	11,850
1,050-foot	1,010	6,097	2.72	16,600
	1,015	10,561	3.22	33,800
1,250-foot	1,210	34,630	4.33	149,600
1,450-foot	1,410	39,781	2.94	117,100
Ore passes		362	2.75	996
Total from stopes		122,627	$3.45	$423,462
Development		1,711	2.43	4,160
Total		124,338	$3.44	$427,622

Ore Reserves

Ore reserves as of January 1, 1946, totalled 190,777 tons valued at $1,027,456, based on $35 per ounce for gold. The summary and make-up of the ore reserves tonnage follows:—

	Tons	Average grade
Broken ore in stopes	18,504	$3.94
Ore in place in stopes	16,760	4.68
Ore in place in pillars	155,113	5.63

In the above calculations on ore reserves, no allowance has been made for the ore indicated by drilling below the 1,600-foot level. This drilling was carried out at quite widely spaced intervals and as such an estimation of tonnage and grade is considered inadvisable until drifts have been driven on this ore from the new levels to be established by shaft-sinking.

To the end of 1945 this property has produced bullion to the value of $4,369,467.99, and it is estimated that the new ore zone referred to above will contain at least as much gold as has already been produced from the mine to date.

Construction

During the year the following changes in building and equipment were completed: bunkhouse building, frame construction, 49 feet 8 inches by 27 feet; fire pump-house, frame construction, 12 by 16 feet. An Ingersoll-Rand type SE-1 sinking-hoist and an Atlas storage battery locomotive were purchased and installed.

Milling

	1945	1944	1939–1945
	tons	tons	tons
Waste sorted	19,598	23,900	179,870
Ore crushed	105,068	118,205	721,317
Ore milled	124,666	142,105	901,187
Average daily tonnage ground	288	323	282
Average daily tonnage milled	341	387	353

Production[1]

	1945	1944	1939–1945
Heads assay ... per ton milled	$2.88	$3.84	$4.71
Heads calculated ... per ton milled	3.43	4.29	5.02
Tailings ... per ton milled	.14	.158	.17
Value precipitated	$410,722.31	$587,628.37	$4,369,467.99
Recovery ... per cent	96	96.3	96.6

[1]Gold at $35 per ton.

Supplies Used in Milling

	Pounds per ton milled		
	1945	1944	1939–1945
Steel	2.59	2.318	2.25
Lime	1.07	1.03	1.19
Cyanide	.506	.547	.391
Zinc dust	.0550	.0517	.0453
Filter cell	.0037	.0077	.0063
Muriatic acid	.0339	.0404	.0314

Summary of Costs

	Total cost	Cost per ton milled	Cost per ounce
Development, including diamond-drilling	$96,884.62	$0.777	$8.25
Mining	180,012.86	1.444	15.34
Ore transportation (105,068 tons)	19,980.04	.160	1.70
Milling	127,365.92	1.022	10.85
Camp maintenance	9,819.95	.079	.84
Shipping and marketing	5,919.86	.047	.50
Administration	35,395.42	.284	3.02
	$475,378.67	$3.813	$40.50
Write-offs:			
Depreciation buildings and equipment	42,676.50	.342	3.64
Pre-production development	23,193.08	.186	1.97
Total	$541,248.25	$4.341	$46.11
Shaft-sinking and preparations (capital)	$40,819.93	....	....

General

Operating costs per ton milled showed a slight increase. This was largely attributable to handling a reduced tonnage of ore.

An average force of 120 men was employed, of whom 63 were in the mine and 20 in the mill. A. E. Pugsley is manager.

Hollinger Consolidated Gold Mines, Limited

Hollinger Consolidated Gold Mines, Limited, has an authorized capitalization of 5,000,000 shares of $5 par value, of which 4,920,000 have been issued. The officers of the company are: Jules R. Timmins, president; John B. Holden, vice-president and treasurer; P. C. Finlay, secretary. The directors are: Leo H. Timmins, Arthur F. White, Jas. Y. Murdoch, John I. Rankin, Allen A. McMartin, N. A. Timmins, and D. M. Dunlap. E. L. Longmore is manager of the Hollinger mine. The mine and head office are at Timmins. The general office is at 602 Royal Bank Building, Toronto.

The main property operated by the company is located in Tisdale township, Porcupine area, district of Cochrane, and includes part of the ground underlying the town of Timmins. The company has numerous other holdings and interests. It owns and operates the Ross mine in Hislop township, district of Cochrane, and controls and operates Young-Davidson Mines, Limited,[1] in Powell township. Matachewan area, district of Timiskaming.

Mine and milling operations at the Hollinger mine continued throughout 1945. A total of 20,904 feet of drifting, 4,920 feet of crosscutting, and 95 feet of raising was added to the development work. Diamond-drilling amounted to 1,639 holes, totalling 179,790 feet, from underground.

The following is taken from the general manager's report for the year ending December 31, 1945:—

BULLION STATEMENT

INVENTORY, JANUARY 1, 1945:		
Gold in process ($20.67)	$291,999.00	
Premium on gold in process	239,924.51	
Silver on hand	4,332.02	
		$536,255.53
GROSS VALUES PRODUCED IN 1945:		
Ore milled	$9,227,926.62	
Tailings loss	310,563.27	
		8,917,363.35
		$9,453,618.88
INVENTORY, DECEMBER 31, 1945:		
Gold in process ($20.67)	$168,545.23	
Premium on gold in process	133,941.74	
Silver on hand	12,310.00	
		$314,796.97
BULLION SHIPPED DURING 1945		9,138,821.91
		$9,453,618.88

Ore Reserves

The ore reserves on December 31, 1945, consisted of 7,509,863 tons, averaging 0.324 ounces of gold, or $6.69 per ton, giving a total value of $50,221,631. The ore reserves on December 31, 1944, consisted of 7,507,976 tons, averaging 0.330 ounces of gold, or $6.82 per ton, giving a total value of $51,245,515.

In the calculations dealing with ore reserves, the price of gold at $20.67 per ounce has been taken as the basis of value, and the same minimum ore grade, namely $4.00, as used in former years, continued. Taking the price of gold at $35.00 per ounce as the basis of value, the ore reserves had a total value of $85,039,033 at the end of the year, a decrease of $1,733,716 from the 1944 figure of $86,772,749.

[1]See account on page 82 of this report.

Employees

The average number of men employed during the year has been 1,877, distributed as follows:—

Miners:		Mechanics:		General:	
Exploration	26	Operation	88	Mill and refinery	129
Development	223	Maintenance	156	Technical	85
Production	906			Clerical	48
				Miscellaneous	142
				Ross mine	74
Total	1,155	Total	244	Total	478

The Mill

The milling results were as follows:—

Ore milled	tons		1,007,286
Average value per ton			$9.16
Gross value		$9,227,926.62	
Deduct loss in tailings		310,563.27	
Net value recovered			$8,917,363.35

Average tons per day		2,862
Per cent. of possible time run		82
Tons per 100 per cent. running time		3,490
Solution precipitated per ton ore	tons	1.23
Value per ton tailings		$0.31
Cyanide consumed per ton of ore	lbs.	0.663
Zinc consumed per ton of ore	lbs.	0.051
Zinc consumed per ton of solution	lbs.	0.041
Lime consumed per ton of ore	lbs.	2.581
Lead acetate per ton of ore	lbs.	0.007
Average value of pregnant solution		$7.21
Average value received per ounce of gold sold		$38.50

Yearly Average Costs

Account	Sundries	Labour	Stores	Total	Per ton ore milled
General miscellaneous charges and administration		$253,645.71	$129,988.30	$383,634.01	$0.3810
Surface services		60,147.43	33,553.37	93,700.80	.0930
Insurance, fire	$32,734.20			32,734.20	.0325
Insurance—group, sickness and accident, medical, and unemployment		232,856.75		232,856.75	.2312
Marketing bullion	91,408.94			91,408.94	.0907
Workmen's compensation		105,608.73		105,608.73	.1048
Silicosis assessment		49,291.14		49,291.14	.0489
Milling charges		393,524.74	428,229.89	821,754.63	.8158
Mining charges		3,232,618.27	1,099,597.66	4,332,215.93	4.3009
Total charges	$124,143.14	$4,327,692.77	$1,691,369.22	$6,143,205.13	$6.0988
Annual vacation[1]				$46,171.24	$0.0458

[1]Distributed among the first and last two items above.

Hollinger Mine

The labour supply steadily decreased during the first six months of the year. The average number of shifts worked per day fell from the 1944 average of 1,778 to 1,548 per day in June. While the number of men engaged during the latter part of the year increased, the total number of underground shifts over the 1944 figure, the rapid turnover in labour, the inexperience of many of the new employees, and the extra work involved in reopening old working-places prevented a corresponding increase in the tonnage milled. It was possible, however, to develop a tonnage slightly in excess of the tons of ore removed from the mine. It is hoped that further improvement in conditions will permit an increased rate of development to compensate for the unavoidable decrease in the past few years.

While supplies are somewhat easier to procure, delivery of much-needed spare equipment, so essential as insurance against interruption of operation, still leaves much to be desired.

To comply with the application of the 48-hour week prescribed under the "Hours of Work and Vacation with Pay Act," it was found advisable to restrict mill operations to six days per week. Consequently, the number of operating days during 1945 was reduced to 352 days as against 363 days in 1944. Hence, the number of tons milled per day is slightly higher than the daily rate shown for 1944, although the total tonnage milled during 1945 is somewhat lower.

Ore from above the 800-foot level accounted for 39.5 per cent. of the tonnage milled, compared to 38.8 per cent. for 1944. The estimated ore reserves at the Hollinger mine are 62,464 tons greater than reported last year, but the gross value of our ore reserves is decreased by $633,255.

Installation of the hoist motor, delivery of which is expected by March 1, will permit No. 27 shaft to be brought into operation.

Young-Davidson Mine

Winter conditions forced suspension of production from February 1 to April 15. There were 206,556 tons milled, being an average of 738 tons per day for the 280 days the mill operated, with a recovery of $3.64 per ton.[1] Broken ore in the stopes on December 31 amounted to 737,049 tons. The reduction in ore reserves in excess of the tonnage milled is due to a 40 per cent. cut in the calculated broken ore above the second level. Deeper frost penetration and dilution from caving walls have limited the probability of recovering more than 60 per cent. of this ore. Any increase in costs would most seriously affect the future of this operation.

Ross Mine

The Ross mine consists of approximately 376 acres, owned by the company, on the north half of lot 1, concession II, and part of the south half of lot 1, concession III, Hislop township, district of Cochrane. Several blocks of claims around the Ross mine in lots 2 and 3 of concession III are held under option.

Operations continued throughout 1945. The mine is served by a vertical, 3-compartment shaft, 979 feet deep, known as No. 1, on the north half of lot 1, concession II. There is also a vertical, 2-compartment winze, which is collared at the 300-foot level, about 120 feet east of the shaft. This winze was sunk a further 606 feet during the year to a depth of 1,535 feet, with levels established at 1,050, 1,200, 1,350, and 1,500 feet. The following table shows the development work done during the year and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
150-foot	....	2,294	....	1,091	....	786
300-foot	....	2,831	....	1,233	....	1,090
450-foot	70	4,240	791	3,951	....	1,657
600-foot	10	1,898	....	1,731	160	1,262
750-foot	193	845	....	1,673	168	616
900-foot	....	635	143	1,977	....	579
1,050-foot	....	....	137	137	....	....
1,200-foot	....	....	206	206	....	....
1,350-foot	....	....	109	109	....	....
1,500-foot	....	....	170	170	....	....

Diamond-drilling consisted of 25 holes, totalling 5,618 feet, from underground.

There were 73,643 tons of ore hoisted. The mill treated 73,538 tons, operating at an average daily rate of 202 tons.

The following is taken from the general manager's report for the year ending December 31, 1945:—

The ore reserves as of December 31, 1945, were 587,433 tons of a total value of $2,689,813, having an average content of 0.221 ounces per ton. These figures compare with 648,010 tons of a total value of $3,080,442, having an average content of 0.230 ounces per ton, at the end of 1944. If we take the price of gold at $35 per ounce as a basis of value, the total value was $4,554,594 at the end of the year, a decrease of 60,557 tons and $661,443.

[1]Gold at $35.00 an ounce.

The winze was sunk from the 900-foot level to the 1,500-foot level and level work done preparatory to development of the ore bodies. This work was done on contract. Shortage of labour prevented actual ore development during the year.

J. J. Caty is resident manager. The mine address is Holtyre.

Hoyle Mining Company, Limited

The Hoyle Mining Company, Limited, was incorporated in July, 1944, to take over the assets of Hoyle Gold Mines, Limited. The authorized capitalization is 3,500,000 common shares of no par value, of which 905,681 have been issued, and 1,500,000 non-voting 5 per cent. preference shares of no par value. The officers and directors are: J. M. Cunningham-Dunlop, president and mine manager; A. G. Fulton, secretary-treasurer; F. C. Sullivan, assistant secretary-treasurer; Thayer Lindsley, W. S. Morlock, and W. C. Martin, directors. The head office is at Haileybury. The mine address is Pamour.

The company's holdings consist of 485 claims, approximately 19,400 acres. The main property is situated in Whitney and Cody townships, Porcupine area, district of Cochrane.

Underground operations on this property were suspended on July 31, 1943, following the destruction of the mill by fire, and only pumping and maintenance operations were carried on during 1944. In February, 1945, underground work was again resumed and 1,575 feet of drifting and 19 feet of crosscutting were done. Total development work on the property to December 31, 1945, is as follows: drifting, 12,742 feet; crosscutting, 2,952 feet; raising, 6,715 feet.

Diamond-drilling amounted to 31 holes, totalling 2,117 feet, all from underground.

A total of 9,296 tons of ore was hoisted during the year.

G. H. Mustard was assistant mine manager, employing an average force of 22 men.

Jason Mines, Limited

Jason Mines, Limited, was incorporated in November, 1938, to succeed Argosy Gold Mines, Limited. The capitalization is 3,000,000 shares of $1 par value, of which 2,999,005 have been issued. The officers and directors are: E. M. Thomson, president; Sir Henry Drayton, vice-president; E. Grahame Joy, secretary-treasurer; E. G. Clarkson and E. A. Clark, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Casummit Lake.

The property, which has also been known as the Casey Summit and the Argosy, consists of 21 claims, approximately 985 acres, at Casummit lake, about 100 miles north of Sioux Lookout on the Canadian National railway, in the Patricia portion of Kenora district.

Operations ceased in 1942. In October, 1945, work was again resumed and the dewatering of No. 1 shaft was begun. Mining operations were started on a very small scale during November, 1945, with 25 feet of crosscutting being done. The following table shows the amount of development work done on the property to the end of 1945:—

Shaft and depth from surface	Drifts	Crosscuts	Raises
	feet	feet	feet
No. 1 shaft (545 feet)	3,828	1,063	732
No. 2 shaft (320 feet)	4,483	2,246	550
Winze (collared at 300-foot level about 225 feet east of No. 2 shaft) (827 feet)	2,651	772	81

The average number of men employed during the time of operation was 25. H. R. Fowlie is mine manager.

Jerome Gold Mines, Limited

Jerome Gold Mines, Limited, was incorporated in February, 1939, with an authorized capitalization of 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: J. H. C. Waite, president; Jules R. Timmins, vice-president; G. C. Ames, secretary-treasurer; R. W. Hart, P. C. Finlay, Chas. McCrea, J. A. H. Paterson, and Leo H. Timmins, directors. The head office is at 350 Bay Street, Toronto. The mine address is Jerome.

The company holds 62 claims, approximately 2,902 acres, south of Opeepeesway lake, in Osway and Huffman townships, district of Sudbury.

Mining operations continued from January 1 to June 30. The mill did not operate during the year. The 3-compartment, vertical shaft on claim S. 32,071, has been sunk to a depth of 1,138 feet. The following table shows the development work done during 1945 and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
200-foot	197	3,736	....	658	14	758
350-foot	636	4,685	80	986	....	995
500-foot	673	4,489	....	447	19	895
650-foot	501	3,651	....	214	5	549
725-foot (loading pocket)	....	....	....	....	....	205
800-foot	963	2,521	....	193	....	....
950-foot (station only)	....	....	....	....	....	....
1,100-foot	....	2,018	....	647	....	....

Diamond-drilling consisted of 20 holes, totalling 7,894 feet, from surface and 171 holes, totalling 10,141 feet, from underground.

The following is taken from the directors' report for the year ending December 31, 1945:—

All operations at the property were stopped on June 30, 1945, and since that time the mine has been closed down. The underground development and surface diamond-drilling done during the six months' period disclosed some new ore and extensions to known ore bodies and, while a fair tonnage was added to the ore reserves, nothing of major importance was encountered. This development work had reached a point where it was considered advisable to discontinue it until the mill could be started up again. Following suspension of operations, the machinery was removed from underground and the mine was allowed to flood. Buildings and equipment were protected from possibilities of damage, and the property has been left in charge of competent watchmen.

It is proposed to reopen the property when sufficient mine labour is available to permit normal development, mining, and milling.

An average force of 69 persons was employed during the time of operation. L. H. Foran was mine superintendent.

Kerr-Addison Gold Mines, Limited

Kerr-Addison Gold Mines, Limited, was incorporated in April, 1936, with an authorized capitalization of 5,000,000 shares of $1 par value, 4,730,301 of which have been issued. The officers and directors are: Jas. Y. Murdoch, president; André Dorfman, vice-president and managing director; G. A. Cavin, secretary-treasurer; Oliver Hall, L. K. Fletcher, H. H. Leather, J. H. Rattray, and J. H. C. Waite, directors. The head office is at 80 King Street West, Toronto. The mine address is Virginiatown.

The property, which is in McGarry township, Larder Lake area, district of Timiskaming, includes the Reddick and Kerr-Addison claims taken over from Proprietary Mines, Limited, on incorporation and several claims acquired later. It consists of 34 patented claims, totalling 1,104 acres.

The following table shows the shafts on the property:—

Shaft	Claim No.	No. of compartments	Depth
			feet
Reddick (No. 2)[1]	H.J.B. 29	2	76
Kerr-Addison (No. 1)[2]	H.S. 166	3	716
Main (No. 3)	H.J.B. 30	5	2,806

[1]The Reddick shaft was sunk by former operators, who did 1,035 feet of crosscutting and 1,130 feet of drifting on a level at the bottom of the shaft. It is not connected with the other workings and is not used now.

[2]The Kerr-Addison shaft was sunk to a depth of 300 feet by the former operators and deepened to 716 feet by the present company. It has an adit level at 60 feet and is connected with the Main (No. 3) shaft on the 175-, 300-, 500-, and 700-foot levels. It is now used only as a ventilation shaft and manway.

Mining and milling operations continued throughout 1945. The following development work was carried out during the year: drifting, 3,713 feet; crosscutting, 1,323 feet; raising, 1,447 feet. The total development work to December 31, 1945, is as follows: drifting, 80,749 feet; crosscutting, 20,251 feet; raising, 22,952 feet.

Diamond-drilling during the year consisted of 10 holes, totalling 3,983 feet, from surface and 349 holes, totalling 60,899 feet, from underground.

The following is taken from the report of the manager for the year ending December 31, 1945:—

During the first half of the year development and mining programmes were slowly declining, but that trend was sharply reversed in the last four months. The total amount of development carried out was slightly less than that for the previous year, but the tonnage of ore broken in mining was increased by 12 per cent.

Mining operations and diamond-drilling disclosed substantial tonnages of additional ore above the 1,450-foot level. Most of this ore was of lower than average grade, and none of these discoveries was of major importance.

Ore Reserves

Ore reserves, all above the 1,450-foot level, total 8,379,951 tons having a grade of 0.1975 ounces per ton after allowing for dilution. Broken ore reserves amounting to 605,643 tons, all above the 1,000-foot level, are included in the above figure. The slight reduction in grade of ore reserves is attributed to the fact that additional ore beyond the limits formerly blocked out, discovered, and mined during stoping operations was, as usual, below average grade. Some ore above the 1,450-foot level is still not developed to a point where it can be included in ore reserves.

Lower Development

Between the 1,450- and 1,600-foot levels, work to date has partially blocked out 2,002,000 tons of ore, of which the indicated grade is 0.2043 ounces per ton.

The main crosscuts were completed on the 1,600- and 1,900-foot levels, and the driving of main haulage drifts parallel to the ore bodies was started. Periodically, diamond-drilling was done from these drifts to locate ore bodies and to determine their dimensions and average grades. On the 1,600-foot level, this work to date indicates carbonate type ore bodies having a total length of 980 feet and a grade of 0.2665 ounces per ton over an average width of 24.8 feet. At the same level it also shows ore bodies Nos. 16 and 21 to have a combined length of 1,070 feet and an average grade of 0.1810 ounces per ton over an average width of 61.2 feet. On the 1,900-foot level, diamond-drilling so far shows ore bodies Nos. 16 and 21 to have a combined length of 615 feet and an average grade of 0.3526 ounces per ton over an average width of 47 feet. On both levels, No. 21 ore body is known to extend east of the area drilled.

During the year, little work was done on the 2,500-foot level, where the four known ore bodies have a combined length of 2,087 feet, an average width of 59.5 feet, and an average grade of 0.2440 ounces per ton ($8.54 at $35.00 per ounce).

Production

Lack of men forced tonnage milled below that for the previous year, but to compensate, the average grade of mill feed was higher, with the result that total production was slightly greater than for 1944.

SUMMARY OF PRODUCTION[1]

Tons milled		430,065
Total gold recovered	ounces	81,065.07
Total silver recovered	ounces	4,650.37
Average gold recovery per ton (0.1885 ounce)		$7.257
Average tailings loss per ton (0.0031 ounce)		$0.120
Average mill head value per ton (bullion plus tails), 0.1916 ounce)		$7.377
Total realized value of bullion (Canadian funds)		$3,122,705.77
Total realized value of bullion per ton (Canadian funds)		$7.261

COST SUMMARY

	Total	Per ton
Mine development	$203,927.68	$0.474
Stope development	78,782.31	.183
Mining	518,982.05	1.207
Crushing and conveying	49,924.79	.116
Milling	266,433.52	.620
General expense	123,823.71	.288
Bullion marketing	39,155.88	.091
Total operating costs at mine	$1,281,029.94	$2.979

The net operating profit at the mine, before provision for depreciation, amortization of deferred development, and taxes, was $1,841,675.83, or $4.282 per ton.

General

The most difficult period in the history of the operation was experienced during the first eight months of the year. Daily tonnage dropped to a low point of 1,105, but by the year end had recovered to 1,280.

The tonnage of broken ore reserve is increasing, and a step-up in milling rate is anticipated within a few months.

An average force of 285 men was employed, of whom 165 were underground, 24 in the mill, and 96 on general surface work. W. S. Row is manager.

Kirkland Lake Gold Mining Company, Limited

The Kirkland Lake Gold Mining Company, Limited, was incorporated in November, 1915, with an authorized capitalization of 5,500,000 shares of $1 par value, of which 5,326,699 have been issued. The officers and directors are: J. B. Tyrrell, president; V. H. Emery, vice-president and managing director; H. F. Cassidy, secretary-treasurer; J. A. Dalton, N. S. Beaton, and W. S. Walton, directors. The executive office is at 44 Victoria Street, Toronto. The head office and mine office are at Chaput Hughes.

The property consists of 11 claims, 334 acres, in Teck township, Kirkland Lake area, district of Timiskaming.

The depths of the shafts and winzes at the mine are given in the following table:—

Shaft or winze	No. of compartments	Total depth from surface
		feet
No. 1 shaft	2	894
No. 2 or main shaft	3	2,666
No. 1 winze (below 2,475-foot level)	4 to 2,975-foot 3 to 4,900-foot	4,914
No. 2 winze (below 4,900-foot level)	3	5,897
No. 3 winze (below 3,600-foot level)	3	4,487
1,000 winze (below 1,000-foot level)	2	1,134
No. 4 winze (below 4,750-foot level)	3	5,645

[1]Gold at $38.50 an ounce.

During 1945, the following development work was completed: drifting, 1,566 feet; crosscutting, 128 feet; raising, 517 feet.

Total development on the property to December 31, 1945, is as follows: drifting, 76,814 feet; crosscutting, 29,914 feet; raising, 11,938 feet. The bottom level of the mine is established at 5,850 feet.

Diamond-drilling during the year consisted of 58 holes, totalling 7,422 feet, from underground.

The following is taken from the report of the managing director for the year ending December 31, 1945:—

ANALYSIS OF OPERATING COST

	Total cost	Cost per ton milled
Development and exploration	$115,595.82	$1.36
Stoping	180,908.43	2.12
Timbering	84,216.30	.98
Transporting ore, hoisting, etc.	149,375.89	1.75
Milling	118,005.80	1.38
Marketing bullion	11,800.47	.14
General and undistributed charges (maintenance mine buildings, administration and management, insurance, workmen's compensation, assaying, and miscellaneous)	122,631.08	1.44
Total	$782,533.79	$9.17

Gold produced	ounces	28,179.103
Cost per ounce		$27.77

Taxes charged against operations (not included above) totalled $60,291.94, or at the rate of 70 cents per ton milled and $2.14 per ounce of gold produced.

Five per cent. of ore hoisted was drawn from levels between the 2,400-foot and surface. The rest came from levels between the 4,900-foot and the 2,400-foot; all development work was also done between these levels.

SUMMARY OF NEW ORE DEVELOPED DURING THE YEAR

Level	Length	Average width	Average cut grade (at $35.00 per ounce)
	feet	feet	
38th	43	4	$33.90
43rd	274	3	12.40
44th	144	3	12.00
46th	609	3.2	16.40
49th	56	3.5	12.00
Total	1,126	3.2	$15.50

TOTAL PRODUCTION FOR THE YEAR

Tons milled	88,359
Value per ton	$13.27
Gross value	$1,133,602.03
Recovery per ton	$12.72
Bullion produced	$1,086,211.68

MILLING STATISTICS

Ore milled	tons	85,359
Average value per ton		$13.27
Gross value		$1,133,602.03
Loss in tailings		$47,390.35
Net value recovered		$1,086,211.68
Average tons milled per day		234
Value in tailings per ton		$0.55
Extraction	per cent.	95.9

PRODUCTION BY QUARTERS

	Tons milled	Bullion value	Recovery per ton
1st quarter	20,076	$243,966.76	$12.15
2nd quarter	19,264	261,041.53	13.55
3rd quarter	21,545	275,638.77	12.80
4th quarter	24,474	305,564.62	12.48

The proven ore reserves in the mine at the end of 1945 amount to 364,384 tons, having a gross value of $4,891,145 at $35 per ounce.

An average force of 210 men was employed, of whom 142 were in the mine and 12 in the mill. G. C. Dunn is general superintendent.

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 of which have been issued. The officers and directors are: A. L. Blomfield, president and managing director; W. H. Wright, vice-president and treasurer; Albert Wende, C. Max Hilton, and Walter W. Foskett, directors. Kirkland Securities, Limited, is secretary. The head office and mine office are at Kirkland Lake.

The property consists of 8 claims and 4 fractions, approximately 287 acres, in Teck township, Kirkland Lake area, district of Timiskaming. The company also owns 11 claims in Teck township and 18 claims in Lebel township in the same area, which are used as a disposal basin for slimes.

Mining and milling operations continued throughout 1945. The depths of the shafts serving the mine are set out in the following table:—

Shaft	No. of compartments	Sinking in 1945	Total depth from surface
		feet	feet
No. 1	3	....	2,250
No. 1 shaft extension (below 2,000-foot level, not in use at present)	3	....	4,500
No. 2 (inclined, used only for supplies and timber)	1	....	200
No. 3 (abandoned)	5	....	4,000
No. 4 (below 4,325-foot level)	3	25	6,885
No. 5	5	....	4,000
No. 6 (below 3,575-foot level)	3 to 3,825-foot level 5 to bottom	....	6,098

During the year the following development work was completed: drifting, 4,770 feet; crosscutting, 3,031 feet; raising, 4,638 feet. The total development work done on the property to December 31, 1945, is as follows: drifting, 224,425 feet; crosscutting, 70,204 feet; raising, 125,095 feet. The bottom level of the mine is established at 6,825 feet.

Diamond-drilling during the calendar year consisted of 167 holes, totalling 19,313 feet, all from underground.

The following is taken from the report of the managing director for the twelve months ending June 30, 1946:—

In the period 128,867 ounces of gold and 35,896 ounces of silver were recovered from 331,048 dry tons of ore milled. The gross value of the production amounted to $4,983,114.19.

PRODUCTION RECORD

Period	Months	Tons milled	Gross value of bullion[1]	Dividends paid
Mar. 1, 1918, to Nov. 30, 1918	9	14,948	$372,352.35	$100,000
Dec. 1, 1918, to Nov. 30, 1919	9	11,907	302,518.17	100,000
Dec. 1, 1919, to Nov. 30, 1920	12	18,889	525,278.38	80,000
Dec. 1, 1920, to Nov. 30, 1921	12	21,681	523,597.39	120,000
Dec. 1, 1921, to June 30, 1923	19	36,825	850,282.92	160,000
July 1, 1923, to June 30, 1924	12	24,223	590,119.98	160,000
July 1, 1924, to June 30, 1925	12	96,838	1,812,008.05	600,000
July 1, 1925, to June 30, 1926	12	125,676	2,233,475.85	700,000
July 1, 1926, to June 30, 1927	12	214,335	3,105,047.85	1,200,000
July 1, 1927, to June 30, 1928	12	237,962	3,629,317.57	1,600,000
July 1, 1928, to June 30, 1929	12	367,015	5,519,138.86	2,000,000
July 1, 1929, to June 30, 1930	12	467,648	6,609,728.42	2,600,000
July 1, 1930, to June 30, 1931	12	698,624	9,153,546.62	3,600,000
July 1, 1931, to June 30, 1932	12	834,434	13,798,128.23	6,000,000
July 1, 1932, to June 30, 1933	12	797,673	13,277,685.72	6,000,000
July 1, 1933, to June 30, 1934	12	836,991	16,382,274.27	6,000,000
July 1, 1934, to June 30, 1935	12	833,094	16,026,108.57	8,000,000
July 1, 1935, to June 30, 1936	12	873,101	16,361,529.69	8,000,000
July 1, 1936, to June 30, 1937	12	879,559	15,692,652.85	12,000,000
July 1, 1937, to June 30, 1938	12	928,036	15,030,273.43	10,000,000
July 1, 1938, to June 30, 1939	12	898,894	14,608,714.60	8,000,000
July 1, 1939, to June 30, 1940	12	755,661	12,281,332.25	5,500,000
July 1, 1940, to June 30, 1941	12	612,906	9,404,780.99	3,700,000
July 1, 1941, to June 30, 1942	12	388,738	6,191,672.38	2,200,000
July 1, 1942, to June 30, 1943	12	338,810	5,540,163.03	1,600,000
July 1, 1943, to June 30, 1944	12	267,698	4,498,529.77	1,600,000
July 1, 1944, to June 30, 1945	12	261,583	4,276,226.30	1,600,000
July 1, 1945, to June 30, 1946	12	331,048	4,983,114.19	1,600,000
Total	....	12,174,797	$203,579,598.78	$94,820,000

[1]Includes exchange premium.

STATEMENT OF COSTS FOR THE YEAR

	Cost per ton
Development	$1.018
Mining	4.690
Milling and refining	1.627
Marketing bullion	.165
General and administrative expense	.196
Operating cost	$7.696
Depreciation	.186
	$7.882
Provision for taxes	2.078
Total cost	$9.960
Retreatment of other tailings	.184

Development

In the year every effort was made to increase the rate of development drifting, with the result that the total advance was up about 37 per cent. over the figure for last year. The footage driven would have been greater but for the fact that when in October, 1945, additional crews became available for this type of work, a large part of their effort had to be directed to crosscutting to known veins on which it was desired to carry out drifting operations. The total footage of crosscutting for the year is up over 90 per cent., and the combined drifting and crosscutting about 53 per cent.

Total advance in development drifts driven during the year amounted to 6,634 feet, of which 2,264 feet, or 34.1 per cent., was ore, having an average gold content of 0.528 ounce per ton across a width in the drifts, before slashing, of 66.3 inches. Of the total drifting advance, 37 per cent. was done in the No. 1 or south vein zone, 51 per cent. in the No. 2 or north vein zone, and 12 per cent. on subsidiary veins.

Vein zone	Advance	Ore	Width	Grade, ounces per ton	Drifting in ore
	feet	feet	inches		per cent.
No. 1	2,480	1,298	68.9	0.523	52.3
No. 2	3,400	849	64.2	.525	25
Subsidiary veins	754	117	53.2	.554	15.5
Total	6,634	2,264	66.3	0.528	34.1

Of the total drifting advance, approximately 45 per cent. was carried out on levels above the 4,575-foot horizon. This is a higher proportion than that for recent years, due largely to the exploration directed towards opening the veins in the upper parts of an important ore shoot on the levels from the 3,700-foot to the 4,450-foot horizon. Better than mine average results have been secured from the development of this ore body, which has been proved by drifting to continue to at least the 5,825-foot horizon, the lowest level at which drifting operations have so far been carried out. It is situated in the eastern part of the mine, to the east of a major fault.

No new deep levels were opened by drifting during the year, but near the end of the period drifting was resumed at the 5,950-foot horizon, which had been inactive since July, 1943. A large amount of drifting remains to be done on the levels down to the 6,075-foot horizon, and no drifting advance and very little crosscutting has been carried out on the six levels established from the 6,200-foot to the 6,825-foot horizon. Because of the large backlog of this type of work and also in order to maintain an adequate balance with current stoping operations, drifting advance should be at the rate of 1,000 feet per month. In the year ahead it is hoped that this figure can be closely approached.

New Ore Exposed during the Year

Level	Advance	Ore	Width	Grade, ounces per ton
	feet	feet	inches	
800-foot	754	117	53.2	0.554
1,400-foot	6			
2,825-foot	37			
3,700-foot	251	186	67.6	.489
3,825-foot	170	170	60.7	.300
4,075-foot	63	66	96.4	.602
4,200-foot	953	379	65.4	.461
4,325-foot	362	170	63.5	.336
4,450-foot	156	80	69.9	.815
4,575-foot	222	43	66.7	.635
5,200-foot	387	303	64	.609
5,325-foot	639	221	73.8	.679
5,450-foot	1,465	238	71.2	.607
5,575-foot	524			
5,700-foot	34			
5,825-foot	487	243	62.1	.493
5,950-foot	124	48	60	.279
Total	6,634	2,264	66.3	0.528

Summary of Development Work Performed since the Beginning of Operations

	Feet
Drifting	229,720
Crosscutting	72,540
Raising	128,797
Subdrifting	41,471
Ore and waste passes	21,031
Shaft-sinking	10,740
Shaft-raising	7,117
Shaft-slashing	6,309
Winze-sinking	1,290
Diamond-drilling	392,196
	cu. ft.
Box-holing	375,069
Station-cutting	1,608,053
Sumps	71,060

Mining

The sources of the ore milled, by levels, are given in the summary of ore trammed. The total treated, which shows an increase of 69,465 tons over the figure for the preceding period, was made up of 47 per cent. from the No. 1 or south vein zone, 62 per cent. from the No. 2 or north vein zone, and 11 per cent. from subsidiary veins.

Summary of Ore Trammed

Level	Development	Stoping	Total
	tons	tons	tons
400-foot	1,105	6,764	7,869
600-foot	694	6,768	7,462
800-foot	1,979	1,643	3,622
1,000-foot	3,942	12,234	16,176
1,200-foot	465	1,112	1,577
1,400-foot	1,514	915	2,429
1,600-foot	....	7,242	7,242
1,800-foot	....	1,534	1,534
2,000-foot	....	21,377	21,377
2,200-foot	....	5,882	5,882
2,575-foot	405	2,076	2,481
2,825-foot	211	....	211
2,950-foot	635	1,539	2,174
3,075-foot	24	4,109	4,133
3,200-foot	....	2,199	2,199
3,325-foot	632	2,650	3,282
3,450-foot	....	125	125
3,575-foot	329	1,819	2,148
3,700-foot	1,078	1,684	2,762
3,825-foot	1,253	11,074	12,327
3,950-foot	631	5,851	6,482
4,075-foot	840	15,896	16,736
4,200-foot	4,177	6,489	10,666
4,325-foot	2,580	10,283	12,863
4,450-foot	1,133	20,018	21,151
4,575-foot	1,052	17,083	18,135
4,700-foot	....	17,231	17,231
4,825-foot	367	20,847	21,214
4,950-foot	1,452	25,992	27,444
5,075-foot	41	20,612	20,653
5,200-foot	3,844	13,217	17,061
5,325-foot	5,114	5,314	10,428
5,450-foot	5,717	1,393	7,110
5,575-foot	2,060	623	2,683
5,700-foot	124	....	124
5,825-foot	1,991	....	1,991
5,950-foot	412	....	412
Total	45,801	273,595	319,396

The tonnage milled daily was increased in September, 1945, when more became available for the underground force. Many of the men taken on the pay-roll were employees returning to their jobs after service in the armed forces; others were new employees, most of whom were inexperienced in underground work. With a more plentiful supply of underground labour the daily tonnage milled was increased, reaching a maximum of 1,035 tons per day in January, 1946. Since then, lowered efficiency, due to inexperienced workmen, excessive labour turnover, and the disruptive effect of absenteeism, has forced a reduction in the tons of ore treated daily.

A noteworthy feature, associated with preparations for an increase in production, was the necessity of increasing the amount of maintenance and repair work, which during the war years had been held at a minimum. Increased expenditures were necessary along this line both underground and in the surface plant. As an example of part of this type of work carried out underground, the cost of drift and crosscut maintenance for the period was up 43 per cent. over the average for the previous six years. The increase in cost resulting from this item alone amounts to slightly more than 10 cents per ton milled.

In the year, stope preparation was undertaken on two new lower levels, namely the 5,325-foot and the 5,450-foot. At the end of the period, two short stoping sections were being mined on each level. In line with a planned sequence of stoping designed to minimize the incidence of bursting, initial stoping operations on new lower levels will be confined to one short section to the west and one to the east of the main crosscut.

The total length of ore exposed in drifts and available for stoping was increased slightly in the year. At the end of the period, the total amounted to 17,724 feet, having an exposed average width before slashing of 58 inches and an average gold content of 0.551 ounce per ton. Comparable figures for the last 12 years are given below:—

Year ended June 30	Length	Width before slashing	Grade, ounces per ton
	feet	inches	
1935	16,540	61	0.665
1936	15,934	61	.674
1937	18,162	58	.610
1938	17,226	55	.600
1939	16,803	54	.601
1940	13,290	54	.585
1941	17,103	54	.624
1942	17,236	56	.606
1943	16,925	57	.575
1944	17,122	58	.575
1945	17,363	58	.556
1946	17,724	58	.551

Supplies and Equipment Purchased

	Mar. 1, 1918, to June 30, 1945	July 1, 1945, to June 30, 1946	Total to date
Explosives	$2,701,533	$65,032	$2,766,565
Lumber and timber	4,196,416	128,979	4,325,395
Rock drills and parts	930,166	25,165	955,331
Pipe and fittings, plumbing supplies	914,891	40,295	955,186
Electrical supplies	1,535,645	15,582	1,551,227
Mill supplies	4,921,623	172,772	5,094,395
Machinery and parts	5,319,763	112,428	5,432,191
Building material	1,042,225	22,521	1,064,746
Fuel	684,815	30,980	715,795
Steel products	2,807,130	114,893	2,922,023
Oil and lubricants	302,183	4,488	306,671
General supplies	607,590	....	607,590
Trucks, cars and parts	94,150	4,659	98,809
Miscellaneous	2,612,408	76,218	2,688,626
Backfill	1,018,941	45,004	1,063,945
Power	6,178,131	197,337	6,375,468
Total	$35,867,610	$1,056,353	$36,923,963
Freight and express included in value of above materials	$2,673,850	$63,075	$2,736,925

An average force of 584 men was employed during the calendar year, of which 356 were in the mine, 47 in the mill, and 181 on general surface work.

Leitch Gold Mines, Limited

Leitch Gold Mines, Limited, was incorporated in July, 1935, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,912,505 have been issued. The officers and directors are: K. J. Springer, president; Dr. J. H. C. McClelland, vice-president; W. W. McBrien, secretary-treasurer; S. H. Robinson, James R. Cryderman, and J. D. Barrington, directors. The head office and mine office are at Beardmore. The executive office is at 67 Yonge Street, Toronto.

The company's main property consists of 433 acres in Eva and Summers townships, district of Thunder Bay, about 5 miles from Beardmore on the Port Arthur–Longlac branch of the Canadian National Railways. It is reached from Beardmore by an automobile road.

Mining and milling operations continued throughout 1945. The vertical, 3-compartment No. 1 shaft on claim H.F. 1 is 1,685 feet deep. No further sinking was done on this shaft during 1945.

During the year the following development work was completed: drifting, 117 feet; crosscutting, 110 feet; raising, 1,044 feet. The total development work to December 31, 1945, is as follows: drifting, 36,366 feet; crosscutting, 8,213 feet; raising, 9,927 feet.

Diamond-drilling during the year consisted of 22 holes, totalling 16,510 feet, from surface.

The following is taken from the manager's report for the twelve months ending December 31, 1945:—

Exploration and Development

Crosscutting was done on the 1st level to open up the station for the loading-pocket from which the waste-pass raise to the crusher-house was driven; on the 9th level to start the enlargement of the sump; and on the 14th level to open up the hoisting-station for the sinking-hoist. Drifting was confined to the No. 2 vein on the 12th and 13th levels. As only a minor amount of work was done, the ore developed has not been taken into the ore-shoot averages or reserves as the shoots are not yet completely developed.

A considerable amount of work was done in improving and enlarging the sumps on the 5th and 9th levels. This was for the purpose of preparing for the installation of new, larger pumps which we expect to install in conjunction with the shaft-sinking programme. In preparation for sinking, a hoisting-station was cut on the 14th level and a rope raise driven from here up to the shaft.

Surface diamond-drilling was carried on during the summer and fall on ground north and west of the present mine workings. This work has revealed several narrow high-grade intersections similar to our present veins and encourages further drilling, which is continuing.

Ore Reserves

Ore reserves amount to 168,056 tons, averaging 0.845 ounces per ton, to make a total of 142,024.49 ounces, or $4,970,857.15 at $35.00 per ounce, or $5,467,942.86 at $38.50 per ounce. This is a decrease of 17,651.23 ounces, or $617,793.05 at $35.00 per ounce, or $679,572.35 at $38.50 per ounce.

Hoisting

Some 22,350 tons of ore were hoisted, of which 83 tons, or 0.4 per cent., was from development; 961 tons, or 4.3 per cent., was from raising; and 21,306 tons, or 95.3 per cent., was from stoping; 3,183 tons of waste were hoisted.

Milling

Some 20,088.8 tons, an average of 55.8 tons per day (based on 360 days of operation during the year), were milled after sorting 1,544 tons of waste. Production for the year was 17,745.474 fine ounces of gold, or $683,452.67, including premium. Average recovery was 0.883 ounces, or $34.01 per ton milled at $38.50 per ounce.

Due to the small tonnage being treated until then, three-shift operation of the ball mill and amalgamation were not resumed until December. Tonnage increased the last month to 2,082 tons from the low in September of 1,400 tons.

Tailings losses were lower at 0.0305 ounces per ton. Extraction for the year showed a slight improvement, being 96.7 per cent.

Costs

	Per ton milled	
Exploration and development:		
Surface diamond-drilling	$1.78	
Station-cutting	.21	
Sump-cutting	.09	
Crosscutting and drifting	.27	
Raising	.81	
		$3.16
Mining		9.07
Milling		3.42
Total operating costs at the mine		$15.65

The above total operating costs compare with a cost of $13.74 per ton milled in 1944. The increase in cost per ton is due to the cost of surface diamond-drilling, underground lateral development, and reduced tonnage treated. The mining and milling costs are substantially the same as last year.

General

Operations reached an all-time low at midsummer. The return of temporary workers to the farms in March and a sudden drift of men immediately after V.E. day left a bare minimum crew required to continue operations. The underground force was most seriously affected. Tonnage and production dropped, and construction came almost to a standstill. Since that time there has been a considerable improvement in the man-power situation, although experienced men are scarce. The situation is brightened, however, by the return of some of our former employees from the armed services. At year's end, production was about 90 per cent. of normal, although development work was limited to shaft preparation.

Production increased 10 per cent. over 1944. Tonnage milled decreased 7.5 per cent., while the recovery per ton increased 18 per cent., or $5.29 per ton.

G. A. McKay was manager, employing an average force of 78 persons during the year, of whom 33 were in the mine and 10 in the mill.

Little Long Lac Gold Mines, Limited

Little Long Lac Gold Mines, Limited, was incorporated in January, 1933, with an authorized capitalization of 2,000,000 shares of no par value, of which 1,841,000 have been issued. The officers and directors are: D. M. Hogarth, president; Mrs. Clela Ellis, vice-president; J. A. MacFadyen, secretary-treasurer; W. H. Englebright, A. B. Gordon, and D. M. Morin, directors. The head office is at 25 King Street West, Toronto. The mine address is Geraldton.

The property consists of 35 claims, approximately 1,400 acres, in the townships of Errington and Ashmore, Little Long Lac area, district of Thunder Bay. The mine is 2 miles south of Geraldton on the Port Arthur–Longlac branch of the Canadian National Railways. There is an automobile road from Geraldton to the property.

Mining and milling operations continued throughout 1945. The mine is being developed from a vertical, 3-compartment shaft, 2,322 feet deep, on claim T.B. 10,560. A vertical, 3-compartment winze, which is collared at the 16th level about 1,680 feet southwest of the shaft, runs to a depth of 3,218 feet from surface.

During 1945, the following development work was completed: drifting, 2,366 feet; raising, 351 feet. The total development work to December 31, 1945, is as follows: drifting, 39,192 feet; crosscutting, 9,023 feet; raising, 13,513 feet.

Diamond-drilling during the year consisted of 42 holes, totalling 4,692 feet, from underground.

The following is taken from the report of the general manager for the year ending December 31, 1945:—

Production

Ore hoisted	tons	86,005
Waste sorted	tons	13,888
Ore milled	tons	72,117
Bullion recovered, gold	ounces	21,152.770
Bullion recovered, silver	ounces	1,975.950
Total gold in residues	ounces	785.193
Calculated mill head assay		$11.72
Calculated mill residues assay		$0.42
Recovery	per cent.	96.42

The mill operated 289.6 days, or 79.37 per cent of full time. The average daily tonnage milled was 249 tons, against 184.52 tons in 1944 and 263.21 tons in 1943. Mill operating time was low due to a shortage in mine labour. Production for the past five years is listed below:—

Year	Tons milled	Gross production	Value per ton
1941	118,332	$1,634,811.26	$13.815
1942	115,790	1,516,057.19	13.093
1943	88,890	1,024,321.24	11.524
1944	67,538	877,901.64	13.000
1945	72,117	815,183.11	11.303

In the eleven years the property has been in production, a total of 1,027,892 tons of ore have been milled for a gross production of $15,199,002.72, or an average of $14.786 per ton milled.

Development

Development for the year consisted of the completion of development of the main vein zone on the 21st level and the development of the main vein zone on the 22nd level. Between the surface and the 11th level, the main vein had an average length of about 1,000 feet. At the 11th level a displacement of the vein was encountered dividing the vein into two parts. This "passed through the vein" in such a way that the main (north) part of the vein grew shorter with depth, while the south (displaced) part grew longer.

On reaching the 22nd level of the mine, the north part had disappeared and the south part of the vein showed a length of 946 feet of ore averaging by channel sampling 0.387 ounces ($14.90) per ton over an average width of 41 inches, an improvement in both width and grade over the south part of the vein on the levels immediately above.

Ore Reserves

The ore reserves as of December 31, 1945, to and including the 22nd level are:—

	Tons	Grade	
		Ounces	Value[1]
Ore in pillars	101,622	0.448	$17.25
Available ore	424,397	.306	11.78
Total reserves	526,019	0.334	$12.86

[1]Gold at $38.50 an ounce.

Operating Costs

	Total cost	Cost per ton
Exploration (underground)	$4,463.97	$0.0617
Development	70,734.64	.9808
Mining	346,031.92	4.7982
Milling	154,835.52	2.1470
Mine office and supervision	37,612.08	.5215
General expense, property	48,130.10	.6674
Administration (Toronto)	26,471.22	.3671
Total	$688,279.45	$9.5437

A comparison of operating costs by years follows:—

Year	Development and exploration	Mining	Milling	Mine office supervision	General expense	Administrative expense	Total	Tons milled	Cost per ton
1941	$221,480.19	$357,793.01	$182,762.15	$38,433.75	$60,909.49	$28,515.76	$889,894.35	118,332	$7.52
1942	137,644.31	438,316.34	190,848.24	37,176.23	65,730.68	26,868.82	896,584.62	115,790	7.74
1943	134,910.18	324,093.49	192,561.19	37,152.29	69,525.75	27,147.65	785,390.55	88,890	8.84
1944	171,862.00	279,864.20	158,628.28	36,685.57	56,835.32	23,541.37	727,416.74	67,538	10.77
1945	75,198.61	346,031.92	154,835.52	37,612.08	48,130.10	26,471.22	688,279.45	72,117	9.54

The above table shows that the reduction in the amount of development carried out is responsible for the reduction in total operating cost, since the cost of mining increased $66,000 over the 1944 cost.

An average force of 191 men was employed, of whom 123 were in the mine and 22 in the mill. W. Samuel is general manager, and A. E. Cave is mine manager.

Macassa Mines, Limited

Macassa Mines, Limited, was incorporated in April, 1926, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,678,068 have been issued. The officers and directors are: Robert A. Bryce, president; L. Soliague, executive vice-president; E. W. Vanstone, secretary-treasurer; C. R. Leonard,

J. D. Perrin, A. G. Slaght, H. M. Porteous, and J. W. Flanagan, directors. The head office is at 85 Richmond Street West, Toronto. The mine address is Kirkland Lake.

The property consists of 11 claims, approximately 374 acres, in Teck township, Kirkland Lake area, district of Timiskaming.

The following table shows the various shafts on the property, their location, number of compartments, and depth:—

Shaft	Claim No.	No. of compartments	Depth from surface
			feet
Elliott[1]	L. 1,617	2	523
Main No. 1	L. 2,837	3	3,043
No. 1 winze[2] (below the 3,000-foot level)		3	4,727
No. 2[3]	L. 4,186	3	4,070

[1]No work has been done for several years in the Elliott shaft area.
[2]About 360 feet southeast of No. 1 shaft.
[3]About 1,000 feet southwest of No. 1 shaft.

During the year No. 1 winze was sunk a further 156 feet to a total depth of 4,727 feet and a level established at 4,625 feet from surface.

Development footage for the year consisted of 1,176 feet of drifting, 589 feet of crosscutting, and 544 feet of raising. The total development to date is as follows: drifting, 72,260 feet; crosscutting, 22,960 feet; raising, 12,791 feet.

Diamond-drilling during the year consisted of 49 holes, totalling 9,334 feet, all from underground.

The following is taken from the mine manager's report for the year ending December 31, 1945:—

Production

During the year, 71,988 tons of ore was hoisted and milled. From this, an income valued at $1,089,838.99, or $15.14 per ton, was obtained. The 1944 figures were 83,392 tons treated, from which $1,402,042.05, or $16.81 per ton, was recovered. The low point since 1940 was during the month of May, when the average tons milled per day was 183 and the underground work force stood at 107 men. Since that month there has been a gradual improvement in that we now have a force of 150 men underground, a large proportion of the increase being due to former employees returning from the various armed services.

Of the 71,988 tons milled during the year, 68,817 tons came from stopes and 3,171 tons from development.

Exploration and Development

The winze-deepening programme had to be stopped in May owing to the need of those men for other work in the mine. With the increase in staff late in the year this work was resumed in November, and the winze will be completed to 4,800 feet in March of this year. The development of the block of ground between the 4,250-foot and 4,750-foot levels, which in normal times would have been practically completed at this time, will get under way. A programme of development of branch veins in the older sections of the mine, which were located in previous diamond-drilling programmes, is also planned for 1946.

During the year a total of 614 lineal feet of new ore was drifted on, which averaged 0.42 ounce over an average width of 5.1 feet. Two-thirds of this total length was on a branch vein in the western section of the mine, on the 4,125- and 4,250-foot levels.

Ore Reserves

The continued shortage of experienced underground men hampered the rate of development work which could otherwise have been carried out during the year. In spite of this, no appreciable drop in ore reserves resulted.

	Tons	Ounces per ton	Value per ton at $38.50
Unbroken ore	390,200	0.45	$17.32
Broken ore	22,400	.34	13.09
Total	412,600	0.444	$17.09

In addition to the above, there are several blocks of an average grade of 0.26 ounces ($10.01), aggregating 29,700 tons, which will be mined and may contain sections of higher grade. Of this reserve, 39.2 per cent. is in bodies along the main break and 60.8 per cent. in branch or subsidiary hanging-wall veins.

Milling

The average tons milled per day throughout the year was 197.2, as compared with an average of 229.1 for the previous year. Income from the re-treatment of our tailings by Lake Shore Mines, Limited, for the year amounted to $3,537.46. The average extraction for the year was 95.01 per cent. At this date the daily milling rate is at 240 tons per day.

Operating Costs

The total operating costs per ton milled before provision for taxes and depreciation are as follows, along with comparable figures for the four previous years.

	1945	1944	1943	1942	1941
Development and exploration	$1.16	$1.41	$0.93	$0.87	$1.51
Mining (stoping, tramming, pumping, etc.)	5.14	4.00	3.84	3.64	3.21
Milling	1.53	1.54	1.33	1.25	1.17
Administration and general charges (including head office and marketing bullion)	1.87	1.59	1.19	1.17	.92
Total	$9.70	$8.54	$7.29	$6.93	$6.81

A comparison of the main items of expenditures during 1945 with those of the previous four years is as follows:—

	1945	1944	1943	1942	1941
Wages	$392,904.60	$392,386.40	$435,996.39	$471,245.23	$550,358.99
Supplies and services	172,558.43	185,721.49	162,338.25	207,144.08	252,235.38
Power	49,515.21	68,936.43	73,812.06	76,774.65	87,897.30
Provision for taxes	83,205.75	169,476.67	242,029.44	358,708.21	463,469.77

An average force of 189 men was employed during the year, of whom 114 were in the mine and 16 in the mill. G. A. Howes is mine manager.

McIntyre Porcupine Mines, Limited

McIntyre Porcupine Mines, Limited, incorporated in March, 1911, has an authorized capitalization of 800,000 shares of $5 par value, of which 798,000 have been issued. The officers and directors are: J. P. Bickell, president; Bernard E. Smith, vice-president; Balmer Neilly, executive vice-president; R. J. Ennis, vice-president and general manager; E D. Fox, secretary; D. H. McDougall and R. S. McLaughlin, directors. The executive office is at 25 King Street West, Toronto. The head office and mine office are at Schumacher.

The company has numerous holdings in Canada, chief of which is the McIntyre mine in Tisdale township, Porcupine area, district of Cochrane.

Operations at the main property continued throughout 1945. An average force of 1,133 men was employed, of whom 767 were in the mine and 79 in the mill.

The following is taken from the report of the general manager for the fiscal year ending March 31, 1946:—

Production

Ore treated ... tons		587,960
Value per ton (0.2917 ounce)		$11.229
Gross value		$6,602,049.83
Bullion produced:		
Gold (164,297.513 ounces at $38.50)	$6,325,459.85	
Silver (32,056.86 ounces at $0.5743)	18,408.98	
Total value		$6,343,868.83
Recovery per ton (0.2802 ounce)		$10.79

PRODUCTION SINCE THE BEGINNING OF MILLING OPERATIONS IN 1912

Period	Months	Tons milled	Value per ton	Gross value	Recovery per ton	Total value	Price received per ounce for gold
1912	12	14,500	$7.00	$101,555.16	$5.25	$76,166.38	
1913	12	31,979	7.85	251,314.45	7.05	225,752.25	
Jan. 1, '14, to Mar. 31, '15	15	85,654	8.87	760,232.16	8.39	718,331.71	
Apr. 1, '15, to Mar. 31, '16	12	105,758	7.71	815,345.49	7.38	779,990.94	
Apr. 1, '16, to June 30, '17	15	195,307	10.00	1,954,793.28	9.55	1,864,914.28	
July 1, '17, to June 30, '18	12	178,327	10.05	1,793,197.55	9.61	1,714,258.00	
July 1, '18, to June 30, '19	12	179,874	9.78	1,759,627.40	9.29	1,671,646.03	
July 1, '19, to June 30, '20	12	188,835	11.52	2,175,891.31	11.02	2,080,178.44	
July 1, '20, to June 30, '21	12	171,916	11.67	2,005,672.00	11.08	1,904,326.36	
July 1, '21, to June 30, '22	12	193,971	10.69	2,074,088.40	9.99	1,937,105.07	$20.67
July 1, '22, to June 30, '23	12	240,615	9.96	2,397,303.00	9.35	2,249,741.63	
July 1, '23, to June 30, '24	12	360,140	9.69	3,488,863.00	9.14	3,291,178.22	
July 1, '24, to June 30, '25	12	400,259	9.43	3,774,068.00	8.86	3,546,637.52	
July 1, '25, to June 30, '26	12	460,909	8.72	4,020,326.00	8.25	3,804,774.90	
July 1, '26, to Mar. 31, '27	9	385,409	8.08	3,113,500.07	7.67	2,957,060.97	
Apr. 1, '27, to Mar. 31, '28	12	520,460	8.09	4,207,553.00	7.66	3,987,634.94	
Apr. 1, '28, to Mar. 31, '29	12	538,165	8.24	4,433,378.00	7.83	4,212,624.82	
Apr. 1, '29, to Mar. 31, '30	12	550,495	8.46	4,657,188.00	8.05	4,433,626.45	
Apr. 1, '30, to Mar. 31, '31	12	558,115	8.84	4,934,122.00	8.30	4,633,140.73	
Apr. 1, '31, to Mar. 31, '32	12	655,030	8.47	5,548,278.10	8.10	5,305,475.29	21.95
Apr. 1, '32, to Mar. 31, '33	12	736,300	8.45	6,224,493.40	8.12	5,981,714.69	22.79
Apr. 1, '33, to Mar. 31, '34	12	776,845	10.68	8,296,704.60	10.24	7,957,252.54	31.50
Apr. 1, '34, to Mar. 31, '35	12	862,100	10.23	8,819,660.27	9.78	8,430,670.26	34.67
Apr. 1, '35, to Mar. 31, '36	12	873,000	9.88	8,621,410.67	9.38	8,190,639.14	35.17
Apr. 1, '36, to Mar. 31, '37	12	864,500	10.00	8,641,205.24	9.49	8,201,416.94	34.99
Apr. 1, '37, to Mar. 31, '38	12	871,200	9.75	8,495,286.60	9.25	8,061,906.45	34.996
Apr. 1, '38, to Mar. 31, '39	12	871,900	10.10	8,809,415.12	9.61	8,375,335.71	35.23
Apr. 1, '39, to Mar. 31, '40	12	883,780	10.50	9,280,648.46	9.95	8,793,575.06	37.06
Apr. 1, '40, to Mar. 31, '41	12	884,000	11.23	9,923,064.15	10.69	9,452,490.59	
Apr. 1, '41, to Mar. 31, '42	12	862,500	11.12	9,588,848.00	10.58	9,123,886.73	
Apr. 1, '42, to Mar. 31, '43	12	757,210	11.34	8,589,076.53	10.85	8,212,402.73	38.50
Apr. 1, '43, to Mar. 31, '44	12	654,930	11.61	7,601,880.07	11.16	7,305,804.75	
Apr. 1, '44, to Mar. 31, '45	12	572,620	11.74	6,722,230.78	11.26	6,450,359.60	
Apr. 1, '45, to Mar. 31, '46	12	587,960	11.23	6,602,049.83	10.79	6,343,868.83	
Total	....	17,074,563	$9.98	$170,482,270.09	$9.50	$162,275,888.95	....

Operating Costs

	Total cost	Cost per ton ore milled
MINING:		
Exploration	$36,273.89	$0.0617
Development	322,369.70	.5483
Breaking and stoping	2,774,915.13	4.7195
	$3,133,558.72	$5.3295
Milling	572,928.85	.9744
Administration and general expense	108,872.26	.1852
Total	$3,815,359.83	$6.4891

ANALYSIS OF MINING COSTS

	Labour and employees' insurance	Explosives	Other supplies	Shop repairs and maintenance	Power and air	Indirect charges	Total cost	Cost per ton
Drifts	$77,542.97	$20,907.87	$6,814.58	....	$7,840.76	$19,161.90	$132,268.08	$0.2251
Crosscuts	32,061.59	10,081.35	2,287.29	....	3,267.54	8,451.30	56,149.07	.0955
Raises	1,251.20	267.15	206.20	....	321.35	789.40	2,835.30	.0048
Diamond-drilling	28,680.81	....	7,902.41	$1,951.57	3,626.71	7,256.75	49,418.25	.0840
Exploration	21,063.16	....	7,537.67	3,820.00	....	3,853.06	36,273.89	.0617
Mining	1,112,187.55	61,658.56	125,276.23	73,331.51	82,887.90	191,509.45	1,646,851.20	2.8009
Timbering	260,410.30	....	228,904.62	18,799.50	1,612.08	24,578.14	534,304.64	.9087
Backfilling	113,713.24	....	65,959.89	6,518.09	1,091.80	4,519.45	191,802.47	.3262
Tramming, development	45,159.00	....	10,607.00	5,979.00	1,460.00	1,127.00	64,332.00	.1094
Tramming, mining	101,921.43	....	23,555.46	13,111.31	3,831.01	15,694.05	158,113.26	.2689
Hoisting, development	10,025.00	....	989.00	3,662.00	2,382.00	309.00	17,367.00	.0295
Hoisting, mining	130,397.52	....	13,469.89	46,547.14	33,807.78	19,621.23	243,843.56	.4148
Total	$1,934,413.77	$92,914.93	$493,510.24	$173,720.12	$142,128.93	$296,870.73	$3,133,558.72	$5.3295
Cost per ton milled	$3.2900	$0.1580	$0.8394	$0.2955	$0.2417	$0.5049	$5.3295	....

Mining

	Tons
Ore broken in stopes	537,767
Ore from development	41,619
Total	579,386
Ore hoisted	586,130

SUMMARY OF DEVELOPMENT AND EXPLORATION, 1945–46

Period	Drifts	Cross-cuts	Raises	Winzes	Shafts	Stations	Sumps	Excavation	Total footage	Total excavation	Diamond-drilling
	feet	feet	feet	feet	feet	cu. ft.	cu. ft.	cu. ft.	feet	cu. ft.	feet
1	988	182	21	...	...	...	...	...	1,191	...	4,015
2	634	376	...	...	...	...	...	...	1,010	...	4,868
3	456	684	33	...	...	...	...	...	1,173	...	3,964
4	400	494	75	...	...	...	...	...	969	...	3,694
5	579	197	11	...	...	...	...	...	787	...	4,184
6	627	302	...	...	...	...	...	2,429	929	2,429	3,847
7	773	333	...	...	...	...	...	3,467	1,106	3,467	4,593
8	981	339	...	...	...	...	...	...	1,320	...	4,810
9	638	361	...	...	...	...	...	624	999	624	4,260
10	880	229	5	...	...	...	...	...	1,114	...	4,132
11	760	222	15	...	...	...	...	...	997	...	3,516
12	827	291	...	...	...	...	...	...	1,118	...	4,135
Total	8,543	4,010	160	...	...	...	...	6,520	12,713	6,520	50,018
Previous to date	403,197	183,629	34,904	613	14,759	1,013,582	55,039	268,931	637,102	1,337,552	1,007,923
Total to date	411,740	187,639	35,064	613	14,759	1,013,582	55,039	275,451	649,815	1,344,072	1,057,941

ORE RESERVES

	Tons	Fine ounces gold	Value at $35
Estimated in place	4,247,460	1,329,153.3	$46,520,365
Broken ore	127,803	29,761.7	1,041,661
Total	4,375,263	1,358,915	$47,562,026
Average per ton	...	0.3106	$10.87

General

During the first five months of the period under review, operating conditions continued to deteriorate until the tonnage of ore treated dropped to 54 per cent. of milling capacity. Since the termination of the war more men have become available and the underground force is now 80 per cent. of normal with a corresponding increase in ore mined.

Upon resumption of work in sections of the mine where operations were necessarily suspended, it has been found that the damage resulting from crushed timber and caved openings is greater than was anticipated. In addition to the time required, it will be costly to reopen these workings and possibly some ore in certain areas will be lost.

While the future may hold uncertainties we feel that progress is now being made towards the re-establishment of the pre-war balance between exploration-development and ore production.

The use of aluminum therapy for the prevention of silicosis in siliceous industries continues to increase.

McKenzie Red Lake Gold Mines, Limited

McKenzie Red Lake Gold Mines, Limited, was incorporated in February, 1933, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,935,000 have been issued. The officers and directors are: H. W. Knight, president; H. G. Young, vice-president; G. Scott, secretary-treasurer; C. A. Gentles, J. Bradley Streit, and A. C. Snively, directors. The head office is at 19 Richmond Street West, Toronto. The mine address is McKenzie Island.

The property consists of 12 claims, approximately 475 acres, at the north end of Mackenzie island, Dome township, Patricia portion of Kenora district.

Mining and milling operations continued throughout 1945. The mine has been developed from a vertical, 3-compartment shaft, 456 feet deep, on claim

K.R.L. 87 and a 3-compartment winze, which is collared at the 250-foot level about 250 feet southwest of the shaft and runs at an angle of 36 degrees to a vertical depth of 1,275 feet from surface. The vertical shaft is known as No. 1 and the winze as No. 2 shaft. During 1945, a 3-compartment, vertical winze, called No. 4 shaft, was collared on the 1,250-foot level at a point about 1,700 feet north and slightly west of the collar of No. 1 shaft and was sunk for a distance of 420 feet. New levels were established at depths of 1,350, 1,450, 1,550, and 1,650 feet from surface.

During 1945, the following development work was done: drifting, 2,553 feet; crosscutting, 443 feet; raising, 192 feet. The total development work to December 31, 1945, is as follows: drifting, 56,982 feet; crosscutting, 11,953 feet; raising, 11,605 feet.

Diamond-drilling consisted of 46 holes, totalling 7,120 feet, from underground.

The following is taken from the manager's report for the year ending December 31, 1945:—

Development work completed during the year about equalled that of 1944, and in addition a winze from the 1,250-foot level was completed to open up four new levels. Tonnage extracted and grade of ore milled are both lower than in the previous year due mainly to labour shortage; while costs were higher due to the reduced tonnage treated and increased plant maintenance.

General Summary of Mining and Milling Operations

	1945	1944	Total to date
	tons	tons	tons
Ore broken in stopes and stope development, slashing included	65,860	86,564	813,690
Ore broken in development	10,436	7,024	100,221
Total ore hoisted (milled and sorted, dry)	76,296	93,588	913,911
Tonnage milled	63,460	78,279	754,326
Tonnage discarded by sorting	12,836	15,309	159,585
	ounces	ounces	ounces
Average value per ton milled	0.2065	0.249	0.343
Average recovery per ton milled	.2016	.2435	.3349
Percentage of extraction	97.63	97.7	97.63
Total value of bullion produced and marketed	$492,583.14	$733,913.43	$9,372,039.33
Total operating cost	$485,893.20	$551,573.07	$5,103,902.46

General Development

A drastic shortage of labour during the past year has been a much more serious factor than in any previous year, with the result that essential development work, including the sinking of a vertical winze iin the northeast zone from the 1,250-foot to the 1,650-foot horizon, had to be carried on at the expense of extraction. The effect of this is reflected in the reduction of ore milled this year compared with last year.

Total drifting amounted to 2,553 feet; of this 1,091 feet was located in the northeast zone on the 1,250-foot level. On the 850-foot level, 1,191 feet of drifting was completed, of which 510 feet was located in the northeast zone and 681 feet in the hanging wall of the older portion of the mine. Drifting on the 950- and 1,050-foot levels was located in the hanging-wall portion of the older mine.

Drifting along ore-bearing structure indicated the following lengths: on the 850-foot level 452 feet in a northeast zone subsidiary structure and 461 feet in the hanging-wall zone; on the 950-foot level, 72 feet; and on the 1,250-foot level, 310 feet in the northeast zone and 120 feet in the hanging wall of the northeast zone.

Tonnage milled from the northeast zone during the year amounted to 41 per cent of the total. Stoping widths averaged 6.2 feet.

Ore Reserves

The footage of new ore developed during the year amounted to 623 feet in the northeast zone and 792 feet in the older section of the mine, totalling 1,415 feet in all. This footage was more than sufficient to maintain the ore reserve position of the mine.

Analysis of Operating Costs

	Total cost	Per ton milled and sorted (76,296 tons)	Per ton milled (63,460 tons)
Development and exploration:			
Diamond-drilling	$5,059.84	$0.066	$0.08
Current development	51,659.25	.677	.814
Total	$56,719.09	$0.743	$0.894
Extraction:			
Slashing	$31,033.23	$0.407	$0.489
Stoping	196,943.37	2.581	3.103
Total	$227,976.60	$2.988	$3.592
Mill operations:			
Crushing and conveying	$13,839.25	$0.181	$0.218
Sorting	6,794.61	.089	.107
Milling	75,685.81	.992	1.193
Total	$96,319.67	$1.262	$1.518
General expense:			
Including maintenance of buildings, water supply, salaries, and office engineering, insurance, heating, hospital, and telegraphs	$86,509.74	$1.134	$1.363
Head office expense:			
Salaries and expenses, stock registration, transfer fees, etc.	$18,368.10	$0.241	$0.289
Total	$485,893.20	$6.368	$7.656

Conclusion

The average daily tonnage hoisted was 209; sorted, 35; milled, 174. Insufficient and inexperienced labour precluded the use of our normal method of selective mining and made necessary the extraction of the easily accessible ore. The inevitable result has been the lowering of the grade of ore mined.

An average force of 124 men was employed, of whom 71 were in the mine and 12 in the mill. J. L. Ramsell is manager.

MacLeod-Cockshutt Gold Mines, Limited

MacLeod-Cockshutt Gold Mines, Limited, which was incorporated in September, 1933, has an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,862,490 have been issued. The officers and directors are: F. G. MacLeod, president; Arthur Cockshutt, vice-president; J. M. Macintosh, secretary-treasurer; W. H. Marsh, Arthur Notman, and A. L. Cochrane, directors. The head office is at 357 Bay Street, Toronto. The mine address is Geraldton.

The property consists of 23 claims, 1,163 acres, about 3 miles from Geraldton on the Port Arthur–Longlac branch of the Canadian National Railways in Ashmore and Errington townships, Little Long Lac area, district of Thunder Bay.

Mining operations continued throughout the year. The mill operated from January 1 to March 31. There are two vertical shafts on the property. The No. 1 3-compartment shaft on claim T.B. 10,040 is down to a depth of 1,755 feet. The No. 2 4-compartment shaft on claim T.B. 10,038, about 1,500 feet southeast of No. 1 shaft, was sunk during the year a further 481 feet to a depth of 1,921 feet. These shafts are connected on the 500- and 1,100-foot levels.

During 1945 the following development work was completed: drifting, 10,999 feet; crosscutting, 397 feet; raising, 1,386 feet. The total development work to date is as follows: drifting, 51,445 feet; crosscutting, 17,458 feet; and raising, 15,739 feet.

Diamond-drilling consisted of 15 holes, totalling 6,536 feet, from surface and 525 holes, totalling 53,680 feet, from underground.

The following is taken from the general manager's report for the twelve months ending September 30, 1945:—

General

The mine during the past year was in production till the end of March. All ore was run through the mill circuit by April 15. The rest of the year, development was stressed to make up for the curtailment in development, which suffered during the war years through lack of labour.

Development work consisted of opening up four new levels at No. 1 shaft, namely the eighth, ninth, tenth, and eleventh. On the bottom level a drive was made from No. 1 shaft to No. 2 shaft and continued along the iron formation to within 100 feet of Hard Rock line. No. 2 shaft was raised 257 feet to connect with the bottom, slashed to full size, and sunk 200 feet below eleventh. A loading-pocket and crusher station will be installed below eleventh.

Other development work consisted of driving west on the sixth and seventh to the west of No. 1 crosscut north without any important ore disclosures. The drive in the porphyry west on the fifth level disclosed some ore, but more work is required.

Mining

Ore mined, hoisted, and conveyed to the crusher plant amounted to 89,902 tons, with an average value of $8.75 per ton. After hand-sorting and magnetic separation of waste rock, amountint to 26,119 tons, ore sent to the mill was 63,783 tons, with an average of $11.976 per ton, an increase of $3.24 per ton. This ore produced $729,920.57. The sources from which this ore was obtained are listed below:—

Summary of Ore Trammed to Ore Passes
October, 1944, to March, 1945

	Ore trammed	Tonnage	Average recovery		Total ounces	Per cent. production
			Ounces	Value		
	tons	per cent.				
North Zone:						
Stopes	43,172	49.9	0.237	$9.12	10,218.79	52
Development	15,889	18.4	.203	7.82	3,221.99	16.4
West Zone:						
Stopes	26,794	31	.227	8.74	6,078.95	31
Development	647	.7	.188	7.24	121.58	.6
Total	86,502	100	0.227	$8.74	19,641.31	100

Milling

During the fiscal year, the mill operated from October, 1944, to the end of March, 1945, for a total of 177.85 operating days. In this period, 63,783 tons were milled for an average of 358.63 tons per day. The grinding circuit was shut down and the mill and roaster circuits were cleaned up during the first half of April, resulting in a clean-up of $45,532.52.

Since the end of milling operations, the equipment in the crusher-house, mill, and roaster has been thoroughly overhauled and many necessary repairs and replacements were made. New pipe lines and electrical wiring were installed.

During October, 1944, 570 tons of impounded concentrate cyanide tails were re-treated by roasting and cyanidation. Further recovery of the impounded material ceased with the coming of the cold weather. With the closing-down of mill operations, it was not economically feasible to treat this material alone during the summer of 1945.

Development and Ore Reserves

A summary of reserves which can be classed as ore with the location and average value is listed below. For comparison there is added a summary of the total ore mined from these same locations from the time the mill started till it closed.

SUMMARY OF ORE RESERVES AND ORE MINED

	Ore reserves			Ore mined		
	Tons	Ounces per ton	Total ounces	Tons	Ounces per ton	Total ounces
North zone..........	205,687	0.213	43,872.86	1,357,035	0.228	309,518.63
West zone...........	247,579	.237	58,601.38	311,413	.241	75,065.72
South zone..........	60,000	.220	13,200	245,789	.225	55,309.71
Total..........	513,266	0.225	115,674.24	1,914,252	0.230	439,894.06

An average force of 200 men was employed, of whom 94 were in the mine and 12 in the mill. J. M. Kilpatrick is general manager.

Madsen Red Lake Gold Mines, Limited

Madsen Red Lake Gold Mines, Limited, was incorporated in March, 1935, with an authorized capitalization of 5,000,000 shares of $1 par value. On June 6, 1940, the capitalization was reduced to $3,500,000 by the cancellation of 1,500,000 unissued shares. The number of shares issued at the end of 1945 was 3,499,528. The officers and directors are: Jos. McDonough, president; F. R. Marshall, vice-president; M. Masterson, secretary-treasurer; Wm. R. Askwith, managing director; Marius Madsen, D. M. Hogarth, Hugh Mackay, and F. M. Connell, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Madsen.

The property consists of 46 claims, 2,179 acres, in Baird and Heyson townships, Red Lake area, Patricia portion of Kenora district. It is about 7½ miles southwest of the Howey mine and may be reached by road from Red Lake.

There are two vertical shafts on the property. Work on No. 1 shaft on claim K.R.L. 11,505 has been discontinued since September, 1936.[1] Operations in the No. 2 shaft area on claim K.R.L. 12,528 continued throughout 1945. This 3-compartment, vertical shaft is 1,959 feet deep.

During 1945, the following development work was completed: drifting, 2,827 feet; crosscutting, 2,778 feet; raising, 1,723 feet. The total development work to December 31, 1945, is as follows: drifting, 21,653 feet; crosscutting, 5,946 feet; raising, 11,841 feet.

Diamond-drilling consisted of 9 holes, totalling 2,998 feet, from surface and 134 holes, totalling 16,682 feet, from underground.

The following is taken from the report of the manager for the twelve months ending February 28, 1946:—

The average daily milling rate was maintained at 300 tons per day until the month of August, after which time it gradually dropped until it reached a low of 226 tons per day in January. However, the milling rate was increased during the month of February and stood at 286 tons per day at the end of the fiscal year. In August the mill operation was interrupted for a period of 12 days due to the necessity of changing the guide timbers in both hoisting compartments of the shaft from the surface to the 1,175-foot loading-station.

During the operating period, 98,472 tons of ore and 46,855 tons of waste rock were hoisted. The milling of the ore produced 25,437.849 troy ounces of gold and 5,348.940 troy ounces of silver. The total value of this bullion was $981,932.52. The average recovery was $9.971 per ton milled.

[1]A table showing the amount of work done from this shaft appears in Ont. Dept. Mines, Vol. XLVII, 1938, pt. 1, p. 168.

ANALYSIS OF OPERATING COSTS

	Total	Cost per ton milled
Development and exploration	$268,994.86	$2.732
Stope preparation	29,044.15	.295
Stoping	51,947.04	.528
Mucking, tramming, and hoisting	125,694.79	1.276
Crushing and conveying	22,718.17	.231
Milling	100,123.69	1.017
Mine general expense	110,338.57	1.120
Head office expense	25,487.14	.259
Marketing charges	12,741.67	.129
Total operating costs	$747,090.08	$7.587

Mining

A further 34,176 tons of waste rock were placed in the 2-B stope as backfill. No mining operations were carried out on the first four levels of the mine. The 5-8 and 5-10 stopes were drawn empty. The west portion of the 5-14 ore body was partially mined. The slot on the west end of the 6-8 ore body was completed, and the mining of this ore body, using diamond-drills, was started.

The east portion of the 7-8 ore body was practically all mined. The east end of the 7-10 stope was carried above the 6th level by shrinkage methods, using rock-drills, while the central and west portions of the ore body were mined by the use of diamond-drills. The ore between the 6th and 5th levels in this ore body is presently being prepared for mining by the driving of a sublevel drift, from which the ore will be mined by the use of diamond-drill holes. It is planned to leave a pillar of 50 feet between the 7-8 and 7-10 stopes as ground support. The ore in this section, from the silled-out stope above the 7th level up to the 6th level, is quite erratic and can be left as a permanent pillar without any great loss of ore.

The silling out of the 7-16 ore body was completed and mining by shrinkage methods started. The 7-18 ore body was partially prepared for mining.

Sufficient ore was developed during the year to replace the 98,472 tons milled and to increase the last year's ore reserve figure by an additional 168,745 tons. The grade of the reserve was raised slightly by the addition of this new ore.

Ore Reserve

The calculated ore reserve at the end of the year is as follows:—

	At Feb. 28, 1945	At Feb. 28, 1946
	tons	tons
Block between 2nd level and surface	19,510	19,510
Block between 3rd level and 2nd level	32,000	32,000
Block between 4th level and 3rd level	27,790	27,790
Block between 5th level and 4th level	20,440	16,900
Block between 6th level and 5th level	273,190	216,920
Block between 7th level and 6th level	154,890	75,890
Block between 8th level and 7th level	....	124,320
Block between 9th level and 8th level	....	30,000
Block between 10th level and 9th level	....	88,200
Block between 11th level and 10th level	....	43,200
Broken reserve	100,725	122,560
Total reserve	628,545	797,290
	ounces	ounces
Grade of reserve	0.199	0.203

In calculating the reserve the practice of former years was followed: All high assays were cut to 1.00-ounce grade and a dilution factor of 20 per cent. was allowed on the calculation of the tonnage and average grade of the reserve.

Milling

The details of the mill operation are shown in the following summary. For purposes of comparison, the details of the operation for the two previous years are also shown.

	Year ending Feb. 29, 1944	Year ending Feb. 28, 1945	Year ending Feb. 28, 1946
Dry tons treated	144,179	127,870	98,472
Per cent. operating time	96.01	87.19	67.4
Tons treated per mill day	396.1	360.2	280.4
Average gold assay of heads ... ounces	0.2507	0.3046	0.2724
Average gold assay of tails ... ounces	0.0167	0.0166	0.0141
Recovery ... per cent.	93.3	94.5	94.8

In the above summary, the "Per cent. operating time" is that of the grinding circuit only. It was our practice to operate the grinding mills at full tonnage for approximately 16 hours per day and then to stop them rather than run continuously at partial capacity. The remainder of the mill operated on a 24-hours-per-day basis.

The figure for "Tons treated per mill day" is for 351 operating days in this past year. The average daily tonnage milled, when calculated on the calendar year, was 270 tons per day.

General

The ore delimited on the lower levels to date has been of better than average grade and of substantial tonnage, resulting in both the grade and the tonnage of the ore reserve being increased. The broken ore reserve was increased by 21,835 tons, this increase being almost entirely in the 7-10 shrinkage stope. The grade of the ore milled, while below last year's average, was still above the average grade for the mine.

The operating costs were increased by $2.767 per ton milled. The great part of this increased cost was caused by the heavy development programme carried out on the lower levels. The lower tonnage milled was due to the shortage of underground men to work in the stopes and on tramming crews and to the hoisting of a large tonnage of waste rock from the development of the lower levels.

An average force of 135 persons was employed. Of these, 50 were in the mine and 17 in the mill. E. G. Crayston is resident manager.

Magnet Consolidated Mines, Limited

Magnet Consolidated Mines (1936), Limited, was incorporated in April, 1936. At the end of 1940 the name was changed to Magnet Consolidated Mines, Limited. The authorized capitalization is 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: Cyril W. Knight, president; R. C. C. Henson, vice-president; Miln Brocklebank, secretary-treasurer; S. J. Brooks, Arthur Kendall, and J. Dumaresq Smith, directors. The head office is at 515 Jarvis Street, Toronto. The mine address is Geraldton.

The company owns 46 claims, 1,840 acres, formerly the property of Wells Longlac Mines, Limited, and Magnet Lake Gold Mines, Limited, in Errington township, Little Long Lac area, district of Thunder Bay. The property adjoins that of Bankfield Consolidated Mines, Limited, about 2 miles southwest of Bankfield station on the Port Arthur–Longlac branch of the Canadian National Railways. It can be reached from Geraldton by a 4-mile automobile road.

No mining or milling operations had been carried on since October, 1943, when operations were suspended and the workings allowed to fill.

Dewatering operations were started on August 1, 1945, and completed in November. During the latter part of the year a small amount of drifting and crosscutting was completed. Diamond-drilling consisted of 2 holes, totalling 602 feet, from underground.

A. Kendall is manager, and an average of 28 men was employed during the period of operation.

Matachewan Consolidated Mines, Limited

Matachewan Consolidated Mines, Limited, was incorporated in July, 1933. The authorized capitalization is 4,000,000 shares of no par value, of which 3,439,000 have been issued. The officers and directors are: Thayer Lindsley, president; H. H. Sutherland, vice-president; A. G. Fulton, secretary-treasurer; George McKeown and E. V. Neelands, directors. The head office is at 25 King Street West, Toronto. The mine address is Matachewan.

The property consists of approximately 886 acres in Powell and Cairo townships, Matachewan area, district of Timiskaming.

Mining and milling continued throughout 1945. Operations were continued from the 3-compartment, vertical shaft on claim M.R. 5,380, known as No. 3, which has been sunk to a depth of 1,861 feet.

During the year, the following development work was completed: drifting, 1,235 feet; crosscutting, 130 feet; raising, 1,239 feet. Total development work to date is as follows: drifting, 29,162 feet; crosscutting, 7,751 feet; raising, 14,266 feet.

The following is taken from the manager's report for the twelve months ending December 31, 1945:—

General

The continuation of the war with the accompanying man-power shortage and the difficulty of obtaining necessary supplies made operation of the mine progressively more difficult. The low point was reached in August when it was necessary to cut tonnage to 325 tons daily. From then on conditions gradually improved until at the end of the year the daily tonnage handled was up to 550 tons. The change was due to fewer absentees among the men, greater efficiency, and an improved attitude to their work more than to an increase in the number of men employed.

Broken ore reserves were drawn on to supply approximately 50 per cent. of the mill feed, and development work was curtailed. In spite of this the mine is in good shape and should respond quickly to improved labour conditions.

Mine Development

Stope development work was confined to the porphyry ore west of No. 3 diabase dike on the 10th level, where four new stopes were opened up and put into production. In addition a ventilation raise was driven from the 10th to the 8th level to provide fresh air to the working stopes on the 10th level. The 11th main west drift was advanced 1,248 feet and had reached a point approximately 200 feet from the projected position of the west boundary porphyry ore body by the end of the year. The No. 2 ore pass system from the 12th level to the 10th level was completed and put into service. More than 550 feet of raising was involved in this work.

Diamond-Drilling

The underground footage drilled for exploration during the year was 6,739 feet. Of this, 768 feet was drilled from the 8th level, 4,010 feet on the 10th level, and 1,961 feet on the 11th level. In addition one hole was drilled from surface to a depth of 653 feet to explore a favourable structure east of the present workings.

No blast-hole drilling was done during 1945.

Ore Reserves

The estimated probable ore reserves, including broken ore, have been figured from surface to the 10th level (1,300-foot elevation). The same dilution factors as last year have been used in figuring both tonnages and grade of ore yet to be mined, namely 20 per cent. for the greenstone and 10 per cent. for the porphyry ore bodies.

Probable ore reserves as at December 31, 1945, including broken ore, are as follows:—

	Tons
Ore reserves December 31, 1944	914,895
Added during 1945	57,543
Total	972,438
Less hoisted during 1945	161,311
Reserves as at December 31, 1945 (average grade, 0.110 ounces)	811,127

In addition to the above, there is indicated in the west boundary porphyry zone a possible 433,000 tons of 0.114 ounce grade between the 1,300-foot and 1,550-foot levels. Below the 1,550-foot level, diamond-drilling indicates that the porphyry ore extends downward, but insufficient information is as yet available to estimate tonnages or grade.

Mining

A summary of the mining operations for the year 1945 is given below:—

ORE BROKEN

	Tons
Ore broken during 1945	86,690
Ore hoisted during 1945	161,311
Ore drawn from broken reserve	74,621
Carried forward from 1944 (adjusted)	233,050
Broken ore reserves, December 31, 1945 (estimated grade, 0.1067 ounces per ton)	158,429

ORE HOISTED

	Tons
From stopes	158,963
From development	2,348
Total	161,311

Of the ore hoisted, 94 per cent. came from the west boundary porphyry zone and 6 per cent. came from the greenstone zone. The source of ore by levels was as follows:—

Level	Per cent.	Tons
2nd	21	33,875
8th	53	85,495
10th	24	38,715
Other levels	2	3,226
Total	100	161,311

Milling

The mill performance for the year was as follows:—

Tons milled	161,361
Average daily tons milled	442
Average value of heads ounces per ton	0.1068
Average value of tails ounces per ton	0.0102
Average value of recovery ounces per ton	0.0966

The acute labour shortage underground with the resultant drop in tonnage available for mill feed necessitated intermittent milling operations. In spite of this handicap very satisfactory results were obtained. The recovery was better than 90 per cent., and the costs, while showing an increase, were well within the range of what might be expected from the mill running at less than half capacity.

Production

The metal recovery for 1945 was as follows: gold, 15,593.476 ounces; silver, 6,217.14 ounces.

STATEMENT OF PRODUCTION, BY YEARS, SINCE COMMENCEMENT OF OPERATIONS

Year	Tons milled	Net value metals recovered	Value per ton	Operating costs	Cost per ton	Operating profit	Profit per ton	Price gold per ounce
1935	48,362	$351,769.40	$7.27	$272,942.24	$5.64	$78,827.16	$1.63	$35.17
1936	54,764	419,178.19	7.65	359,383.13	6.56	59,795.06	1.09	35.04
1937	132,764	698,976.61	5.26	594,969.29	4.49	104,007.32	.77	34.98
1938	154,409	820,823.00	5.31	639,672.64	4.14	181,150.36	1.17	35.19
1939	155,238	855,310.76	5.51	600,204.73	3.87	255,106.03	1.64	36.32
1940	182,033	817,916.52	4.49	642,135.16	3.53	175,781.36	.96	38.50
1941	196,962	879,187.86	4.46	709,249.55	3.60	169,938.31	.86	38.50
1942	315,040	962,620.23	3.06	764,369.80	2.43	198,250.43	.63	38.50
1943	249,779	714,763.40	2.86	593,776.16	2.38	120,987.24	.48	38.50
1944	179,586	536,662.68	2.99	469,563.24	2.62	67,099.44	.37	38.50
1945	161,361	595,415.45	3.69	491,529.13	3.05	103,886.32	.64	38.50

An average force of 108 men was employed, of whom 45 were in the mine and 14 in the mill. H. S. McGowan is manager.

Omega Gold Mines, Limited

Omega Gold Mines, Limited, was incorporated in May, 1935, with an authorized capitalization of 5,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: Jas. Y. Murdoch, president; J. Ingram, secretary-treasurer; Dr. A. F. Demary, André Dorfman, and Oliver Hall, directors. The head office and mine office are at Larder Lake, and the executive office is at 80 King Street West, Toronto.

The property consists of 28 claims, approximately 926 acres, in McVittie township, Larder Lake area, district of Timiskaming.

Mining and milling operations continued throughout 1945. The vertical, 3-compartment No. 1 main operating shaft, also known as the Crown, on claim L.S. 191 is 1,592 feet deep; the 2-compartment, vertical winze, known as No. 3 internal shaft, which is about 1,600 feet southeast of No. 1 shaft, is 2,000 feet deep; and the vertical, 3-compartment No. 2 or Goldfields shaft on claim L. 1,794, which is about 265 feet southwest of No. 1 shaft, is 1,030 feet deep.

During the year, 318 feet of raising was done. The total development work done on the property to the end of 1945 is as follows: drifting, 38,271 feet; crosscutting, 19,011 feet; raising, 13,614 feet.

Diamond-drilling during 1945 consisted of 9 holes, totalling 1,420 feet, from underground.

The following is taken from the manager's report for the twelve months ending March 31, 1946:—

Production

Ore treated .... tons	103,983	
Value per ton (0.126 ounces)	$4.851	
Gross value	$504,422.00	
Bullion recovered:		
Gold (11,421.251 ounces at $38.50)		$439,718.56
Silver (1,544.833 ounces)		784.75
Total value		$440,503.31
Recovered per ton (0.1100 ounces)	$4.236	
Bullion melting, refining, and handling charges		5,046.44
Net value of bullion		$435,456.87

Production since the Beginning of Milling Operations in 1936

Period	Months	Tons milled	Value per ton	Gross value	Recovery per ton	Total value
Feb. 1, 1936, to Mar. 31, 1936..	2	17,352	$4.286	$74,369.00	$3.557	$61,726.28
Apr. 1, 1936, to Mar. 31, 1937..	12	132,642	5.00	663,010.70	4.324	573,504.29
Apr. 1, 1937, to Mar. 31, 1938..	12	167,051	5.36	895,393.36	4.668	779,766.65
Apr. 1, 1938, to Mar. 31, 1939..	12	177,388	5.572	988,405.94	4.885	866,503.30
Apr. 1, 1939, to Mar. 31, 1940..	12	174,449	5.816	1,014,717.00	5.104	890,341.82
Apr. 1, 1940, to Mar. 31, 1941..	12	176,300	5.752	1,014,206.00	5.033	887,354.69
Apr. 1, 1941, to Mar. 31, 1942..	12	171,916	5.822	1,000,835.00	5.158	886,737.68
Apr. 1, 1942, to Mar. 31, 1943..	12	136,228	6.073	827,292.00	5.399	735,552.17
Apr. 1, 1943, to Mar. 31, 1944..	12	109,396	6.103	667,697.00	5.408	591,580.22
Apr. 1, 1944, to Mar. 31, 1945..	12	115,573	5.708	659,782.35	4.766	550,765.65
Apr. 1, 1945, to Mar. 31, 1946..	12	103,983	4.851	504,422.00	4.236	440,503.31
Total	....	1,482,278	$5.606	$8,310,130.35	$4.901	$7,264,336.06

Mining

Underground labour continued to decrease during the year but was on the increase during the fourth quarter. Practically no development was undertaken with the exception of a small amount of raising done to facilitate mining known ore bodies. Despite the fact that mining was confined to the larger and more accessible stopes, tonnage for the year was down by approximately 10 per cent.

The ore milled during the year was obtained from the following sources: development, 530 tons; stoping, 103,453 tons; a total of 103,983 tons.

The ore hoisted from our operating veins was estimated as to grade and tonnage as follows:—

Vein	Tons	Ounces per ton	Total ounces
No. 1	61,510	0.132	8,136
No. 2	28,923	.132	3,816.4
No. 4	7,599	.132	990.2
Sundry	5,951	.132	785.8
Total	103,983	0.132	13,728.4

About 59 per cent. of production came from the main producer, No. 1 vein, with 40 per cent. from above the 170-foot level. The grade of the ore milled was 0.132, considerably lower than our previous ore reserve estimate. This drop was due for the most part to the deterioration of grade in our large stope above the 170-foot level on the No. 1 vein. This deterioration of grade was due to an overestimation of the grade of this block of our ore reserves.

Development

Through raising and sublevel development of present ore bodies, approximately 10,000 tons of ore were added. The largest amount was above the 425-foot level on the No. 1 vein with lesser amounts being added on the No. 2 vein above the 1,050-, 1,175-, and 1,425-foot levels.

Ore Reserves

Production for the year, unfortunately, was considerably below the estimated grade of the reserves. The ore reserves are now estimated at 195,867 tons, with an average grade of 0.147 ounces. By eliminating some pillars which would not be withdrawn until mining is completed, our production reserves are estimated at 155,457 tons, with a grade of 0.144 ounces per ton.

Operating Costs

Total operating costs for the year were down somewhat due to the reduction in tonnage. However, unit costs were on the increase with over-all costs increasing 31 cents per ton. Unit cost of development showed a decrease of 15 cents per ton, mining an increase of 41 cents per ton, and milling an increase of 6 cents per ton over last year's figures. These increases were due in the most part to the decreased tonnage. The operating costs were:—

	Total	Cost per ton milled
Development	$3,307.49	$0.032
Mining	335,099.68	3.223
	$338,407.17	$3.255
Milling	159,949.54	1.538
	$498,356.71	$4.793
Administration and municipal taxes	3,911.69	.037
Total	$502,268.40	$4.830

General

Due to the shortage of labour and the disappointment in the grade of the ore treated, the year's operations resulted in an operating loss.

Man-power continued on the decline until the last quarter, at which time we were able to increase our underground staff somewhat. The total underground shifts worked were approximately the same as those in the previous year. Continued operation depends upon an increase of grade and a further increase in man-power. No lateral development in search of ore was carried on, but this will shortly become a necessity if operations are to continue.

An average force of 135 men was employed, of whom 80 were in the mine and 17 in the mill. F. J. O'Connell was manager.

Pamour Porcupine Mines, Limited

Pamour Porcupine Mines, Limited, which was incorporated in March, 1934, has an authorized capitalization of 5,000,000 shares of no par value, all of which have been issued. The officers and directors are: Jas. Y. Murdoch, president; G. H. Rainville, vice-president; J. R. Bradfield, secretary; R. G. Rudolf, treasurer; Jules R. Timmins, Leo H. Timmins, M. Kendall, J. E. Perrault, and Oliver Hall, directors. The head office is at 1600 Royal Bank Building, Toronto. The mine address is Pamour.

The company's main property consists of 1,160 acres in concessions V and VI, Whitney township, Porcupine area, district of Cochrane, and includes the former La Palme Porcupine, Three Nations, and Porcupine Grande properties. They also hold three claims at the south end of Three Nations lake in the same area.

Mining and milling operations continued throughout 1945. The No. 3 or main operating shaft on claim No. 13,783 is 2,132 feet deep and has five compartments. There is a connection with the Hallnor workings on the 400-foot level, which is used for ventilation purposes. There are two other shafts on the property, which were sunk by former operators. No. 1 shaft, 110 feet deep, on claim No. 13,793 is not connected with the other mine workings and is not used. No. 2 shaft, also on claim No. 13,793 about 1,100 feet west of No. 3 shaft, is 220 feet deep, with levels at 100 and 200 feet. It is connected to the No. 3 shaft workings on the 200-foot level and serves as an emergency exit.

Development footage during the year comprised 2,841 feet of drifting, 62 feet of crosscutting, and 978 feet of raising. The total development work to date is as follows: drifting, 78,920 feet; crosscutting, 15,885 feet; raising, 42,112 feet.

Diamond-drilling consisted of 58 holes, totalling 15,073 feet, from underground.

The following is taken from the manager's report for the twelve months ending December 31, 1945:—

Drifting was done on the 1,800-foot level east of the shaft and on the 600-foot level west to the location of an internal shaft. Some crosscutting was done for manway connections to stopes. Raising was done in stopes for stope access.

MINE PRODUCTION

Level	Tons	Ounces per ton
400-foot	1,625	0.1993
600-foot	130,883	.0966
800-foot	115,464	.1069
1,000-foot	60,283	.0840
1,200-foot	53,111	.0932
1,400-foot	55,253	.1022
Development	1,295	.1259
Total milled	417,914	0.0984

ORE RESERVES

	Tons	Ounces per ton
Broken ore	427,100	0.089
In place	590,000	.0126
Drilled off	106,000	.080
Floor pillars	40,000	.144
Total	1,163,100	0.1088

Average daily tonnage for the year was 1,145 tons, making a total of 417,914 tons at 0.0984 ounces per ton and a recovery of 92.41 per cent.

Period	Tons	Mill head assay	Gold recovered	Recovery
		ounces per ton	ounces per ton	per cent.
1st quarter	116,503	0.10097	0.0932	92.276
2nd quarter	108,602	.10069	.0931	92.443
3rd quarter	88,470	.10089	.0937	92.862
4th quarter	104,339	.09109	.0839	92.101
Total	417,914	0.09841	0.0909	92.407

An average force of 265 men was employed, of whom 138 were in the mine and 31 in the mill. C. E. Anderson is manager.

Paymaster Consolidated Mines, Limited

Paymaster Consolidated Mines, Limited, incorporated in February, 1930, has an authorized capitalization of 9,000,000 shares of $1 par value, of which 8,629,090 have been issued. The officers and directors are: E. H. Walker, president and managing director; A. S. Fuller, vice-president; E. L. O'Reilly, secretary; A. W. Hodgetts, assistant secretary-treasurer; Chas. E. Cook, H. M. Pryale, and H. D. Rothwell, directors. The head office and mine office are at South Porcupine. The executive office is at 19 Melinda Street, Toronto.

The main property, in Deloro and Tisdale townships, Porcupine area, district of Cochrane, contains approximately 748 acres and consists of the amalgamated holdings of former operating companies. The company also owns several hundred acres of land in Tisdale, Cody, and Whitney townships, all in the district of Cochrane, and holds under lease 500 acres in Leonard and Tyrrell townships, Matachewan area, district of Timiskaming.

Operations continued throughout 1945. Diamond-drilling in the calendar year consisted of 719 holes, totalling 35,755 feet, from underground. A total of 126,386 tons of ore was hoisted and 130,794 tons were milled, the mill operating at an average daily rate of 358 tons.

There are nine shafts on the main property, four of which have been used by the company for hoisting purposes. The others are used for ventilation purposes or not at all. There are also several winzes.

During 1945, the following development work was completed: drifting, 3,838 feet; crosscutting, 557 feet; raising, 1,638 feet. The total development work to December 31, 1945, is as follows: drifting, 101,884 feet; crosscutting, 51,780 feet; raising, 12,747 feet.

The following is taken from the report of the general manager for the twelve months ending June 30, 1946:—

Mining

The mine development programme consisted of the following:—

No. 5 Shaft.—On the 600- and 750-foot levels, the No. 14 vein was drifted out. On the 900-foot level, the No. 14 and No. 19 veins were drifted out. On the 1,200-foot level, some drifting was done on the No. 3 and No. 15 veins. On the 1,400-foot level, some drifting was done on the No. 10 vein. On the 1,740-foot level, the No. 3 vein was drifted out. On the 1,910-foot level, some drifting was done on the Nos. 3, 17, 18, and 24 veins. On the 2,075-foot level, some lateral development drifting was done on the Nos. 19, 23, and 24 veins. On the 2,575-foot level, some lateral development was done on the Nos. 8, 17, 20, 23, and 24 veins. Drifting is now under way on the Nos. 14 and 27 veins.

Most of the ore mined and drawn has been from stopes between the 1,050- and 2,575-foot levels.

In the No. 5-2075-1 winze, a small amount of drifting was done on the Nos. 3 and 24 veins on the 2,200-, 2,325-, and 2,400-foot levels. Station-cutting between the 3,075- and 3,575-foot levels is now in progress and is being continued down to the 4,075-foot level.

No. 6 Shaft.—A small amount of mining was carried on from No. 5 shaft on the ore lenses between the 800- and 1,050-foot levels.

No. 2 Shaft.—Pumping operations only were maintained in this section of the mine.

Ore Reserves

	Tons	Ounces per ton
Probable ore	120,001	0.228
Positive ore	350,455	.225
Broken ore	113,218	.209
Total	583,674	0.223

Milling

During the fiscal year, there were milled 135,407.5 tons of ore. The average daily milling rate was 371 tons, as against 346 tons for the previous fiscal year.

Costs

The mining cost per ton of ore broken at Nos. 5 and 6 shafts was $4.45. Nos. 2 and 3 shafts were kept pumped out. Following is an analysis of operating costs:—

	Total cost	Cost per ton milled
Diamond-drilling	$22,985.91	$0.17
Outside exploration	384.09	....
Stations	10,124.01	.07
Development	127,278.15	.94
Mining	487,360.90	3.60
Backfilling	2,756.00	.02
Ore transportation	14,149.44	.10
Crushing	15,871.02	.12
Milling	158,904.97	1.17
General expense	99,662.89	.74
Total	$939,477.38	$6.93

An average force of 219 men was employed, of whom 136 were in the mine and 29 in the mill. Charles E. Cook is general manager.

Pickle Crow Gold Mines, Limited

Pickle Crow Gold Mines, Limited, was incorporated in January, 1934, with an authorized capitalization of 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: J. E. Hammell, president; C. S. Hamilton, vice-president; G. M. Huycke, secretary-treasurer; John Bland, assistant secretary-treasurer; A. G. Hattie, director of mining; Eola Hammell, director. The head office and mine office are at Pickle Crow. The executive office is at 25 King Street West, Toronto.

The property, which is in the Pickle Crow area, Patricia portion of Kenora district, consists of 79 claims containing 3,160 acres.

Operations continued throughout 1945. The vertical No. 1 main shaft, in the Howell vein system, on claim Pa. 747, is 2,545 feet deep and has three compartments from surface to the 1,200-foot level and four compartments from that point to the bottom. The 3-compartment, vertical winze, known as No. 2 shaft, is collared at the 750-foot level about a mile northeast of the No. 1 shaft in the Cohen-McArthur section and runs to a depth of 1,516 feet from surface. The new 3-compartment vertical shaft, known as No. 3, on claim Pa. 2,062, is collared on surface about 5,000 feet northeast of No. 1 shaft and is about 1,400 feet south of No. 2 shaft (winze), which is collared on the 750-foot level. This shaft was sunk a further 1,319 feet during the year to a total depth of 1,546 feet, and new levels were established at 400, 550, 750, 850, 975, 1,100, 1,225, 1,350, and 1,475 feet.

During the year, the following development work was completed: drifting, 1,266 feet; crosscutting, 950 feet; raising, 788 feet. The total development footage to end of 1945 is as follows: drifting, 28,086 feet; crosscutting, 18,016 feet; raising, 8,197 feet.

Diamond-drilling during the year consisted of 33 holes, totalling 16,290 feet, from surface and 80 holes, totalling 16,628 feet, from underground.

The following is taken from the manager's report for the year ending December 31, 1945:—

The following is a table of the ore opened up to date on No. 2 vein. All values in this report are based on gold at $35.00 per ounce.

Ore Opened Up on No. 2 Vein

Level	Drift	Length	Width	Assay	
				Ounces	Value
		feet	inches		
750-foot	748E	130	113	0.16	$5.60
	749E	680	60	.31	10.85
Total		810	69	0.27	$9.45
850-foot	2-81E	580	55	0.50	$17.50
	2-81W	54	58	.18	6.30
Total		634	54	0.49	$17.15
975-foot	2-91E	847	66	0.65	$22.75
	2-91S.E	255	91	.54	18.90
	2-91S	25	58	.83	29.05
	2-91W	312	40	.37	12.95
	2-92E	495	56	.36	12.60
Total		1,934	64	0.53	$18.55
1,100-foot	2-111E	290	35	0.56	$19.60
	2-112E	355	49	.30	10.50
Total		645	43	0.39	$13.65
1,225-foot	2-121E	60	11	0.46	$16.10
	2-122E	300	34	.37	12.95
Total		360	30	0.37	$12.95

During the year, a total of 57,144 tons of ore was taken from the stopes. The stopes on No. 2 vein supplied 29,015 tons, the remainder coming from the Howell vein.

A total of 64,170 tons of ore was hoisted during 1945, of which 7,026 tons came from development.

Ore Reserves

At the year end the estimated ore left in the Howell vein from the surface to the 2,450-foot level was 418,295 tons of an average grade of $11.65.

On No. 2 vein, a block of ore extending from a point 75 feet above the 750-foot level down to the 1,225-foot level has now been developed, and the estimated ore for this block is 276,800 tons of an average grade of $16.95.

The mine has now a total estimated blocked ore reserve of 695,095 tons of an average grade of $13.10. Based on a normal milling rate of 480 tons per day, which was the average daily tonnage during 1941, this is sufficient to operate for 3.95 years. The above-mentioned ore reserves include only the ore blocked out by drifting and raising.

Diamond-drilling

During the year, surface diamond-drilling was of an exploratory nature. Some interesting values were obtained and favourable geological conditions, which will be further explored as opportunity permits.

Milling

The mill operated continuously throughout the year, and a summary of operations follows:—

		Tons
Waste picked		3,863
Ore ground		60,227
Total milled		64,090
Gold produced per ton milled	ounces	0.5311
Gold produced per ton ground	ounces	0.5658

	Gold		Silver	
	Troy ounces	Per cent.	Troy ounces	Per cent.
By amalgamation	16,825.674	49.374	2,090.55	44.731
By cyanidation	16,663.450	48.898	2,582.99	55.269
Total recovery	33,489.124	98.272	4,673.54	100
Gold in tailings	588.640	1.728	....	....
Total gold in ore	34,077.764	100	....	....

Supplies Used in Milling

		Per ton milled	Per ton ground
Balls	lbs.	2.32	2.46
Lime	lbs.	1.51	1.60
Cyanide	lbs.	.603	.642
Zinc	lbs.	.1584	.1680
Litharge	lbs.	.2216	.2358
Lead acetate	ounces	.1236	.1315

Operating Costs

	Total cost	Cost per ton of ore milled (64,090 tons)	Cost per ounce of gold produced (33,489 ounces)
Development	$272,191.72	$4.25	$8.13
Mining	292,343.54	4.56	8.73
Milling	97,120.72	1.52	2.90
Shipping and marketing	15,613.73	.24	.46
General mine expenditures	100,479.09	1.57	3.00
Total before depreciation	$777,748.80	$12.14	$23.22
Depreciation, etc.	96,771.15	1.51	2.89
Total	$874,519.95	$13.65	$26.11

Supplies and Equipment Purchased

Power	$45,120.39
Explosives	28,732.21
Timber and lumber	21,784.05
Wood fuel	9,327.25
Commissary supplies	174,438.72
General supplies and equipment	135,249.80
Total	$414,652.42

Wages and Salaries

Wages and salaries paid during 1945 amounted to $391,644.39.

An average force of 153 men was employed during the year, of whom 83 were in the mine and 13 in the mill. A. G. Hattie is manager.

Porcupine Peninsular Gold Mines, Limited

Porcupine Peninsular Gold Mines, Limited, was incorporated in 1921 with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,305,000 have been issued. The officers and directors are: Jas. R. Dodworth, Jr., president; Jas. Ingram, secretary-treasurer; Paul K. Dodworth, G. C. Andrew, and G. Ehrlich, directors. The head office is at 80 King Street West, Toronto. The mine mine address is Timmins.

The property, which was formerly owned by Night Hawk Peninsular Mines, Limited, consists of 18 claims, approximately 2,230 acres, in Cody and Macklem townships, Porcupine area, district of Cochrane.

A previous report[1] states that the main shaft of the mine is sunk on claim H.R. 919 to a depth of 440 feet, with levels at the 80-, 180-, 300-, and 425-foot levels. The 5th and 6th levels at 525 and 625 feet, respectively, were worked from a winze that had been sunk at a point 240 feet southeast of the main shaft on the 4th level.[2]

No mining or milling operations were carried on during 1945.

During the latter part of the year a dry-house, 20 by 40 feet, was erected, and repairs were made to the headframe, hoist-house, compressor house, and pump-house. A 200 g.p.m. Worthington centrifugal pump, a 60-gallon supply pump, a Rand steel-sharpening shop, 3 transformers, and switching equipment were added to the mining-plant equipment.

An average of 10 men was employed on general surface work during the time of operation. John Knox, Jr., is manager.

Preston East Dome Mines, Limited

Preston East Dome Mines, Limited, was incorporated in 1911 and reorganized by supplementary letters patent in 1936. The authorized capitalization is 3,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: W. H. Bouck, president; S. N. Graham, vice-president; L. I. Hall, secretary; H. Preston Coursen, J. B. Allen, J. W. Ecclestone, J. W. Hubbard, and C. L. Hershman, directors. The executive office is at 10 Adelaide Street East, Toronto. The head office and mine office are at South Porcupine.

The property consists of 7 claims, 280 acres, in Tisdale township, Porcupine area, district of Cochrane. It is adjacent to and lies south and east of the Dome mine.

Mining and milling operations continued throughout 1945. The 5-compartment, vertical No. 2 shaft on claim No. 13,151, through which operations are conducted, was sunk a further 606 feet to a total depth of 2,388 feet, with the cutting of the 14th, 15th, 16th, 17th, 18th, and 19th levels at depths of 1,673, 1,798, 1,922, 2,046, 2,171, and 2,349 feet, respectively.

Development work during the year consisted of 1,787 feet of drifting, 4,097 feet of crosscutting, and 471 feet of raising, which brings the total development work to date as follows: drifting, 44,228 feet; crosscutting, 29,415 feet; raising, 12,662 feet. Diamond-drilling during 1945 consisted of 11 holes, totalling 4,517 feet, from surface and 240 holes, totalling 50,593 feet, from underground.

[1]Ont. Dept. Mines, Vol. XXXIII, 1924, pt. 7, p. 60.
[2]Ont. Dept. Mines, Vol. XXXV, 1926, pt. 1, p. 121.

The following is taken from the report of the manager for the year ending December 31, 1945:—

Production

Mining and milling operations were carried on without interruption during the year. The average daily milling rate was 609.2 tons per day in 1945, as compared with 681.06 tons in 1944. The daily tonnage milled showed a small but steady decrease during the first nine months of 1945 and during the last quarter showed an increase. Production results for the year ending December 31, 1945, are shown below:—

Ore hoisted........tons	221,598
Dry tons milled	222,359
Dry tons milled, average per day	609.2
Average mill heads........ounces gold per ton	0.2601
Average net recovery........ounces per ton milled	0.2533
Average gold in tailings........ounces per ton	0.0068
Average recovery........per cent.	97.4
Gold produced........fine ounces	56,327.722
Silver produced........fine ounces	6,758.63

Tonnage of ore hoisted was 27,372 tons less than in 1944. The average grade of mill feed showed a slight increase from that of the previous year. Bullion production for the year showed a decrease of 1,233.46 ounces. The extraction during the year showed a slight improvement. The sorting plant was not operated during 1945.

Costs

	Cost per ton hoisted (221,598 tons)	Cost per ton milled (222,359 tons)
Development and diamond-drilling	$1.4609	$1.4559
Mining	4.0818	4.0678
Milling	.8421	.8393
Total per ton	$6.3848	$6.3630

The above is the total mine operating cost exclusive of bullion marketing, administration, taxes, and write-offs. The operating cost per ounce of gold produced was $25.12. The cost per ton milled showed an increase of $0.72 from those of the previous year.

Development Summary

The deepening of the No. 2 shaft together with the station-cutting took about half of the year, and due to the extreme shortage of experienced miners existing during that period no lateral work could be done, as the men were taken from development work to do the shaft-sinking.

On the completion of the shaft-sinking, line drives were started on all levels from the 14th to the 18th westerly towards the west porphyry and northeasterly towards the porphyry greenstone area and the Preston porphyry. The greatest progress has been made in the westerly drives on the 16th and 18th levels.

The westerly drives are for the purpose of exploring and opening up the West porphyry, where some interesting diamond-drilling results have been obtained; and the northeasterly drives are being driven to explore and develop the Preston porphyry, which to date has been the chief source of ore supply. Shaft-sinking and these drives have largely accounted for all development work done during the year, which has resulted in the use of ore reserves to maintain production. The northeasterly drives have a considerable distance to go to reach the projected positions of the favourable areas. In the upper levels of the mine a limited programme of development was continued. Several drives were extended to provide bases for diamond-drilling.

During the year a total of 608 feet of ore was developed with an average width of 10 feet and an average grade of 0.21 ounce per ton. In the Preston porphyry a total length of 256 feet of ore was developed, or 42 per cent. of the total ore developed. In the porphyry greenstone area a total length of 352 feet or 58 per cent. of the ore was developed. No ore was developed in the west porphyry during the year.

Mining

During the year, 19 per cent. of the ore milled was taken from shrinkage stopes; 34.3 per cent. of the ore was taken from cut-and-fill stopes; 31 per cent. of the ore was taken from stull stopes; and 12.9 per cent. came from square-set stopes. The balance, 2.8 per cent., came from development.

No attempt was made during the year to selectively mine the higher-grade sections. Mill heads for the year average very close to ore reserve grade.

The following table shows the sources by levels for the year 1945:—

Level	Ore trammed	Percentage of total	Cut grade by sampling
	tons		ounces
2nd	40,310	18.4	0.22
3rd	26,737	12.2	.25
4th	34,555	15.7	.21
5th	19,849	9	.19
6th	1,391	.6	.29
7th	7,458	3.4	.18
8th	15,135	6.9	.20
9th	20,944	9.5	.24
10th	26,707	12.2	.20
11th	10,742	4.9	.23
12th	9,361	4.3	.42
Development	6,414	2.9	.14
Total	219,603	100	0.22

During the year, 86,907 tons of backfill were used, including 44,855 tons of our own waste from shaft-sinking and development. This backfill was obtained at a cost of $24,916.80, which is the equivalent to $0.29 per ton of backfill used, or $0.11 per ton of ore milled.

Ore Reserves

Ore reserves as of December 31, 1945, are estimated at 486,653 tons, with a grade of 0.237 ounce per ton after allowance for dilution has been made. This included all ore sufficiently exposed for measurements down to and including the 13th level. Details of the ore reserve estimate are as follows:—

	Tons	Ounces per ton	
		Uncut	Cut
Ore in place	452,621	0.31	0.22
Broken ore in stopes	33,232	.30	.20
Broken ore in bins	800	.21	.21

The above total of ore reserves as of December 31, 1945, shows a decrease from those of the previous year of 188,837 tons. The decrease is largely accounted for by the fact that during the year a comparatively small amount of lateral development work was done.

General

During the year the staff negotiated a collective bargaining agreement with Local No. 241, Timmins Mine and Mill Workers Union. The negotiations were completed and an agreement was signed on December 7, 1945.

Welfare

The Porcupine Mines Employees' Medical Services Association continued in operation during the year and meets with general approval from the employees. One week's holidays with pay were given to all employees who had worked 300 days during the year.

An average force of 393 men was employed during the year, of whom 251 were in the mine and 24 in the mill. G. G. Campbell is manager.

Starratt Olsen Gold Mines, Limited

Starratt Olsen Gold Mines, Limited, was incorporated in June, 1945, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,700,000 have been issued. The officers and directors are: J. E. Hammell, president; C. S. Hamilton, vice-president; G. M. Huycke, secretary-treasurer; John Bland, assistant secretary-treasurer; A. G. Hattie and A. Notman, directors. The head office is at 25 King Street West, Toronto. The mine office address is Red Lake.

The property consists of 17 claims, approximately 1,004 acres, in Baird township, Red Lake area, Patricia portion of Kenora district. It adjoins the property of Madsen Red Lake Gold Mines, Limited, to the west and is connected to Red Lake by a serviceable road 8 miles in length.

The property was operated in 1938, under an option agreement, by Faulkenham Lake Gold Mines, Limited. Work ceased in the early part of 1939, and in August of that year the property was acquired by Hasaga Gold Mines, Limited, who carried out an extensive diamond-drilling programme and completed a limited amount of underground development. Work ceased in 1940. The Starratt Olsen company acquired the property in 1945. Operations began on September 16 and continued for the rest of the year.

There are two shafts on the property. The No. 1 vertical, 3-compartment shaft on claim K.R.L. 12,730 has been sunk to a depth of 330 feet, with levels at 175 and 300 feet. The No. 2 vertical, 1-compartment shaft has been sunk to a depth of 43 feet. The following table shows the development work done during 1945 and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
175-foot	786	1,488	....	174	....	....
300-foot	640	899	114	227	....	150

Diamond-drilling in 1945 consisted of 2 holes, totalling 781 feet, from surface and 56 holes, totalling 4,330 feet, from underground.

A total of 727 tons of ore was hoisted during the time of operation. The work was carried on under the direction of A. E. Pugsley, Hasaga Gold Mines, Limited, and an average of 18 persons was employed.

Sylvanite Gold Mines, Limited

Sylvanite Gold Mines, Limited, was incorporated in June, 1913, with an authorized capitalization of 3,300,000 shares of $1 par value, of which 3,299,500 have been issued. The officers and directors are: Edward L. Koons, president; Welles V. Moot, vice-president and managing director; William S. Walton, secretary; Clark L. Ingham, treasurer; Alfred H. Sharpe, Harry Yates, and Lewis R. Gulick, directors. The executive office is at Erie County Bank Building, Buffalo, N.Y. The secretary's office is at 603 Royal Bank Building, Toronto. The head office and mine office are at Kirkland Lake.

The main property consists of 5 claims and a fraction, approximately 230 acres, in Teck township, Kirkland Lake area, district of Timiskaming.

Mining and milling operations continued throughout 1945. The table below shows the number of shafts on the property and their depths at the end of the year. Nos. 2 and 4 are the main operating shafts from surface. No. 5 internal shaft, which is collared at the 3,150-foot level, was carried to a total depth of 5,605 feet from surface in 1945, and a level was cut at 5,550 feet. The workings at 3,600 feet are connected between the internal shaft and No. 2 shaft.

Shaft	Claim No.	No. of compartments	Depth from surface
			feet
No. 1	L. 2,226	2	125
No. 2	L. 2,100	3	3,642
No. 3	L. 2,227	2	118
No. 4	L. 2,101	2	1,762
No. 5 (internal)	L. 2,227	4	5,605

During the year, the following development work was completed: drifting, 4,926 feet; crosscutting, 1,090 feet; raising, 1,426 feet. Total development footage to date is as follows: drifting, 166,294 feet; crosscutting, 56,176 feet; raising, 33,322 feet

Diamond-drilling in 1945 consisted of 221 holes, totalling 12,462 feet, from underground.

The following is taken from the general manager's report for the twelve months ending December 31, 1945:—

Production

During the year, 114,227 tons were milled, producing 37,647.601 troy ounces of gold and 7,396.61 troy ounces of silver, with a value of $1,452,359.92. The mill averaged 313 tons per day, which is approximately 64 tons less per day than in the previous year. The following is a summary of production for the last five years:—

Year	Tons milled	Fine ounces gold produced	Average price per ounce gold	Total gold and silver production	Average gold recovery, troy ounces per ton
1941	197,293	67,159.788	$38.50	$2,589,635.12	0.34
1942	175,745	52,418.009	38.50	2,021,506.35	.30
1943	148,190	52,514.752	38.50	2,025,005.29	.35
1944	137,822	44,649.882	38.50	1,722,240.78	.32
1945	114,227	37,647.601	38.50	1,452,359.92	.33

The following is a summary of ore and waste broken and hoisted:—

Year	Ore broken			Waste broken			Total ore and waste broken
	In stopes	From development and backs	Total	Hoisted to surface	Used for backfill	Total	
	tons	tons	tons	tons	tons	tons	tons
1941	148,637	40,821	189,458	25,434	13,772	39,206	228,664
1942	133,724	32,733	166,497	11,686	13,788	25,474	191,971
1943	113,866	34,276	148,142	12,700	9,915	22,615	170,757
1944	94,065	29,739	123,804	13,320	10,507	23,827	147,631
1945	81,834	28,753	110,587	10,529	[1]24,573	19,682	130,269

[1]Includes 5,291 tons from surface dump, placed there prior to January 1, 1945.

Broken Ore Reserves

Broken ore reserves were 53,538 tons at the end of the period. This is 3,483 tons less than a year ago.

Development

During the year a total of 6,788 feet of drifting and subdrifting was done. No development of an exploratory nature was done, and drifting was confined to the more accessible areas of the mine.

In a total drifting advance of 4,925.5 feet, there was developed 1,082 feet of ore. The most important ore length opened up by drifting was on the 2,125-foot level, where a 275-foot length of continuous ore was developed on the incline vein system in the southeast section of the mine.

In an advance of 1,862.5 feet of subdrifting 968 feet of new ore was developed. In addition, 359 feet of the subdrifting was in ore previously estimated as existing.

Operating Costs

Operating costs were higher at $7.555. The operating costs for the two previous periods are given for comparison:—

	Total cost	Cost per ton ore milled	Cost per fine ounce gold produced
1943:			
Development and exploration[1]	$258,332.42	$1.743	$4.919
Mining	380,114.37	2.565	7.238
Milling (including tailings disposal expense)	178,972.02	1.208	3.408
General charges, including employees' group life, accident and sickness insurance, unemployment insurance, medical aid and pension plan expense, and after deducting sundry revenue	89,675.79	.605	1.708
Administration expense	69,788.13	.471	1.329
Bullion selling expense:			
Insurance, shipping, and mint refining charges	3,282.42	.022	.063
Mint handling charges	18,380.17	.124	.350
Total	$998,545.32	$6.738	$19.015
1944:			
Development and exploration[2]	$258,403.99	$1.875	$5.787
Mining	356,107.07	2.584	7.976
Milling (including tailings disposal expense)	195,787.50	1.420	4.385
General charges, including employees' group life, accident and sickness insurance, unemployment insurance, medical aid and pension plan expense, and after deducting sundry revenue	84,738.23	.615	1.898
Administration expense	72,733.64	.528	1.629
Bullion selling expense:			
Insurance, shipping, and Mint refining charges	3,018.27	.022	0.067
Mint handling charges	15,627.48	.113	.350
Total	$986,416.18	$7.157	$22.092
1945:			
Development and exploration[3]	$243,805.19	$2.135	$6.476
Mining	305,075.99	2.671	8.103
Milling (including tailings disposal expense)	150,769.92	1.320	4.005
General charges, including employees' group life, accident and sickness insurance, unemployment insurance, medical aid and pension plan expense, and after deducting sundry revenue	76,687.07	.671	2.037
Administration expense	71,022.61	.622	1.887
Bullion selling expense:			
Insurance, shipping, and Mint refining charges	2,439.99	.021	.065
Mint handling charges	13,176.65	.115	.350
Total	$862,977.42	$7.555	$22.923

[1]Including the sum of $66,492.53, or 44.87 cents per ton milled, for direct charges for work on internal shaft, covering shaft-sinking and station-cutting.
[2]Including the sum of $73,628.45, or 53.42 cents per ton milled, for direct charges for work on internal shaft, covering shaft-sinking and station-cutting.
[3]Including the sum of $32,918.87, or 28.82 cents per ton milled, for direct charges for work on internal shaft, covering shaft-sinking and station-cutting.

The main charges to operations in the fiscal year were:—

Wages and mine salaries	$504,720.00
Supplies, including water	195,188.19
Power	59,524.18
Provision for taxes on mining income	142,266.51

Capital Expenditures

For additional buildings and equipment, $13,632.06 was spent on capital account during the year; $8,750.96 of this amount was spent in the No. 5 internal shaft on various equipment, including pumps and motors, shaft cages and power, lighting and telephone lines, and equipment. A new battery Loco trammer complete with batteries is also included in the total, together with cost of additional powder-storage facilities and housing surface opening of waste pass system for backfilling at No. 2 shaft.

General Summary

Due to the labour shortage, it was again necessary to reduce our mill tonnage during 1945. This reduction averaged 64 tons daily as compared to 1944. The low point was reached in October, with an average daily tonnage milled of 277 tons. At the year end, the mill was averaging approximately 350 tons daily.

An average force of 262 men was employed during the year, of whom 169 were in the mine and 21 in the mill. K. C. Gray is general manager.

Teck-Hughes Gold Mines, Limited

Teck-Hughes Gold Mines, Limited, was incorporated in March, 1923, with an authorized capitalization of 5,000,000 shares of $1 par value, of which 4,807,144 have been issued. The officers and directors are: Albert W. Johnston, chairman of the board; D. L. H. Forbes, president and general manager; H. C. McCloskey, vice-president; C. G. Williams, secretary; K. P. Emmons, treasurer; John F. Lash and Gilbert A. La Bine, directors. The executive office is at 25 King Street West, Toronto, and the mine office is at Kirkland Lake.

The main property, which is a consolidation of the original Hughes claims, located by Sandy McIntyre, and the claims of Orr Gold Mines, Limited, is in Teck township, Kirkland Lake area, district of Timiskaming. It contains 446 acres. The company also holds 6 undeveloped claims about 2 miles to the southwest. The holdings total 618 acres.

The mine has been developed from three shafts[1] and six winzes. The following table shows the depth, inclination, and number of compartments in the various shafts and winzes:—

Shaft	Inclination	No. of compartments	Depth below surface
	degrees		feet
No. 1 shaft	90	2	520
Central shaft[2]	90	4	3,014
South shaft	90	4	3,692
Central shaft extension (below 25th level)	90	3	3,619
South shaft extension (below 30th level)	90	4	5,546
No. 1 winze (below 5th level)	90	2	1,129
10th level winze (below 10th level)	90	3	1,994
No. 2 winze (below 30th level)	60	3	4,912
No. 3 winze (below 40th level)	60	3	6,182

Mining and milling continued throughout 1945. During the year the following development work was completed: drifting, 1,774 feet; crosscutting, 2,409 feet; raising, 1,145 feet. The total development footage to December 31, 1945, is as follows: drifting, 124,219 feet; crosscutting, 42,621 feet; raising, 61,960 feet.

The following is taken from the report of the manager for the year ending December 31, 1945:—

During the year, 106,006 tons of ore from the mine were milled. The total recovery of bullion was the equivalent of 28,533.31 troy ounces of fine gold. The realized value of bullion production was $1,098,532.44, or $10.36 per ton, while operating costs amounted to $753,625.25, or $7.11 per ton, leaving an operating profit of $344,907.17, or $3.25 per ton.

Income from general investments and dividends from shares of Lamaque Gold Mines, Limited, amounted to $388,496.82. After charging the expenditure on examination and explora-

[1]Does not include the original Orr shaft, 400 feet deep, not now used.
[2]Blocked between the 16th and 18th levels.

tion of outside properties of $47,429.00 and providing $105,462.97 for taxes, net surplus for the fiscal year was $580,512.02.

An analysis of operating costs follows:—

	Total cost	Cost per ton of ore treated	Cost per ounce of gold produced
Mining and development	$451,233.60	$4.26	$15.814
Milling	140,019.34	1.32	4.907
General expense	162,372.31	1.53	5.691
Total	$753,625.25	$7.11	$26.412

Diamond-drill exploration amounted to 18,592.5 feet. Ore production from drifting and crosscutting totalled 2,651 tons. New ore found totalled 303 feet, or 17.1 per cent. of all drifting.

During the year 18.5 per cent. of the total tonnage and 18.1 per cent. of the gold production came from branch veins.

The technical estimate of "positive ore" at December 31 is as follows:—

	Tons	Gold content in troy ounces	Average grade in pennyweights per ton
Broken ore	99,042	21,999.1	4.44
Blocked ore	182,430	74,703.1	8.19
Total	281,472	96,702.2	6.87

Operations continued at approximately the same rate as in 1944 with additional development and diamond-drilling. The labour situation improved during the latter part of the year due principally to the release of employees from the armed services.

Approximately 75 per cent. of the tonnage milled came from levels 5 to 10; 22 per cent. from levels 11, 12, and 15; and 3 per cent. from levels 25 to 30.

An average force of 207 men was employed during 1945, of whom 115 were in the mine and 21 in the mill. G. G. Gilchrist is manager.

Toburn Gold Mines, Limited

Toburn Gold Mines, Limited, was incorporated in January, 1931, with an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,850,000 have been issued. The officers and directors are: H. A. Guess, president; R. F. Goodwin, vice-president; G. A. Brockington, secretary; J. C. Emison, treasurer; E. C. Corson, comptroller; A. W. Holmested and J. E. Dempsey, directors. The head office is at 1809 Royal Bank Building, Toronto, and the executive office is at 120 Broadway, New York, N.Y. The mine address is Kirkland Lake.

The property, formerly called the Tough-Oakes Burnside, consists of 10 claims, 343 acres, in Teck and Lebel townships, Kirkland Lake area, district of Timiskaming.

The main operations are carried on from the No. 3 shaft and No. 3 subshaft, both on claim L. 1,823. No. 3 shaft is 1,105 feet deep and has two compartments to a depth of 400 feet and three compartments from that point to the bottom. The 3-compartment subshaft, which is collared at the 1,090-foot level about 300 feet south of the shaft, runs to a depth of 2,498 feet from surface. Both shaft and winze are vertical. No. A inclined shaft, on claim L. 2,375 about 675 feet northeast of No. 3 shaft, has a vertical depth of 400 feet, with levels at 85, 171, 247, and 319 feet. There are connections between the two lowest levels and the 200- and 400-foot levels from No. 3 shaft. No. A shaft is used as a ventilation and escapement shaft and for the transportation of supplies. There are a number of other shallow shafts sunk by former operators, some of which are now used as manways and ore passes.

Mining and milling operations continued throughout 1945. The following development work was carried out during the year: drifting, 1,832 feet; crosscutting, 326 feet; raising, 367 feet. The total development on the property to date is as follows: drifting, 47,250 feet; crosscutting, 20,684 feet; raising, 13,047 feet.

The following is taken from the president's report to the shareholders for the year ending December 31, 1945:—

During the year 1945, nine underground diamond-drill holes plus one hole deepened, aggregating 3,091 feet, were drilled, in comparison with 20 diamond-drill holes plus four holes deepened in 1944, aggregating 4,683 feet of drilling.

Two of these holes were drilled downward to observe the behaviour of the 2,511 drift fracture zone at 400 and 800 feet vertically below the level, but results were inconclusive. One hole followed a strong strike fault, and the other was in a disturbed area at the calculated point of intersection.

Production figures for 1945, compared with 1944, are:—

	1944	1945
Tons milled	39,940	41,655
Average ounces gold per ton	0.333	0.316
Ounces fine gold produced	12,780	12,681
Percentage mill recovery	96.07	96.29

Due to shortage of labour, the ore treated in the mill was not sorted to reduce dilution, except in a very limited way; consequently, the average grade of ore in 1945 is slightly lower than the average for 1944.

Estimated ore reserves, both broken and unbroken, at December 31, 1945, were 72,600 tons, averaging 0.525 ounces gold per ton as compared with 77,600 tons averaging 0.51 ounces gold per ton at December 31, 1944. Due to dilution in actual mining, and scaling when shrinkage stopes are drawn, this tonnage may be somewhat increased with a corresponding decrease in grade. It is apparent, therefore, that 36,665 tons of new ore were found and opened up in 1945, as compared with 34,340 tons of new ore in 1944.

Earnings for the year 1945, after deducting administrative and legal expenses and taxes, but before deduction of $22,112.26 depreciation and depletion, were $45,110.64.

Continental Kirkland Mines, Limited

All mining operations remained suspended during the year 1945, with the usual shut-down expenses.

On the 2,475-foot horizon of Toburn Gold Mines, Limited, eastward development in the 2,511 drift was continued toward Continental Kirkland's boundary for 914 feet, making an aggregate of 2,356 feet to date. Depending upon the results obtained from future eastward development, a decision will be made as to the advisability of drifting into Continental Kirkland's property in the hope of locating commercial ore.

As of December 31, 1945, your company owned a total of 425,000 shares of Continental Kirkland Mines, Limited, acquired at a total cost of $82,673.25.

An average force of 121 men was employed, of whom 64 were in the mine and 7 in the mill. M. W. Hotchkin is manager.

Undersill Gold Mining Company, Limited

The Undersill Gold Mining Company, Limited, was incorporated in November, 1944, with an authorized capitalization of 1,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: F. Searls, Jr., president; R. J. Jowsey, vice-president; H. E. Dodge, secretary-treasurer; W. S. Hargraft and A. W. Burt, directors. The company is controlled by Northern Empire Mines Company, Limited. The head office is at 25 King Street West, Toronto. The mine address is Beardmore.

The property consists of 22 claims, approximately 1,032 acres, adjoining the property of Leitch Gold Mines, Limited, on the west, in Eva and Summers townships, Beardmore area, district of Thunder Bay.

Operations had been previously carried on by the former owners, the Sand River Gold Mining Company, Limited. In 1941 a contract was made with the Northern Empire Mines Company, Limited, whereby operations were carried on under their direction until the mine was closed down in August, 1942, owing to existing labour and war-time conditions.

There is a vertical, 3-compartment shaft on claim T.B. 12,944, which has been sunk to a depth of 1,486 feet. The bottom level of the mine is established at 1,450 feet.

The property was reopened in September, 1945, and dewatering of the mine continued until the end of the year, when this operation was almost completed.

An average of 15 men was employed during the period of operation. C. Caldwell is manager.

Upper Canada Mines, Limited

Upper Canada Mines, Limited, was incorporated in April, 1929. The authorized capitalization is 3,000,000 shares of $1 par value, of which 2,963,009 have been issued. The officers and directors are: R. R. Brown, president; W. H. Despard, vice-president; G. F. Summers, secretary-treasurer; T. J. Day and J. A. W. Brown, directors. The head office is at 85 Richmond Street West, Toronto. The mine address is Dobie.

The property consists of 16 claims, approximately 597 acres, in Gauthier township, Kirkland Lake area, district of Timiskaming.

Operations continued throughout 1945. The vertical, 3-compartment No. 1 shaft in the northwest corner of claim L. 6,314 has been sunk to a total depth of 1,810 feet. No. 2 vertical, 3-compartment shaft, in the northeast corner of claim L. 6,321 about 2,900 feet west of No. 1 shaft, was sunk a further 510 feet during the year to a total depth of 1,306 feet, and new levels were established at 875, 1,000, 1,125, and 1,250 feet. The two shafts are connected on the 375-foot level.

Development footage during the year is as follows: drifting, 7,790 feet; crosscutting, 816 feet; raising, 724 feet. The total development work done to the end of 1945 is as follows: drifting, 42,755 feet; crosscutting, 11,257 feet; and raising, 4,775 feet.

Diamond-drilling during the year consisted of 393 holes, totalling 35,907 feet, from underground.

The following is taken from the manager's report for the twelve months ending April 30, 1946:—

Following the completion of the No. 2 shaft to the 1,250-foot level in August, an expanded programme of lateral development was begun. This may best be described in three parts as follows: (a) The four new levels from the No. 2 shaft, 875- to 1,250-foot inclusive, were partially opened up with very encouraging results. (b) The three levels from the No. 2 shaft, 500- to 750-foot, inclusive, were extended westward, and ore was developed in an area not previously known to be productive. (c) Considerable progress was made towards reaching the No. 2 shaft location by drives from the No. 1 shaft on the 1,000- and 1,750-foot levels. Ore developments here during the fiscal year were negligible, but about June 1, 1946, lateral diamond-drilling at the face of the 1,750 M, Dr. West, 1,250 feet east of the No. 2 shaft location, intersected commercial values which, we expect, will prove of importance.

The estimates of ore developed in the following table are not necessarily final, as in many cases they are based on incomplete exploration and sampling. Also, there remain many indications of ore in lateral drilling which have not yet been investigated. The development campaign as a whole has yielded very satisfactory results and has restored the ore in reserve to a safe position. However, any exact estimate of ore reserves is impossible until vertical continuity by raising is completed.

ORE DEVELOPED FROM MAY 1, 1945, TO APRIL 30, 1946

Vein or zone	Level	Length zone exposed	Ore developed			Ore milled from lateral development		
			Length	Width	Estimated stoping grade	Tons	Grade	Value
		feet	feet	feet				
L	500-foot	700	184	5.7	$8.75	1,510	$8.12	$12,282
	625-foot	43	210	6.8	10.70	1,322	9.22	12,227
	750-foot	355	394	6.3	9.40	3,157	8.98	28,352
	875-foot	969	534.5	6.9	13.36	3,145	13.95	43,792
	1,000-foot	891	533	5.5	9.25	3,968	8.34	33,138
	1,125-foot	507	191	7	9.06	1,689	9.75	16,476
	1,250-foot	705	472.5	9.9	14.80	2,624	13.07	34,227
H	875-foot	......	......	......	......	57	4.47	255
	1,250-foot	......	......	......	......	24	3.96	95
	1,000-foot	1,090	......	......	......	......	......	......
M	1,000-foot	255	......	......	......	......	......	......
	1,250-foot	......	......	......	......	236	6.38	1,508
	1,750-foot east	688	100	5.5	7.50	759	4.60	3,489
	1,750-foot west	1,493	......	......	......	......	......	......
Total	......	7,696	2,619	6.9	$11.56	18,491	$10.05	$185,841

Of all ore sent to the mill, 21.2 per cent. came from lateral development; 34 per cent. of all ore zone explored developed ore bodies of stoping grade.

MINE PRODUCTION

Shaft	Tons	Value[1]	
		Per ton	Total
No. 1	26,490	$17.75	$471,218
No. 2	61,101	9.43	576,191
Total	87,591	$11.94	$1,047,409

[1]Gold at $35.00 an ounce.

Operating costs declined slightly, except development and exploration charges, which rose from $2.12 for 1944–45 to $2.92. Net increase of operating cost was 30 cents per ton. Cost per ounce of gold produced was $25.69 before depreciation, write-offs, and taxes, or $32.41 after including same.

Tons milled for the first six months averaged 225 per day and for the last six months, 255. Recovery of gold content was 92.73 per cent.

The small hoist and low headframe erected at the No. 2 shaft in 1941 will become obsolete after this summer, and since improved ore conditions in this area warrant the use of skips a hoist somewhat larger than in use at the No. 1 shaft has been ordered. A new 100-foot headframe with a new building to house the hoist and compressors is under construction this summer.

The two shafts were connected in June, 1946, by a drive on the 1,000-foot level, and this will lend flexibility to our operations and improve underground ventilation.

Except on the 1,750-foot level, no major development was done in the No. 1 area. Considerable subsidiary ore is being found by interlevel exploration.

An average force of 124 men was employed, of whom 79 were in the mine and 8 in the mill. R. J. Henry is manager.

Van Houten Gold Mines, Limited

Van Houten Gold Mines, Limited, was incorporated in February, 1940, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,900,000 have been issued. The company succeeded the Van Houten Gold Syndicate. The officers and directors are: E. L. Stasse, president; E. I. Adams, vice-president and managing director; Wm. B. McPherson, secretary; R. L. Dick, treasurer;

H. F. Reid, L. C. Lemieux, and Wm. A. Wachenfeld, directors. The head office is at 171 Yonge Street, Toronto. The mine address is Dyment.

The company's holdings consist of 28 claims, approximately 1,120 acres, near Moose lake, off Wabigoon lake, about 10 miles south of Wabigoon, and 5 claims, totalling 200 acres, located south of Dyment. All these claims are in the district of Kenora.

During the year no underground work was done, but the underground workings were pumped out, and the collar timbering was rebuilt. A start was made on the erection of the headframe, but this was not completed during the year.

A drill shop, 20 by 30 feet, and a garage of the same size were erected. An office, 16 by 20 feet, was built.

An average of 21 employees worked at the property during the year.

Wright-Hargreaves Mines, Limited

Wright-Hargreaves Mines, Limited, was incorporated in June, 1916, with an authorized capitalization of 5,500,000 shares of no par value, all of which have been issued. The officers and directors are: E. L. Miller, president; W. H. Wright, vice-president; P. H. Gerhard, secretary; Gerard F. Miller, treasurer; M. W. Summerhayes, managing director; Jas. Y. Murdoch, director. The head office is at Fort Erie North. The executive office is at the Liberty Bank Building, Buffalo, N.Y. The mine address is Kirkland Lake.

The main property consists of 4 claims, approximately 153 acres, in Teck township, Kirkland Lake area, district of Timiskaming. The company also has five claims, totalling 243 acres, in Morrisette township, from which sand for backfilling is obtained. Eleven claims in Teck and Lebel townships are used for slimes disposal.

The following table shows the depth of the shafts and winzes that serve the mine:—

	No. of compartments	Depth from surface at December 31, 1945
		feet
No. 1 shaft[1]	2 to 2,000 feet 3 to bottom	2,277
No. 2 shaft[2]	2	317
No. 3 shaft	3 to 1,200 feet 4 to bottom	4,089
No. 4 shaft	4	4,000
No. 5 winze (below 3,600-foot level)	3 to 3,800 feet 4 to bottom	6,404

[1]Now used for ventilation.
[2]Now used as a sand pass.

All the shafts are at the west end of claim L. 1,829, except No. 2 shaft, which is at the west end of claim L. 1,830.

Mining and milling operations continued throughout 1945. The following table shows the development work done during the year and the total footage to December 31, 1945:—

	Drifts	Crosscuts	Raises
	feet	feet	feet
Total to Dec. 31, 1944	277,266	83,977	33,818
During 1945	916	472	255
Total to Dec. 31, 1945	278,182	84,449	34,074

Diamond-drilling during the year consisted of 43 holes, totalling 15,533 feet, from surface and 242 holes, totalling 21,561 feet, from underground.

The following is taken from the report of the general manager for the fiscal year ending August 31, 1945:—

During the period, 159,710 tons of dry ore were treated in the mill, from which were recovered 81,937.919 ounces fine gold and 14,372.63 ounces fine silver. There was realized from marketing this bullion, $3,152,856.63. The average grade of ore milled was 0.528 ounces, or $20.30 per ton, with a recovery of 0.513 ounces, or $19.74 per ton, an extraction of 97.25 per cent.

Because of further loss of experienced underground men, operating conditions were the most difficult of the war years. As a direct result, further curtailment in tonnage and development was necessary.

ANALYSIS OF OPERATING COSTS

	Total cost	Cost per ton milled
Development, exploration, and pumping	$116,552.85	$0.730
Stoping	620,760.52	3.887
Transporting ore (hoisting, etc.)	175,117.48	1.096
Milling charges	300,194.82	1.880
General surface, storehouse, and miscellaneous mine buildings charges	97,978.54	.613
Stock transfer, dividend, excise stamps, annual report expense, property taxes, and fire protection	52,838.85	.331
Unemployment and employees' group life insurance, silicosis, workmen's compensation and hospitalization	66,345.63	.415
General and miscellaneous undistributed charges	53,532.71	.335
Financial and corporate expense	33,178.16	.208
Marketing bullion	6,055.43	.038
	$1,522,554.99	$9.533
Provision for taxes	475,000.00	
Royal Mint special bullion handling tax	28,678.24	3.486
Depreciation buildings and equipment	53,085.59	
Total	$2,079,318.82	$13.019

MILLING STATISTICS

September 1, 1944, to August 31, 1945

Ore milled ... tons		159,710
Average grade per ton		$20.300
Gross value	$3,242,084.37	
Loss in tailings	89,227.74	
Net value recovered		$3,152,856.63
Average tons milled per day		437.56
Per cent. of possible running time		36.5
Tons 100 per cent. running time		1,200
Solution precipitated ... tons		628,230
Solution precipitated per ton of ore ... tons		3.93
Value per ton in tailings		$0.559
Yield per ton of ore		$19.741
Per cent. recovery		97.25
Cyanide consumed per ton of ore (K.C.N.) ... pounds		0.813
Zinc consumed per ton of ore ... ounces		1.032
Zinc consumed per ton of solution ... ounces		0.262
Lime consumed per ton of ore ... pounds		4.109
Steel consumed per ton of ore, ball mills ... pounds		3.371
Steel consumed per ton of ore, tube mills ... pounds		2.504
Cost of flotation reagents consumed per ton of ore		$0.040
Average value of pregnant solution per ton		$5.03
Average h.p. load (crushing and milling)		1,450
Average h.p. per ton milled per day (crushing and milling)		3.31
Power cost per h.p. year		$36.00
Cost of crushing per ton of ore milled	$0.109	
Cost of ball-milling per ton of ore milled	.256	
Cost of tube-milling per ton of ore milled	.277	
Cost of all other milling per ton of ore milled	.834	
Total milling costs per ton of ore milled		$1.476

PRODUCTION RECORD, 1921–1945

Year	Tons milled	Value per ton	Gross value	Recovery per ton	Bullion produced
1921 (8 mos.)	36,081	$13.96	$503,302	$13.00	$468,665
1922[1]	66,181	12.49	827,447	11.52	762,752
1923	79,242	10.48	830,992	9.52	754,978
1924	84,487	14.16	1,194,217	12.89	1,088,725
1925	147,939	14.49	2,148,554	12.93	1,913,401
1926	153,392	15.66	2,400,795	14.02	2,150,844
1927	209,164	11.77	2,455,460	10.51	2,151,916
1928	256,331	8.36	2,144,002	7.20	1,845,923
1929	188,238	10.29	1,938,552	9.25	1,741,872
1930	220,430	12.20	2,687,828	11.03	2,431,896
1931[2]	266,352	12.20	3,248,496	11.37	3,027,848
1932	295,525	14.52	4,292,194	13.57	4,011,554
1933 (8 mos.)[3]	193,441	17.85	3,452,207	16.62	3,215,730
1934[4]	330,741	22.44	7,423,229	21.44	7,089,884
1935	350,196	21.76	7,619,834	21.06	7,374,158
1936	387,464	20.30	7,866,397	19.60	7,595,231
1937	429,120	18.70	8,022,580	17.98	7,714,486
1938	437,130	18.90	8,261,852	18.15	7,933,104
1939	436,250	18.59	8,108,961	17.95	7,828,494
1940	443,930	20.40	9,054,032	19.66	8,729,477
1941	438,210	20.31	8,898,772	19.57	8,576,063
1942	316,210	20.49	6,477,943	19.80	6,259,433
1943	245,130	20.57	5,040,980	19.93	4,886,358
1944	196,600	19.45	3,823,325	18.88	3,710,866
1945	159,710	20.30	3,242,084	19.74	3,152,857
Total	6,367,494	$17.58	$111,964,035	$16.71	$106,416,515

[1]Period 1922 to 1932, inclusive, calendar years.
[2]Years 1931 to 1945, inclusive, reflect increase in value of gold.
[3]In 1933, fiscal year closing changed to August 31.
[4]12 months ending fiscal year August 31, 1934.

ORE RESERVES ESTIMATE

	Tons	Ounces	Grade	Value at $38.50 per ounce
On hand August 31, 1944	1,060,835	0.49	$18.76	$19,906,299
Developed in fiscal year	89,614	.33	12.62	1,130,838
	1,150,449	0.48	$18.29	$21,037,137
Milled in fiscal year	159,710	.53	20.30	3,242,084
Ore reserves, August 31, 1945	990,739	0.47	$17.96	$17,795,053

The amount of development done was again further curtailed because of the lack of underground labour, all work of this nature being suspended the latter part of the fiscal year. There were no outstanding ore disclosures, such development being confined entirely to extension of known ore bodies and to testing out of values disclosed by diamond-drilling. No drifting was done below the 5,100-foot level.

The mill treated 159,710 tons of ore, an average of 437.6 tons per day. The average grade was 0.528 ounces, or $20.30 per ton, with tailings loss of 0.015 ounces, or $0.56 per ton, an extraction of 97.25 per cent. This compares with 97.06 per cent. for the previous year.

Due to the adoption of detachable bits in place of standard drill steel for use with mine rock-drills, changes in our drill-sharpening practice were made. The steel-sharpening shop was revamped, and the building was made smaller. Additional equipment was added with resultant more efficient sharpening practice.

Fire-proofing of the compressor plant was effected during the year by changes in the building.

An average force of 415 men was employed during the year, of whom 251 were in the mine and 21 in the mill. R. L. Healy is general manager.

Young-Davidson Mines, Limited

Young-Davidson Mines, Limited, was incorporated in April, 1926, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,584,108 have been issued. The officers and directors are: A. R. McKay, president; W. T. Davidson, vice-president; Geoffrey W. Adams, secretary-treasurer; A. C. Ross and J. R. Ferrie, directors. The head office is at 320 Bay Street, Toronto. The mine address is Matachewan.

The property, which is in Powell township, Matachewan area, district of Timiskaming, is operated under agreement by Hollinger Consolidated Gold Mines, Limited. A reference to the operation appears on page 33 of this report.

Mining operations continued throughout 1945. The mill operated from January 1 to January 29 and from April 14 to December 31. The mine is served by a vertical, 3-compartment shaft, 1,082 feet deep, called No. 1, on claim M.R. 5,372, and a vertical, 2-compartment winze, which is collared at the 463-foot level about 250 feet west of and slightly to the north of the shaft. During the year the winze was sunk an additional 28 feet to a total depth of 1,530 feet from surface. Apart from shaft-sinking, the only development work done during the year was 135 feet of crosscutting and 45 feet of raising on the third level. The following table shows the total amount of development work at December 31, 1945:—

Level	Drifts	Crosscuts	Raises
	feet	feet	feet
1st	2,290	1,055	1,271
2nd	2,969	883	2,001
3rd	1,501	849	1,841
4th	1,080	784	1,313
5th	788	575	890
6th	201	302	....

There were 206,511 tons of ore hoisted. The mill treated 206,566 tons.

An average force of 99 men was employed, of whom 50 were in the mine, 17 in the mill, and 32 on general surface work. H. North is manager.

GRAPHITE

Black Donald Graphite, Limited

Black Donald Graphite, Limited, was incorporated in October, 1942, to take over the assets of the Black Donald Graphite Company, Limited. The authorized capitalization is 200,000 shares of no par value. The issued stock, 137,505 shares, is all owned by the Frobisher Exploration Company, Limited. The officers and directors are: J. S. Dickson, president; E. V. Neelands and A. J. Anderson, vice-presidents; W. B. Malone, secretary-treasurer; Thayer Lindsley, director. The head office is at 25 King Street West, Toronto. The mine address is Calabogie.

The property consists of 300 acres in Brougham township, Renfrew county.

Mining and milling operations continued throughout 1945. A new headframe and hoist-room were built at No. 3 shaft, and a 36- by 30-inch single-drum electric hoist was installed. The shaft was dewatered and the timber reconditioned to a depth of 320 feet. Levels were established at 180 and 290 feet. The McConnell shaft, which is used only for dewatering purposes, was reconditioned to a depth of 110 feet.

Two diamond-drill holes, totalling 263 feet, were drilled from underground.

About 2,850 tons of ore was mined and milled. The rest of the mill feed, about 4,048 tons, came from the old tailings dump.

B. G. Edward was manager, employing an average force of 58 men.

GYPSUM

Canadian Gypsum Company, Limited

The Canadian Gypsum Company, Limited, was incorporated in September, 1907. It has a capitalization of 3,000 shares of $100 par value, of which 2,710 have been issued. The officers and directors are: W. L. Keady, president; J. P. Sanger and H. F. Sadler, vice-presidents; C. H. Shaver, secretary-treasurer; S. L. Avery, F. B. Gibbs, O. M. Knode, J. E. MacLeish, and Otis Wack, directors. The head office is at Windsor, N.S., and the business office is at 170 Bloor Street West, Toronto.

The company operates a gypsum mine and plant near Hagersville in Oneida township, Haldimand county. All commercial gypsum products are produced at the plant, which includes a mill and wall board and block manufacturing buildings. During 1945, some 66,397 tons of gypsum were mined and 65,274 tons milled.

An average of 40 men was employed in the mine and crushing-plant. W. E. Allen is works manager. The mine address is Hagersville.

The company also operates a quarry and lime plant at Guelph and a rock wool plant at Weston. Through a wholly owned subsidiary, Toronto Asphalt Roofing Manufacturing Company, Limited, the company operates an asphalt roofing plant at Mount Dennis.

Gypsum, Lime and Alabastine, Canada, Limited

Gypsum, Lime and Alabastine, Canada, Limited, has a capitalization of 500,000 shares of no par value, of which 440,043 have been issued. The officers and directors are: George A. Dobbie, president; J. E. McConnell and C. G. Cockshutt, vice-presidents; S. H. J. Reid, secretary; F. Andrews, comptroller and treasurer; P. P. Tyler, managing director; S. G. Dixon, W. H. Cooper, and R. A. Bryce, directors. The head office is at Paris, Ont.

The mine and mill at Caledonia, Seneca township, Haldimand county, were operated throughout 1944. L. V. Robinson was superintendent, employing an average of 32 persons in the mine and crushing-plant.

A total of 53,635 tons of gypsum was mined.

In addition to the Caledonia mine the company operated lime plants at Beachville, Hespeler, and Milton. The alabastine plant is at Paris.

IRON

Algoma Ore Properties, Limited

Algoma Ore Properties, Limited, was incorporated in February, 1936, with an authorized capitalization of 50,000 shares of no par value, all of which have been issued. The officers and directors are: Sir James Dunn, president; William Jeffrey, secretary; E. W. Shell, treasurer; W. C. Franz, J. A. McPhail, E. G. McMillan, S. V. McLeod, and J. L. Lang, directors. George W. MacLeod is general manager. The head office is at Sault Ste. Marie, Ont. The mine address is Helen Mine.

The company is a wholly owned subsidiary of the Algoma Steel Corporation, Limited, from which various iron properties in Algoma district were acquired, including the Helen mine in township 29, range 24. This property consists of 52 claims, containing approximately 1,754 acres.

The open-pit operations continued throughout the year. Production was obtained from the 1,450-foot bench in the west pit and from the 1st bench in the east pit. The construction of a sink-float was started in order to remove excess silica in the east-pit ore. A total of 261 churn-drill holes, with a length of 16,370 feet, was drilled.

A total of 787,261 short tons of ore was mined. The sintering plant operated from March 30 to December 29 and produced 566,294 short tons of sinter.

C. M. Beck is manager, employing an average force of 198 persons. Of these 45 men were in the pit, and 65 men and 14 women were at the sintering plant.

Michipicoten Iron Mines, Limited

Michipicoten Iron Mines, Limited, was incorporated in October, 1941, with an authorized capitalization of 3,000,000 shares of no par value. In 1943, the capitalization was increased to 4,000,000 shares of no par value, of which 2,185,269 have been issued. The company is controlled by Sherritt Gordon Mines, Limited, and the Frobisher Exploration Company, Limited. The two companies share equally in the cost of operations, which are under the direction of Sherritt Gordon Mines, Limited. The officers and directors are: Eldon L. Brown, president; Thayer Lindsley, vice-president; A. G. Fulton, secretary-treasurer; E. V. Neelands, W. Dunn, J. C. Rix, and H. H. Hales, directors. The head office is at 25 King Street West, Toronto. The mine address is Josephine.

The property consists of 69 claims, totalling 2,847 acres, in townships 28 and 29, range 24, and township 28, range 25, Algoma district. It includes the Josephine mine, the Ruth group of claims about 1½ miles away, and the Lucy claims, which adjoin the Ruth. The mining plant is about one mile north of the Josephine stop on the Algoma Central railway, 6 miles west of Hawk Junction.

Operations at the Josephine mine continued throughout 1945. No further sinking was done during the year on the 3-compartment, vertical shaft on the south side of Parks lake on claim Y. 452 (A.C.R. 4,263), which is now down to a total depth of 1,226 feet. The following shows the development work done during 1945 and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
265-foot	19	112	....	414	....	....
415-foot (station only)	....	14	....	247	....	....
565-foot	....	12	....	243	....	....
715-foot	51	1,997	45	445	....	....
865-foot	638	2,418	93	748	274	856
No. 4,140 sublevel	1,114	1,155	....	....	....	....
1,015-foot	186	2,986	....	2,385	1,554	2,651
1,145-foot	....	....	....	....	531	2,074
1,190-foot	....	....	....	55	....	....

Diamond-drilling during 1945 consisted of 34 holes, totalling 10,674 feet, from underground.

The following is taken from the report of Sherritt Gordon Mines, Limited, for the year ending December 31, 1945:—

Construction

All orders were placed in 1944 for the construction programme leading to production at the Josephine mine. Due to the shortage of labour and unusually long delay in the delivery of essential equipment, the plant did not turn over even on a small scale until the middle of October.

During the year the following main units with accessories were constructed: Power distribution lines were completed, the substation equipped, and new transformers were installed. The hoist was remodelled by the addition of a new, larger motor and controls, and 1-inch wire ropes were installed in place of ⅞-inch ropes. The headframe was altered to include the skip-dumping mechanism, and the mine ore and waste bins with necessary chutes were erected. The crushing-plant was built and equipped with two cone crushers and necessary screening equipment for the complete screening, washing, and picking of the ore. The crushing-plant also includes the heavy density type separator for the production of lump ore. The mill building was altered to include an ore bin and dewatering equipment for two jig concentrators and tailings. The mill building also includes a media grinding unit for the heavy density separator. A conveyer bridge over the railway tracks was erected for the shipping of concentrate and conveying of tailings to the waste dump. Facilities for stock-piling of concentrate included levelling operations, the building of conveyer galleries and the concrete collecting-hopper for stock-pile reclamation. The mill water supply pump, lines, tank, and disposal lines were installed. The Parks lake drainage pumps were changed and an additional pumping unit installed to take advantage of off-peak power. The railway spur from the Algoma Central railway and necessary yard tracks were laid. The compressor house was enlarged to include an auxiliary motor compressor unit, also an auxiliary heating unit was erected to supply the mill. A new powder-house was built, and the cap- and fuse-house moved to a new location. A power line was extended to the new townsite, and a water tank erected on the townsite. A new bunk-house (No. 4) was started, and a manager's residence was completed.

Underground

Preparation for production underground included the following: completion of the loading-pocket for hoisting ore in skips; installation of 36- by 48-inch jaw-crusher with accessory equipment; completion of ore-pass chute to jaw-crusher; underground charging-stations for electric locomotive.

Mining

Stoping operations during the latter part of the year resulted in the opening up of five stopes, all being worked between the 4,050-foot (sixth) level and the 4,140-foot sublevel. The five stopes, 6-8, 6-22, and 6-36 on the east side of the shaft section and 6-7 and 6-21 on the west side were undercut above the box-holes on sixth level. In 6-8, 6-21, and 6-36 sublevel, stoping by diamond-drill blast-holing from the 4,140-foot level was initiated. The following tonnages were broken:—

Stope	Long tons
6-7	4,644
6-8	10,316
6-21	2,777
6-22	1,471
6-36	633
Total	19,841

Ore Reserves

Diamond-drilling at third (4,500-foot) level developed an additional 176,000 tons of ore above sixth level. Mining operations reduced the ore reserve by 16,000 tons, resulting in a net gain of 160,000 tons for the year. At year end, the ore reserve is as follows:—

Calculated Ore Reserves (4,000,000 Gross Tons)

	Per cent.
Fe	52.23
SiO_2	14.95
S	2.046
P	.039
Mn	.42
As	.030
CaO	1.32
MgO	.79
Al_2O_3	1.81
Ignition loss	4.88

Diamond-drilling below sixth level west of the shaft on a horizon 550 feet below sixth level developed an additional block of probable ore of 840,000 gross tons with a grade of 47.51 per cent. Fe, 21.48 per cent. SiO_2, and 8.863 per cent. S.

By incorporating this probable ore with the main reserve gives a total ore reserve of 4,840,000 tons with a grade of 51.40 per cent. Fe, 16.09 per cent. SiO_2, and 3.235 per cent. S.

Treatment and Production

Ore hoisted (dry)	tons	18,126
Waste hoisted	tons	10,778
Ore treated	tons	16,827
Ore milled	tons	15,823
Open hearth lump produced	tons	1,004
Open hearth lump shipped	tons	914
Jig concentrate produced	tons	10,850
Jig concentrate shipped	tons	3,743
Jig concentrate stock-piled	tons	7,107
Percentage open hearth lump produced		7.38
Percentage recovery from mill feed		77.2
Ratio of concentration		1.461 to 1

Grades of Products (Dry Analysis)

	Fe	SiO_2	S
	per cent.	per cent.	per cent.
O. H. lump	58.03	8.01	0.047
Jig feed	53.00	....	....
Jig concentrate	59.63	....	....
Jig tailings	38.50	....	....
Stock-pile	59.30	9.55	.318

W. D. Mackenzie was superintendent. An average force of 133 persons was employed. Of these, 44 men were in the mine.

Steep Rock Iron Mines, Limited

Steep Rock Iron Mines, Limited, was incorporated in February, 1939. The authorized capitalization is 6,000,000 shares of $1 par value, of which 5,875,511 have been issued. The officers and directors are: C. S. Eaton, chairman of the board; D. M. Hogarth, president; M. S. Fotheringham, vice-president and general manager; N. Edmonstone, secretary-treasurer; G. E. Allen, J. G. Cross, Bethune L. Smith, John Stewart, D. H. McDougall, W. R. Van Slyke, W. H. Englebright, and W. R. Daley, directors. The head office is at 25 King Street West, Toronto. The mine address is Steep Rock Lake.

The company holds 161 claims and part ownership in 32 claims in Freeborn and Schwenger townships, district of Rainy River.

The company operated its property continuously during the year, although production of iron ore is confined to the lake-shipping months between April and November.

The ore area opened up was in the "B" ore body between sections Nos. 1 and 9, a length of some 1,700 feet. This length was cleared at the end of the year, and production was from the north and south ends of it.

One dredge was operated all year and two part of the year. Twelve to twenty monitors are operated in conjunction with the dredges. Most of the operation during the year consisted of the removal of the lake-bottom silt.

The ore is hauled from the pit to the crushing-plant, and after screening it is dropped into loading-bins over the railway siding.

During operations some 682,063 tons were mined and 565,345 tons shipped, via Duluth and Port Arthur.

An average force of 379 persons was employed during the year.

Tomahawk Iron Mines, Limited

Tomahawk Iron Mines, Limited, was incorporated in February, 1938, with an authorized capitalization of 3,500,000 shares of $1 par value, of which 2,189,318 have been issued. The officers and directors are: George M. Edwards, president and general manager; Charles F. Edwards, vice-president; W. J. Sceviour, secretary-treasurer; J. A. Smith, Gordon V. Young, and J. W. Hill, directors. The head office is at 67 Yonge Street, Toronto. The mine address is Millbridge.

The company holds 200 acres in concessions III and IV, Lake township, Hastings county.

During 1945 additional stripping was done to expose a sheared zone containing iron. Preparations were made to construct a small concentrating-plant for the production of powdered iron. A 12- by 16-foot office building was erected.

Geo. K. Edwards was manager, employing 10 men.

LIGNITE

Department of Mines

Operations at the Onakawana lignite development located on the Abitibi river 126 miles north of Cochrane, were severely hampered in 1945 through the loss by fire early in the year of the building housing the garage, machine shop, and warehouse, which resulted in extensive damage to the stock and equipment.

Under conditions prevailing at the time it was found impossible to obtain early replacement of much of the essential equipment, with the result that no pit work of consequence was accomplished during the year.

During the summer months the remaining fitting on the boiler and process plants was completed, and in November it was possible to start up the plant in a preliminary way to determine what adjustments and changes might be necessary to undertake an initial operation. In all, approximately 100 tons of lignite were treated in the autoclaves.

In replacement of the building destroyed by fire, a new garage and machine shop, 90 by 24 feet, and a combined office and warehouse building, 40 by 24 feet, were erected.

A gravel seam some 2,000 feet south of the plant was partially stripped, and sufficient gravel was obtained for the surfacing of all roads in preparation for the commencement of operations.

R. E. Sullivan was in charge of operations at the property as resident superintendent. An average crew of 15 men was employed. The address is Onakawana, via Cochrane.

MAGNESIUM

Dominion Magnesium, Limited

Dominion Magnesium, Limited, is a private company formed to develop and operate the Pidgeon process for making magnesium. The capitalization is 150,000 shares of no par value, all of which have been issued. The officers and directors are: R. J. Jowsey, president; W. E. Segsworth, vice-president; M. M. Crabtree, secretary; H. B. Clearihue, treasurer; C. C. Calvin and Thayer Lindsley, directors. The head office is at 67 Yonge Street, Toronto. The plant address is Haley.

Operations continued throughout 1945 at the company's quarry and plant about three miles from Haley, in concession V, Ross township, Renfrew county. In May, 1945, the land, plant, buildings, and equipment were purchased from the Government, which had financed the construction of the plant as a war-time project.

There were 43,203 tons of dolomite treated in the plant.

J. D. Barrington was general manager, and H. B. Megill was resident manager. An average force of 270 persons was employed. Of these, 9 men were in the quarry, 175 persons in the treatment plant, and 104 persons on general surface work.

MICA

Purdy Mica Mines, Limited

Purdy Mica Mines, Limited, was incorporated on October 30, 1942, with an authorized capitalization of 2,000,000 shares of $1 par value, all of which have been issued. The officers and directors are: M. A. Thomson, president; F. D. Lamont, secretary-treasurer; A. J. Davis, P. A. Thomson, and R. I. Ferguson, directors. The head office is at 184 Bay Street, Toronto. The mine office address is 98 Oak Street, North Bay.

The property consists of 37 claims, approximately 1,480 acres, three miles north of Eauclaire, in Mattawan township, district of Nipissing.

Operations continued from January to October, 1945. A total of 106 tons of muscovite mica was mined from open cuts and shipped to the company's processing plant at North Bay.

About 4,811 feet of exploratory diamond-drilling was done.

An average force of 15 men was employed. J. R. Norrie was manager.

Sydenham Mining Company, Limited

The Sydenham Mining Company, Limited, was incorporated in August, 1944, with an authorized capitalization of 15,000 shares of no par value, of which 200 have been issued. The officers are: James J. Egan, president; Charles D. Keller, treasurer; A. L. Egan, secretary. The head office address is Box 252, Kingston. The mine address is Sydenham.

The company carried on operations at the Lacey mine on the west half of lot 11, concession VII, Loughborough township, Frontenac county, throughout 1945. Production of mica was from the extraction of old horizontal pillars, mostly at the south end of the Lacey pit. At the end of the year the work was at a depth of 100 feet in the pit.

About 440 tons of mine-run mica were mined.

Richard Smith was mine superintendent, employing 8 men.

NEPHELINE SYENITE

American Nepheline, Limited

American Nepheline, Limited, was incorporated in January, 1945, with an authorized capitalization of 2,500,000 shares of no par value, of which 1,123,540 have been issued. The officers and directors are: Wm. G. Hubler, president; J. S. Dickson, vice-president; A. Kelso Roberts, secretary-treasurer; Thayer Lindsley, director. The head office and mine office are at Lakefield.

The new company acquired from the American Nepheline Corporation 43 claims, 2,000 acres, in Methuen township, Peterborough county. The quarry from which the nepheline syenite is taken is on lot 14, concession IX.

Operations were carried on throughout 1945. Thirteen diamond-drill holes, totalling 2,500 feet, were drilled from surface. About 63,452 tons of nepheline syenite were mined and crushed at the quarry. The product is taken in trucks to the head of Stony lake, a distance of about 3 miles, and then transported by barge to the company's mill at Lakefield, where some of it is ground. The rest is shipped to the American Nepheline Corporation's mill at Rochester, N.Y.

The driving of a tunnel, inclined at an angle of 10 degrees, was begun in the fall a short distance northeast of the quarry operations. The tunnel runs from a point on the south side of the syenite ridge. The portal is at an elevation some 200 feet below the crest of the ridge. At the end of the year the tunnel was 63 feet long.

Thirty-seven men were employed at the quarry. R. G. Kilbon was manager.

NICKEL AND COPPER

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 3,344,172 have been issued. The officers and directors are: L. K. Brindley, president; Thayer Lindsley, vice-president; R. Campbell, secretary; J. C. Rix, treasurer; J. Gordon Hardy, W. G. Malcolm, and W. S. Morlock, directors. The head office is at 304 Bay Street, Toronto. The mine address is Falconbridge.

The company operates a nickel-copper mine, concentrator, and smelter in the Sudbury district and a refinery at Kristiansand, Norway. H. J. Fraser succeeded Ernest Craig as manager of the Sudbury district operations. S. B. Steen is manager at the refinery, and Anton Gronningsater is consulting metallurgist. During 1945, an average force of 1,092 persons was employed. Of these, 425 were in the mine, 270 in the concentrator and smelter, and 388 persons on surface work.

The following is taken from the manager's report for the year ending December 31, 1945:—

Both the tonnage of ore treated and of metals produced declined substantially from the all-time peak established in 1944. During the first quarter of 1945, operations were at a level only slightly reduced from the last quarter of 1944, but during the second quarter the shortage of labour became so acute, particularly underground, that it was necessary to close the smaller of the two furnaces at the end of June, due to the shortage of hoisted ore.

Following the cessation of hostilities in Europe, receipt of favourable news concerning the company's Norwegian refinery led to diversion of part of our matte production to our refinery at Kristiansand. The first shipment left Falconbridge about the end of July, and beginning in late November the total matte production was earmarked for Kristiansand.

By the end of the year the quantity of matte *en route* to Norway reached a normal level. However, owing to uncertainties concerning world conditions, caused in part by delays in settling problems of exchange, transportation, reconversion, and reconstruction, a further curtailment of mine production was under consideration in December, 1945.

Mine Development

The chief items of underground development follow:—

	Feet
Drifting and crosscutting (including slashing)	6,355
Stope-raising (including box-holes)	4,323
Fill-pass raising	199
Ore-pass raising	218
Ventilation raises	211
Shaft-sinking (No. 1)	157
Diamond test-drilling	7,572
	cu. ft.
Station-cutting	32,444

Ore zone development consisted of advances east from No. 5 shaft on the 650-, 1,000-, and 1,200-foot levels and the continuation of development on the 2,625- and 2,800-foot levels. On the three upper levels mentioned, drives were continued easterly to the limit of commercial ore and disclosed ore of widths and grade characteristic of the eastern low-grade section of the mine.

At the lower horizons, connection between No. 1 shaft and No. 5 shaft was completed on the 2,800-foot level and the drift advanced easterly to a point 729 feet from No. 5 shaft. The 2,625-foot level was driven west from No. 5 shaft a further 634 feet to a point midway between the two shafts. After sinking of No. 1 shaft was completed, the 2,625-foot level drive was started from this area, and at the year end there remained 945 feet of driving to complete the connection. On both levels sufficient advance was made westerly to establish the continuance of the easterly rake of the western ore limit.

In the central area, the ore zone at this lower level was continuous. During the preliminary development a number of substantial, though irregular, swells of better than average grade ore were encountered. However, the picture so far disclosed is complicated by a number of structural features, the influence of which can only be properly interpreted after further development.

New stoping sections prepared for production during the year totalled 1,912 feet in length.

An advance of 157 feet completed the sinking of No. 1 shaft to the sump below the 2,800-foot level. A section of bad ground at the 2,800-foot level required reinforced concrete support. Extensions of the ore-pass system at No. 5 shaft and the fill-pass system at No. 1 shaft were begun in preparation for mining at deeper horizons. Two more concrete bulkheads were installed in the series designed to seal off No. 1 shaft from the adjacent mined-out area.

Shortage of labour and other factors seriously hampered work on the crusher station at the 2,800-foot level. However, considerable headway was made during the last few months of the year, and every effort is being made to complete the installation as rapidly as possible. The underground ventilation system was further extended during the year.

Ore Production

	Tons
Broken ore in stopes as of December 31, 1944	57,243
Ore broken in stopes, 1945	668,599
Total	725,842
Ore from stopes, 1945	651,559
Broken ore balance, December 31, 1945	74,283

With the inclusion of ore obtained from development, the tonnage of ore hoisted develop as follows:—

	Tons
Ore from stopes, 1945	651,559
Ore from development, 1945	64,337
Total ore hoisted, 1945	715,896
Ore recovered from surface dump	1,209
Total ore available to treatment plant	717,105

Ore Treatment

During the first half of the year operations in the treatment plant were progressively handicapped by a lack of adequate tonnage. By the end of June the hoisted tonnage was insufficient for a two-furnace operation. Accordingly, the small blast furnace was shut down and smelting was continued on a one-furnace basis for the balance of the year. These changes affected metallurgical recovery to some degree. The tabulation of tonnage treated and products produced develops as follows:—

	Tons
Total ore treated (made up of milling ore, 422,679 tons, 59 per cent.; smelting ore, 294,189 tons, 41 per cent.)	716,868
Matte produced	19,470.3
Nickel in matte produced	10,348.8
Copper in matte produced	5,271.4

	Nickel	Copper
	pounds	pounds
Metals recovered per ton treated	28.87	14.71
Metallurgical losses per ton treated	3.04	2.66
Total	31.91	17.37
	per cent.	per cent.
Indicated grade of ore treated	1.595	0.868
Sampled grade of ore treated	1.57	.84
Indicated grade of hoisted ore (deducting dump ore recovered and allowing for changes in above-ground storage)	1.596	.868

Construction and Capital Expenditure

The installation of a new settler for No. 1 blast furnace, together with revision of slag haulage tracks, the erection of a skull-breaker in the smelter, and replacement of the locomotive shed, which was destroyed by fire in August, comprised the construction work undertaken in the surface plants. Although the balance of the equipment required for the 2,800-foot level crusher station underground was received, this project did not reach the installation stage.

A small dam was constructed on Emery creek some distance below the plant to forestall any possibility of stream pollution from mill tailings. A new source of supply for domestic water was sought during the year, but this investigation has not yet been completed.

In July, No. 3 converter blower was seriously damaged through failure of the impeller. Parts required to return this unit to running condition have not yet been delivered.

International Nickel Company of Canada, Limited

The authorized capitalization of the International Nickel Company of Canada, Limited, consists of $27,679,900 of preferred shares of $100 and $5 par value and 15,000,000 shares of common stock of no par value.

The officers are: Robert C. Stanley, chairman of the board and president; John F. Thompson, executive vice-president; Paul D. Merica, R. L. Beattie, and Sir W. T. Griffiths, vice-presidents; Henry S. Wingate, secretary; Wm. J. Hutchinson, treasurer; F. P. Bernhard, comptroller.

The directors whose term expires in 1946 are: J. P. Bickell, Wm. Nelson Cromwell, J. S. Duncan, Sir W. T. Griffiths, Wm. J. Hutchinson, Rt. Hon. Lord McGowan, Ross H. McMaster, Rt. Hon. Lord Melchett, Paul D. Merica, Thos. Morrison, Grant B. Shipley, J. C. Traphagen, and Henry S. Wingate.

The directors whose term expires in 1947 are: R. L. Beattie, John F. Dulles, Reg. Halladay, H. R. MacMillan, Rt. Hon. Viscount Margesson of Rugby, R. S. McLaughlin, H. C. F. Mockridge, G. W. Spinney, Robert C. Stanley, Andrew V. Stout, J. F. Thompson, and Rt. Hon. Viscount Weir of Eastwood.

The executive office is at 67 Wall Street, New York, N.Y., and the general offices are at Copper Cliff. The Toronto office is at 25 King Street West, Toronto.

This company and subsidiary companies operate hydro-electric plants at High Falls, Big Eddy, Wabageshik, and Nairn Falls, Ont.; nickel-copper mines in the Sudbury district, Ont.; smelters at Copper Cliff and Coniston, Ont.; refineries at Copper Cliff and Port Colborne, Ont., Acton, England, and Clydach, Wales; rolling mills at Birmingham, England, Huntington, W.Va., and Glasgow, Scotland; a colliery at Pontardawe, Wales; and a foundry at Bayonne, N.J. The nickel deposit at Kolosjoki, Finland, which was being developed prior to November, 1939, was acquired by the Russian Government late in 1944.

The following information is extracted from the annual report of the company covering the year ending December 31, 1945:—

The cessation of hostilities in the summer of 1945, followed by the cancellation of war contracts, caused a sharp decline in deliveries of our metals and an accumulation of nickel stocks. As all of our plants were equipped for sufficient output to fulfil the maximum war-time demands of the United Nations, it became necessary to inaugurate a programme of curtailment of operations. This was commenced in August, and by the year end the production of nickel was down to about 50 per cent. of the expanded capacity.

The war years imposed an extraordinarily heavy drain on the ore reserves of the company, and the annual tonnage of ore mined greatly exceeded that of any pre-war year. The ore mined in 1943, 1944, and 1945 was 12,105,545 short tons, 12,117,567 short tons, and 10,136,350 short tons, respectively. This compares with an average yearly output of 5,321,634 short tons for the three pre-war years 1936, 1937, and 1938.

It has, nevertheless, been possible through our extensive diamond-drilling and exploration programme to make great progress in the replenishment of proven ore reserves. In spite of the tremendous tonnage of ore removed from the mines during the war years, the proven ore reserves at the end of 1945 stood at 217,373,000 short tons, containing 6,866,000 tons of nickel-copper, compared with 212,368,000 short tons at the end of 1938, containing 6,806,000 tons of nickel-copper.

The underground development in 1945 totalled 50,701 feet, compared with 66,104 in 1944. This brings the total footage of underground development to 1,136,045 at the year end.

Process improvement designed to increase efficiency of operations has been demonstrated satisfactorily in a pilot plant. Work has already been commenced on an addition to the Copper Cliff smelter to provide for this betterment.

Net profit of $25,010,938 for the year, after all charges and provisions as set forth in the financial statements, is equivalent to $1.58 per share on the common stock after provision for preferred dividends. This compares with $26,927,652 in 1944, or $1.71 per share.

Capital expenditures of $2,999,282 in 1945 compare with $4,652,127 in 1944. Expenditures of $8,000,000 are projected for 1946.

SALES

	1945	1944	1943
	pounds	pounds	pounds
Nickel in refinery products (Port Colborne, Clydach, Huntington)	146,943,593	195,003,854	217,534,068
Nickel in rolling-mill and foundry products (Birmingham, Glasgow, Huntington, Bayonne)	51,946,979	54,639,377	51,878,052
Nickel in salts and chemicals (Copper Cliff, Clydach)	2,682,415	1,096,879	1,086,554
Total sales of nickel in all forms	201,572,987	250,740,110	270,498,674
Monel[1]	41,027,515	51,609,459	52,146,477
Rolled and cast nickel[1]	17,993,206	11,140,349	9,179,194
Copper	215,723,220	264,711,925	253,977,027
	ounces	ounces	ounces
Gold (including recoveries from purchased materials)	58,179	61,838	58,331
Silver (including recoveries from purchased materials)	1,601,476	1,784,633	1,768,052
Platinum metals	381,741	303,394	376,604

[1]The nickel content of these products is included in the item "Nickel in rolling-mill and foundry products."

R. L. Beattie was general manager; R. D. Parker, general superintendent; A. E. O'Brien, superintendent of the Frood mine; C. H. Stewart, superintendent of the Frood-Stobie open pit; T. M. Gaetz, superintendent of the Creighton mine; Chas. Lively, superintendent of the Levack mine; F. F. Todd, superintendent of the Garson mine; J. B. Fyfe, superintendent of the Stobie and Murray mines; J. C. Parlee, superintendent of the Copper Cliff concentrator; D. Finlayson, superintendent of the Copper Cliff smelter; E. T. Austin, superintendent of the Coniston smelter; and R. H. Waddington, superintendent of the Copper Cliff refinery.

During 1945 an average of 3,125 persons was employed at the Copper Cliff concentrator and smelter; 647 at the Copper Cliff refinery; 400 at the Coniston smelter; 1,025 at the Creighton mine; 1,487 at the Frood mine; 569 at the Garson mine; 529 at the Levack mine; 93 at the Murray mine; 49 at the Stobie mine; 752 at the Frood-Stobie open pit; and 30 at the Lawson quarry.

Nickel Offsets, Limited

Nickel Offsets, Limited, was incorporated in April, 1938, with an authorized capitalization of 3,000,000 shares of no par value, of which 2,159,361 have been issued. The officers and directors are: D. W. Lang, president; Albert Wende, vice-president and managing director; D. R. Michener, secretary-treasurer; Ralph Hochstetter, S. H. Knox, and H. W. Wende, directors. The head office is at 372 Bay Street, Toronto. The mine address is Chelmsford.

The company holds 57 claims, 2,140 acres, in Foy and Bowell townships, district of Sudbury.

No mining operations were carried on during 1945.

Construction work consisted of a new bunk-house and combined dining-room and kitchen.

An average of 7 men was employed during the year. Walter Riddell is superintendent.

Ontario Nickel Mines, Limited

Ontario Nickel Mines, Limited, was incorporated in August, 1943, with an authorized capitalization of 4,000,000 shares of $1 par value, of which 2,259,205 have been issued. The company succeeded the Ontario Nickel Corporation, Limited. The officers and directors are: J. H. Adams, president; F. G. McPeak, vice-president; M. H. Johnson, secretary; G. E. Buchanan, D. F. MacDonald, and C. R. Belisle, directors. The head office is at 350 Bay Street, Toronto. The mine address is Sudbury.

The company's holdings include the Moose Lake property in Maclennan township, district of Sudbury, several miles north of the Falconbridge mine, and the Cuniptau mine in Strathy township, district of Nipissing. The Cuniptau mine has been idle since 1938.

The Moose Lake mine was operated by the Ontario Nickel Corporation, Limited, from January 1 to June 30, 1943, when it ceased operations. Operations were again resumed in 1945, when the property operated from May 20 to September 30.

The mine is served by a vertical, 2-compartment shaft, 265 feet deep, on claim F. 6, with a level at 250 feet and a sublevel at 115 feet. The only development work reported during the year was 40 feet of crosscutting. Diamond-drilling consisted of 17 holes, totalling 1,360 feet, from underground.

About 2,500 tons of nickel-copper ore was shipped during the year to the International Nickel Company of Canada, Limited.

W. G. Watkins was manager employing an average of 22 men.

SILVER AND COBALT

Augener Mines, Limited

Augener Mines, Limited, was incorporated in March, 1944, with an authorized capitalization of 1,000,000 shares of $1 par value. The officers and directors are: A. B. Pilliner, president and manager; C. H. Mathews, vice-president and treasurer; T. W. Friend, Jr., and Henry Oliver, Jr., directors. The head office is at Cobalt. The mine address is Cobalt.

The company leases the Nerlip property and owns the Augener property in Coleman township, Cobalt area, district of Timiskaming.

Pumping operations were carried on at the Nerlip and Augener properties from January 1 to the latter part of May, 1945. About 160 feet of diamond-drilling was done from underground. The hoist and equipment from the Augener winze were removed in May, and the workings were allowed to flood.

Three men were employed during the period of operation.

Ausic Mining and Reduction Company, Limited

The Ausic Mining and Reduction Company, Limited, was incorporated in April, 1944, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 950,000 have been issued. The officers and directors are: A. B. Pilliner, president and manager; C. H. Mathews, vice-president and treasurer; H. G. Miller, secretary; T. W. Friend, Jr., and Henry Oliver, Jr., directors. The head office and mine office are at Cobalt.

The company owns the Silver Cliff mine and mill, in Coleman township, and the Genesee property, in Bucke township, Cobalt area, district of Timiskaming.

Genesee Mine

Operations were carried on at the Genesee mine from January to June, 1945. The mine was kept pumped for the remainder of the year. About 312 feet of raising and some stoping were done on the 350-foot level. Diamond-drilling amounted to 701 feet, all from underground.

There were 2,472 tons of silver-cobalt ore mined, of which 1,940 tons were treated in the Silver Cliff mill.

An average force of 22 men was employed.

Silver Cliff Property

From January to May and from August to December, 1945, work was done from the adit level of the Silver Cliff mine. The No. 1 shaft was dewatered in May and has been kept pumped. About 195 feet of diamond-drilling was done from underground. There were 800 tons of ore mined. The mill operated from January to June, treating 833 tons of ore.

Fifteen men were employed in the adit from January to May and 5 men from August to December. There were 7 men in the mill.

Cobalt Properties, Limited

Cobalt Properties, Limited, was incorporated in August, 1931. The authorized capitalization is 25,000 shares of $1 par value, all of which have been issued. The company's operations are carried on under the control of Silanco Mining and Smelting Corporation, Limited. The officers are: Louis Cadesky, president; H. T. Leslie, vice-president; Samuel Ciglen, secretary-treasurer. The head office is at 45 Richmond Street West, Toronto. The mine address is Cobalt.

Operations at the Townsite mine, in Coleman township, Cobalt area, district of Timiskaming, were carried on from June to December, 1945. The property is held under a long-term lease from the Temiskaming and Northern Ontario Railway Commission.

A timber headframe, 44 feet high, and a 32- by 30-foot hoist-house were built at the No. 7 shaft. A double-drum Canadian Ingersoll-Rand electric hoist, with 42-inch diameter and 30-inch face, purchased from the Cross Lake Lease, was installed.

No mining or development work was done.

A. A. Hasselbring was in charge of operations. An average force of 9 men was employed.

Cross Lake Lease

The partnership composed of Lorne Umphrey, D. M. McLeod, and C. J. Donegan, of Cobalt, known as the Cross Lake Lease, operates the O'Brien mine, in Coleman township, Cobalt area, and from January 1 to September 27, 1945, operated the Miller Lake O'Brien mine in Nicol and Haultain townships, Gowganda area, district of Timiskaming. The properties were held under lease from M. J. O'Brien, Limited. The Miller Lake O'Brien mine was sold to Siscoe Gold Mines, Limited, in September. An account of the latter company's operation appears on page 96 of this report.

Miller Lake O'Brien Mine

No development work was done by the lessees in 1945. About 200 tons of ore were mined.

An average force of 11 men was employed during the period of operation. The mine address is O'Brien.

O'Brien Mine

No development work was done during 1945. A total of 250 tons of ore was mined.

An average force of 10 men was employed. Lorne Umphrey was manager. The mine address is Box 390, Cobalt.

Niki Silver-Cobalt, Limited

Niki Silver-Cobalt, Limited, was incorporated in 1942. The officers are: C. E. Duesling, president; A. M. Duesling, secretary-treasurer; S. D. Dawson, G. Finkbeiner, and W. H. Longfield, directors. The head office is at 45 Richmond Street West, Toronto. The mine address is Cobalt.

The company's holdings include the property formerly known as the White Reserve mine, in Whitson township, Maple Mountain area, district of Timiskaming.

The present company began surface operations about the middle of August, 1945. The old camp buildings were renovated, and the mining plant was reconditioned. The workings were dewatered and examined.

An average of 5 men was employed during the time of operation.

Silanco Mining and Smelting Corporation

The Silanco Mining and Smelting Corporation, Limited, was incorporated in August, 1943, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 767,599 have been issued. The officers and directors are: S. A. Morse, president; H. T. Leslie, vice-president; Geo. E. Buchanan, secretary-treasurer; Samuel Ciglen, assistant secretary-treasurer; P. H. Hershey, V. B. Rumley, W. C. Knight, and C. J. Hilliard, directors. Mining Research Corporation, Limited, is mine manager, and A. A. Hasselbring is resident engineer. The head office is at 45 Richmond Street West, Toronto. The mine address is Cobalt.

The company operated its Agaunico and Ruethel properties in Bucke township and the Temiskaming and Beaver mines in Coleman township, Cobalt area, district of Timiskaming, in 1945. The mill on the Colonial property in Coleman township was operated throughout the year treating ores from the company's properties as well as customs ores. An average force of 10 men was employed in the mill.

Agaunico and Ruethel Mines

Operations on the Agaunico and Ruethel mines were carried on throughout the year. There is no shaft on the Ruethel property. The work was done from the No. 1 shaft on the Agaunico property, which is 400 feet deep, with six levels. The development in 1945 consisted of 319 feet of drifting, 23 feet of crosscutting, and 324 feet of raising on the 200-foot level.

A total of 21,866 tons of ore was mined and treated.

An average force of 33 men was employed, of whom 6 were on surface and 27 underground.

Beaver Mine

The No. 1 shaft of the Beaver mine was used as an auxiliary shaft for the Temiskaming mine operations. The pumping for the latter mine was done through the Beaver shaft. No mining operations were conducted in the Beaver mine. Three diamond-drill holes, totalling 283 feet, were drilled from underground.

Temiskaming Mine

Operations at the Temiskaming mine were carried on throughout the year. No development work was done. Diamond-drilling amounted to 3 holes, totalling 553 feet, from surface and 3 holes, totalling 652 feet, from underground.

A total of 5,679 tons of ore was mined and milled.

An average force of 11 men was employed, of whom 8 were underground and 3 on surface.

Silco Mines, Limited

Silco Mines, Limited, was incorporated in November, 1943, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 799,712 have been issued. The officers and directors are: J. P. Michaud, president; E. E. Ott, secretary-treasurer; J. M. Carmichael, director. The head office is at 330 Bay Street, Toronto. The mine address is Box 653, Cobalt.

The company owns claims Nos. A. 23, 26, 39, 53, 56, 57, 88, 89, 91, 92, and 93 and leases claim No. A. 54 in the Gillies limit, Cobalt area, district of Timiskaming.

Operations were carried on throughout 1945. The work was done from the vertical, 2-compartment No. 1 shaft on claim A. 53. The shaft is 104 feet deep, with levels at 60 and 100 feet. During the year 180 feet of drifting was done on the 60-foot level and 630 feet of drifting on the 100-foot level. A vertical raise, 115 feet in length, was driven from the 100-foot level to surface.

A 16- by 32-foot ore bin was built.

An average force of 16 men was employed. J. G. Pollard was superintendent.

Siscoe Gold Mines, Limited

Siscoe Gold Mines, Limited, bought the Miller Lake O'Brien silver property, consisting of 14 claims, 560 acres, in Nicol and Haultain townships, Gowganda area, district of Timiskaming, in September, 1945, taking over the operation from the Cross Lake Lease partnership and continuing it until the end of the year. An account of the operations by Cross Lake Lease appears on page 94 of this report.

No development work was done and no ore was mined. Work consisted of sampling and making preparations for diamond-drilling.

R. G. Walsh was general manager, and G. D. Wagner was mine superintendent. An average of 11 men was employed for the last three months of the year. The mine address is O'Brien.

Van Tassel Silver Mining Syndicate, Limited

The Van Tassel Silver Mining Syndicate, Limited, was incorporated in March, 1945, with an authorized capitalization of 35,000 shares of $1 par value, of which 25,500 have been issued. The officers are: T. J. Johnson, president; John H. Hoffman, vice-president; P. Ackroyd, secretary-treasurer. The head office address is Box 651, New Liskeard. The mine address is Cobalt.

The syndicate owns a 25-acre claim on part of lot 5, concession IV, Coleman township, Cobalt area, district of Timiskaming, known as the Silver Bar property.

Operations were carried on from June to October, 1945. A shaft-house was erected, the dry-house was enlarged, and a new garage was built. A 7- by 9-inch Jenckes air hoist was installed.

There are several shallow shafts, sunk by former operators, on the property, the deepest of which is the 110-foot vertical, 2-compartment No. 2 shaft. The work in 1945 was done on the 105-foot level from No. 2 shaft and consisted of 70 feet of drifting, 300 feet of crosscutting, and 105 feet of raising.

A total of 100 tons of ore and 300 tons of waste was hoisted.

W. D. Taylor was foreman, employing an average force of 11 men, of whom 7 were underground, during the period of operation.

Waldag Mining Company, Limited

The Waldag Mining Company, Limited, was incorporated in June, 1944, with an authorized capitalization of 1,000,000 shares of $1 par value, of which 439,100 have been issued. The officers and directors are: T. M. Rozelle, president; L. P. Monahan, vice-president; A. J. Gravelle, secretary-treasurer; G. D. Medland, T. E. Forbear, and E. B. E. de Camps, directors. The head office is at 21 King Street East, Toronto. The mine address is Cobalt.

The Waldman mine in the Gillies limit, Cobalt area, district of Timiskaming, was kept pumped until June, 1945. No other work was done.

W. D. Taylor was in charge.

Windsor-Cobalt Silvers, Limited

Windsor-Cobalt Silvers, Limited, was incorporated in September, 1927, with an authorized capitalization of 2,000,000 shares of $1 par value, of which 1,625,000 have been issued. The officers and directors are: A. D. McArthur, president and general manager; J. A. McArthur, vice-president; A. M. Van Winckel, secretary; A. D. McIntosh, treasurer; D. C. Walmsley and F. Harrington, directors. The head office is at 9 Toronto Street, Toronto. The mine address is North Cobalt.

The lease on the Cobnor mine on lot 14, concession I, Bucke township, Cobalt area, district of Timiskaming, was continued throughout 1945. The mine was dewatered in July, and pumping was continued until November 20, when the workings were allowed to flood. No mining or development work was done.

Geo. A. Ellis was superintendent, employing 1 man.

TALC

Canada Talc, Limited

Canada Talc, Limited, has an authorized capitalization of $250,000, divided into 2,500 shares of $100 par value, all of which have been issued. The officers and directors are: E. S. James, president; Roy Taylor, vice-president, secretary-treasurer, and general manager; A. R. Cameron, director. The head office and mine office are at Madoc.

The company owns the Conley (or Connolly) and Henderson mines in Huntingdon township and a claim in Elzevir township, Hastings county. The combined holdings consist of 4 claims and total 750 acres.

Operations continued throughout 1945 at the Conley mine and were carried on intermittently at the Henderson mine.

The following table shows the depths of the shafts on the two properties:—

Shaft or winze	No. of compartments	Depth
		feet
CONLEY MINE:		
No. 1 shaft	2	431
7th level winze	2	31
No. 2 shaft (escapement way)	1	185
No. 3 shaft	2	383
HENDERSON MINE:		
No. 4 shaft	2	456

The above shafts are all vertical.

The two mines are connected by a drift 748 feet long from the 4th level of the Conley mine. A raise 21 feet high runs from the 5th level of the Henderson mine to the end of this drift.

The following table shows the development work done during 1945 and the total:—

Level	Drifts		Crosscuts		Raises	
	1945	Total	1945	Total	1945	Total
	feet	feet	feet	feet	feet	feet
CONLEY MINE						
No. 1 SHAFT:						
1st level[1]	....	310	....	....	75	....
2nd level[1]	....	345	....	....	....	180
3rd level[1]	....	1,040	....	420	....	150
4th level[2] (255 feet)	....	650	....	80	....	90
5th level[3] (300 feet)	....	625	....	90	....	130
6th level[3] (360 feet)	....	275	....	75	....	180
7th level[3] (420 feet)	....	250	....	90	....	190
7TH LEVEL WINZE:						
8th level[3] (451 feet)	....	225	....	....	....	160
No. 3 SHAFT:						
1st level[2] (270 feet)	151	2,399	....	277	....	515
2nd level (370 feet)	....	50	....	....	....	....
HENDERSON MINE						
No. 4 SHAFT:						
1st level[1]	....	455	....	110	....	180
2nd level[1]	....	485	....	130	....	220
3rd level[1]	....	575	....	90	....	245
4th level[1]	....	625	....	185	....	265
5th level[1]	....	690	....	210	....	330
6th level (372 feet)	63	733	....	275	....	485
7th level[4] (264 feet)	....	334	....	49	....	....

[1]The figures given represent the original development footages. The ore has been mined out and the workings caved.
[2]The 4th level from No. 1 shaft and the 1st level from No. 3 shaft are the same level.
[3]These levels are flooded, and the depths given are approximate.
[4]This level has been flooded since 1944.

The reconditioning of No. 3 shaft and headframe was completed, and a new Ingersoll-Rand 24- by 18-inch, divided single-drum electric hoist and a cage and skip were installed. The new mill, begun in 1944, was completed and equipped and began operation in April. The mill proper is of the Raymond type, in which the process is totally enclosed, reducing the dust in the building to a minimum. The capacity is approximately 100 tons per day, depending on the grade of the product.

A total of 14,017 tons of talc was hoisted and 12,963 tons were milled.

Eighteen men were employed.

METALLURGICAL WORKS

Algoma Steel Corporation, Limited

The Algoma Steel Corporation, Limited, has an authorized capitalization of 27,000 shares of preferred stock of $100 par value and 1,000,000 shares of common stock of no par value. At December 31, 1945, the number of preferred shares outstanding was 17,152 and the number of common shares 412,700. The officers and directors are: Sir James H. Dunn, president and chairman; William

Jeffrey, secretary; E. W. Shell, treasurer; W. C. Franz, John A. McPhail, E. G. McMillan, John W. Hobbs, Thomas Arnold, Joseph A. Simard, Leo H. Timmins, and T. A. Crerar, directors. Louis H. Derrer is acting general manager. The head office and blast furnaces are at Sault Ste. Marie, Ont.

Nos. 1 and 2 furnaces did not operate during 1945. Nos. 3 and 5 were in blast throughout the year, and No. 4 from January 15 to August 4. A total of 566,641 gross tons of iron was produced.

J. A. Murphy is blast furnace superintendent. An average force of 388 persons was employed.

Canadian Furnace, Limited

Canadian Furnace, Limited, has an authorized capitalization of 500 shares of $100 each, all of which have been issued. The officers are: Richard C. Yates, president and manager; Henry L. Caulkins, secretary; Perry G. Harrison, treasurer. The three officers are also directors. The head office and the plant are at Port Colborne.

No. 1 furnace operated for 318 days in 1945 and produced 106,684 tons of pig iron, 3,179 tons of ferro-silicon, and 3,807 tons of spiegeleisen.

An average force of 154 men was employed. D. J. Higgon was superintendent.

Canadian Industries, Limited

During 1945 the plant of Canadian Industries, Limited, located at Copper Cliff, was in continuous operation.

The three 50-ton-per-day sulphuric-acid units were operated at capacity throughout the year. These units manufacture the acid from converter gases produced at the smelter of the International Nickel Company.

An average force of 40 persons was employed. E. H. Jordan is works manager.

Deloro Smelting and Refining Company, Limited

The Deloro Smelting and Refining Company, Limited, was incorporated under Dominion charter in July, 1916. In November, 1936, it was converted into a private company by Supplementary Letters Patent. The officers and directors are: J. A. O'Brien, president and managing director; Alan Scott, vice-president; A. V. Yates, general manager and secretary-treasurer; H. A. Green, M. J. O'Brien, Jr., and G. E. Bell, directors.

The blast furnace at the company's plant at Deloro operated during the year, and refined silver and arsenic were produced.

An average force of 288 men was employed. The head office and plant address is Deloro.

International Nickel Company of Canada, Limited

The nickel refinery of the International Nickel Company of Canada, Limited, at Port Colborne, was operated continuously throughout 1945. An average force of 1,475 persons was employed. H. W. Walter is general superintendent.

Steel Company of Canada, Limited

The Steel Company of Canada, Limited, was incorporated in June, 1910. It has an authorized capitalization of 400,000 seven per cent. cumulative preference shares of $25 par value, of which 259,852 have been issued, and 600,000 common shares of no par value, of which 360,000 have been issued. The officers and directors are: H. G. Hilton, president; H. S. Alexander, secretary; G. B. Elwin, treasurer; H. H. Champ, G. W. Spinney, G. H. Duggan, H. M. Jaquays, S. C. Mewburn, Glyn Osler, Sir Thomas White, Hon. C. A. Dunning, R. H. McMaster, and L. L. Lang, directors. The address is Hamilton.

"A," "B," and "C" furnaces each operated for 364 days in 1945, producing a total of 599,152 tons of pig iron.

R. A. Gillies is works manager. An average force of 266 men was employed

LIST OF MINES, QUARRIES, AND WORKS OPERATING IN 1945[1]

METALLICS

Company	Mine	Manager	Mine Address	Head Office Address
		GOLD		
Armistice Gold Mines, Ltd.	Armistice	P. G. Scott	Virginiatown	100 Adelaide St. W., Toronto.
*Aunor Gold Mines, Ltd.	Aunor	Stanley S. Saxton	Timmins	1600 Royal Bank Bldg., Toronto.
*Berens River Mines, Ltd.	Berens River	C. W. MacDonald	Favourable Lake	Favourable Lake.
*Bidgood Kirkland Gold Mines, Ltd.	Bidgood	F. L. Smith	Kirkland Lake	Kirkland Lake.
*Bonetal Gold Mines, Ltd. (under direction of Broulan Porcupine Mines, Ltd.).	Bonetal	Walter F. Brown	Pamour	372 Bay St., Toronto.
*Broulan Porcupine Mines, Ltd.[2]	Broulan	Walter F. Brown	Pamour	372 Bay St., Toronto.
*Buffalo Ankerite Gold Mines, Ltd.	Buffalo Ankerite	R. P. Kinkel	South Porcupine	South Porcupine.
Cathroy Larder Mines, Ltd.	Cathroy	K. S. Oliver	Boston Creek	171 Yonge St., Toronto.
*Central Patricia Gold Mines, Ltd.	Central Patricia	R. E. Barrett	Central Patricia	Central Patricia.
*Chesterville Larder Lake Gold Mining Co., Ltd.	Chesterville	L. T. Postle	Kearns	330 Bay St., Toronto.
*Cochenour Willans Gold Mines, Ltd.	Cochenour Willans	W. P. Mackle	McKenzie Island	801 Dominion Bank Bldg., Toronto.
*Coniaurum Mines, Ltd.	Coniaurum	John Redington	Schumacher	25 King St. W., Toronto.
†Continental Kirkland Mines, Ltd. (under agreement with Toburn Gold Mines, Ltd.)	Continental Kirkland			Kirkland Lake.
Crowshore Patricia Gold Mines, Ltd.	Crowshore	C. D. Salkeld	Pickle Crow	171 Yonge St., Toronto.
*Delnite Mines, Ltd. (under control of Sylvanite Gold Mines, Ltd.).	Delnite	John Beattie	Timmins	Timmins.
*Dome Mines, Ltd.	Dome	Robert E. Dye	South Porcupine	36 Toronto St., Toronto.
Golden Gate Mining Co., Ltd.	Golden Gate	S. A. Pain	Swastika	371 Bay St., Toronto.
Goldhawk Porcupine Mines, Ltd.	Goldhawk	E. B. Gillanders	South Porcupine	67 Yonge St., Toronto.
*Hallnor Mines, Ltd.	Hallnor	A. L. Sharp	Pamour	Pamour.
*Hard Rock Gold Mines, Ltd.	Hard Rock	R. G. McKelvey	Geraldton	Geraldton.
*Hasaga Gold Mines, Ltd.	Hasaga	A. E. Pugsley	Box 320, Red Lake	Red Lake.
*Hollinger Consolidated Gold Mines, Ltd.[3]	*Hollinger	E. L. Longmore	Timmins	Timmins.
	*Ross	J. J. Caty	Holtyre	
Hoyle Mining Co., Ltd.	Hoyle	G. H. Mustard	Pamour	Haileybury.
Jason Mines, Ltd.	Jason	H. R. Fowlie	Casummit Lake	67 Yonge St., Toronto.
†Jerome Gold Mines, Ltd.	Jerome	L. H. Foran	Jerome	350 Bay St., Toronto.

[1] This list does not cover prospects on which only exploration work has been done. Companies whose mines produced in 1945 are marked with an asterisk (*): those at whose mines operations had been suspended at the end of 1945 are marked with a dagger (†).
[2] See also Bonetal Gold Mines, Ltd.
[3] See also Young-Davidson Mines, Ltd.

GOLD—*Continued*

Company	Mine	Manager	Mine Address	Head Office Address
*Kerr-Addison Gold Mines, Ltd.	Kerr-Addison	W. S. Row	Virginiatown	80 King St. W., Toronto.
*Kirkland Lake Gold Mining Co., Ltd.	Kirkland Lake Gold	G. C. Dunn	Chaput Hughes	Chaput Hughes.
*Lake Shore Mines, Ltd.	Lake Shore	A. L. Blomfield	Kirkland Lake	Kirkland Lake.
*Leitch Gold Mines, Ltd.	Leitch	G. A. McKay	Beardmore	Beardmore.
*Little Long Lac Gold Mines, Ltd.	Little Long Lac	A. E. Cave	Geraldton	25 King St. W., Toronto.
*Macassa Mines, Ltd.	Macassa	G. A. Howes	Kirkland Lake	85 Richmond St. W., Toronto.
*McIntyre Porcupine Mines, Ltd.	McIntyre Porcupine	R. J. Ennis	Schumacher	Schumacher.
*McKenzie Red Lake Gold Mines, Ltd.	McKenzie Red Lake	J. L. Ramsell	McKenzie Island	19 Richmond St. W., Toronto.
*MacLeod-Cockshutt Gold Mines, Ltd.	MacLeod-Cockshutt	J. M. Kilpatrick	Geraldton	357 Bay St., Toronto.
*Madsen Red Lake Gold Mines, Ltd.	Madsen Red Lake	E. G. Crayston	Madsen	67 Yonge St., Toronto.
Magnet Consolidated Mines, Ltd.	Magnet	A. Kendall	Geraldton	515 Jarvis St., Toronto.
*Matachewan Consolidated Mines, Ltd.	Matachewan Consolidated	H. S. McGowan	Matachewan	25 King St. W., Toronto.
*Omega Gold Mines, Ltd.	Omega	F. J. O'Connell	Larder Lake	Larder Lake.
*Pamour Porcupine Mines, Ltd.	Pamour	C. E. Anderson	Pamour	1600 Royal Bank Bldg., Toronto.
*Paymaster Consolidated Mines, Ltd.	Paymaster Consolidated	Chas. E. Cook	South Porcupine	South Porcupine.
*Pickle Crow Gold Mines, Ltd.	Pickle Crow	A. G. Hattie	Pickle Crow	Pickle Crow.
Porcupine Peninsular Gold Mines, Ltd.	Porcupine Peninsular	John Knox, Jr.	Timmins	80 King St. W., Toronto.
*Preston East Dome Mines, Ltd.	Preston East Dome	G. G. Campbell	South Porcupine	South Porcupine.
Starratt Olsen Gold Mines, Ltd.	Starratt Olsen	A. E. Pugsley	Red Lake	25 King St. W., Toronto.
*Sylvanite Gold Mines, Ltd[1]	Sylvanite	K. C. Gray	Kirkland Lake	Kirkland Lake.
*Teck-Hughes Gold Mines, Ltd.	Teck-Hughes	G. G. Gilchrist	Kirkland Lake	25 King St. W., Toronto.
*Toburn Gold Mines, Ltd.[2]	Toburn	M. W. Hotchkin	Kirkland Lake	1809 Royal Bank Bldg., Toronto.
Undersill Gold Mining Co., Ltd. (under control of Northern Empire Mines Co., Ltd.)	Undersill	C. Caldwell	Beardmore	25 King St. W., Toronto.
*Upper Canada Mines, Ltd.	Upper Canada	R. J. Henry	Dobie	85 Richmond St. W., Toronto.
Van Houten Gold Mines, Ltd.	Van Houten	E. I. Adams	Dyment	171 Yonge St., Toronto.
*Wright-Hargreaves Mines, Ltd.	Wright-Hargreaves	R. L. Healy	Kirkland Lake	Fort Erie North.
*Young-Davidson Mines, Ltd. (under agreement with Hollinger Consol. Gold Mines)	Young-Davidson	H. North	Matachewan	320 Bay St., Toronto.

[1]See also Delnite Mines, Ltd.
[2]See also Continental Kirkland Mines, Ltd.

IRON

Company	Mine	Manager	Mine Address	Head Office Address
*Algoma Ore Properties, Ltd.	Helen	C. M. Beck	Helen Mine	Sault Ste. Marie, Ont.
*Michipicoten Iron Mines, Ltd. (under control of Sherritt Gordon Mines, Ltd., and Frobisher Exploration Co., Ltd.).	Josephine	W. D. Mackenzie	Josephine, Algoma Central Railway.	25 King St. W., Toronto.

*Steep Rock Iron Mines, Ltd.	Steep Rock	M. S. Fotheringham.	Steep Rock Lake	25 King St. W., Toronto.
Tomahawk Iron Mines, Ltd.	Tomahawk	Geo. K. Edwards	Millbridge	67 Yonge St., Toronto.
		MAGNESIUM		
*Dominion Magnesium, Ltd.	Dominion Magnesium	J. D. Barrington	Haley	67 Yonge St., Toronto.
		NICKEL AND COPPER		
*Falconbridge Nickel Mines, Ltd.	Falconbridge	H. J. Fraser	Falconbridge	304 Bay St., Toronto.
*International Nickel Co. of Can., Ltd.	*Creighton	T. M. Gaetz	Creighton	25 King St. W., Toronto.
	*Frood	A. E. O'Brien	Frood	
	*Frood-Stobie open pit	C. H. Stewart	Frood	
	*Garson	F. F. Todd	Garson	
	*Levack	Chas. Lively	Levack	
	*Murray	J. B. Fyfe	Murray Mine	
	*Stobie	J. B. Fyfe	Stobie	
Nickel Offsets, Ltd.	Nickel Offsets	Walter Riddell	Chelmsford	372 Bay St., Toronto.
*Ontario Nickel Mines, Ltd.	Moose Lake	W. G. Watkins	Sudbury	350 Bay St., Toronto.
		SILVER AND COBALT		
*Augener Mines, Ltd.	Augener	A. B. Pilliner	Cobalt	Cobalt.
	Nerlip (under lease)			
*Ausic Mining and Reduction Co., Ltd.	Genesee	A. B. Pilliner	Cobalt	Cobalt.
	Silver Cliff			
Cobalt Properties, Ltd. (under control of Silanco Mg. and Smelting Corp., Ltd.).	Townsite	A. A. Hasselbring	Cobalt	45 Richmond St. W., Toronto.
*Cross Lake Lease (under lease)	Miller Lake O'Brien	......	O'Brien.	
	O'Brien	Lorne Umphrey	Cobalt.	
Niki Silver-Cobalt, Ltd.	White Reserve	......	Cobalt	45 Richmond St. W., Toronto.
*Silanco Mining and Smelting Corp., Ltd.[1]	*Agaunico and Ruethel	Mining Research Corp., Ltd.	Cobalt	45 Richmond St. W., Toronto.
	Beaver			
	*Temiskaming			
*Silco Mines, Ltd.	Gillies limit	J. G. Pollard	Cobalt	330 Bay St., Toronto.
Siscoe Gold Mines, Ltd.	Siscoe Miller Lake	R. G. Walsh	O'Brien	Siscoe, Que.
*Van Tassel Silver Mining Syndicate, Ltd.	Silver Bar	W. D. Taylor	Cobalt	New Liskeard.
Waldag Mining Co., Ltd.	Waldman	W. D. Taylor	Cobalt	21 King St. E., Toronto.
Windsor-Cobalt Silvers, Ltd. (under lease)	Cobnor	Geo. A. Ellis	North Cobalt	9 Toronto St., Toronto.

[1]See also Cobalt Properties, Ltd.

METALLURGICAL WORKS

Operator	Works	Manager	Address
*Algoma Steel Corporation, Ltd.	Iron blast furnace	J. A. Murphy	Sault Ste. Marie, Ont.
*Canadian Furnace, Ltd.	Iron blast furnace	D. J. Higgon	Port Colborne.
*Canadian Industries, Limited	Acid and chemical plant	E. H. Jordan	Copper Cliff.
*Deloro Smelting and Refining Co., Ltd.	Silver-cobalt refinery	A. V. Yates	Deloro.
*Falconbridge Nickel Mines, Ltd.	Nickel-copper smelter	H. J. Fraser	Falconbridge.
*International Nickel Co. of Can., Ltd.	Nickel-copper smelter	D. Finlayson	Copper Cliff.
	Nickel-copper smelter	E. T. Austin	Coniston.
	Nickel refinery	H. W. Walter	Port Colborne.
	Electrolytic copper refinery	R. H. Waddington	Copper Cliff.
*Steel Co. of Canada, Ltd.	Iron blast furnace	R. A. Gillies	Hamilton.

NON-METALLICS

Operator	Location	Manager	Address
APATITE			
†Ontario Phosphate Industries, Ltd.	McLaren property, Bedford tp., Frontenac co.	Wm. L. Shelest	Box 220, Westport.
ASBESTOS			
Carswell, L. M.	Lot 22, con. IV, Blithfield tp., Renfrew co.	L. M. Carswell	Renfrew.
BARITE			
†Woodhall Mines, Ltd.	Southern part of Langmuir tp., Night Hawk Lake area, Timiskaming dist.	B. R. Shortt	South Porcupine.
CORUNDUM			
*Craigmont Corundum Project (under supervision of Dept. of Reconstruction).	Craigmont mine, lots 4 and 5, con. XVIII, Raglan tp., Renfrew co.	A. G. Roach	Craigmont.

FELDSPAR

*Bancroft Feldspar Mines, Ltd.	Lot 6, con. XII, Monteagle tp., Hastings co.	A. Shore	Bancroft.
*Bathurst Feldspar Mines, Ltd.	Bathurst property, Bathurst tp., Lanark co.	J. Bowes	Perth.
*Canspar Mines, Ltd.	N. ½ lot 17, con. VIII, Dickens tp., Nipissing dist.	J. G. Pierdon	Madawaska.
*Conger Feldspar Mining Co., Ltd.	Parts lots 6, 7, and 8, con. X, Conger tp., Parry Sound dist.	T. W. Page	Box 541, Parry Sound.

FLUORSPAR

*Bassett Fluorspar Mining Syndicate, Ltd.	George Lee property, lot 2, con. III, Madoc tp., Hastings co.	R. H. Binch	Madoc.
Fluoroc Mines, Ltd.	Johnson property, W. ½ lot 14, con. XI, Huntingdon tp., Hastings co.	W. Badgley	Madoc.
*Millwood Fluorspar Mines, Ltd.	Bailey property, lot 1, con. IV, Madoc tp., Hastings co.	John G. Harris	Madoc.
*Reliance Fluorspar Mining Syndicate, Ltd.	Rogers mine, lot 10, con. XIV, Huntingdon tp., Hastings co.	W. J. Symon	Madoc.
*Stoklosar, Charles A.	Blakely mine, E. ½ lot 10, con. XII, Huntingdon tp., Hastings co.	Chas. A. Stoklosar	Madoc.
Tops Mining Syndicate, Ltd.	N. pt. lot 13, con. XXII, Cardiff tp., Haliburton co.	Wm. E. Clark	Harcourt.

GRAPHITE

*Black Donald Graphite, Ltd. (under control of Frobisher Exploration Co., Ltd.).	Black Donald mine, Brougham tp., Renfrew co.	B. G. Edward	Calabogie.

GYPSUM

*Canadian Gypsum Co., Ltd.	Canadian Gypsum mine, Oneida tp., Haldimand co.	W. E. Allen	Hagersville.
*Gypsum, Lime and Alabastine, Ltd.	Caledonia mine, Seneca tp., Haldimand co.	L. V. Robinson	Caledonia.

LIGNITE

Department of Mines	Onakawana, near Abitibi river	R. E. Sullivan	Onakawana, via Cochrane.

Operator	Location	Manager	Address
MICA			
*Purdy Mica Mines, Ltd.	Mattawan tp., Nipissing dist.	J. R. Norrie	98 Oak St., North Bay.
*Sydenham Mining Co., Ltd.	Lacey mine, W. ½ lot 11, con. VII, Loughborough tp., Frontenac co.	R. Smith	Sydenham.
NEPHELINE SYENITE			
*American Nepheline, Ltd.	Lot 14, con. IX, Methuen tp., Peterborough co.	R. G. Kilbon	Lakefield.
TALC			
*Canada Talc, Ltd.	Conley Henderson	Roy Taylor	Madoc.

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NOTE.—All places referred to are in Ontario, unless otherwise designated.

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. LESLIE M. FROST, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FIFTY-FIFTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

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1946

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NATURAL GAS IN 1945

By R. B. Harkness

General

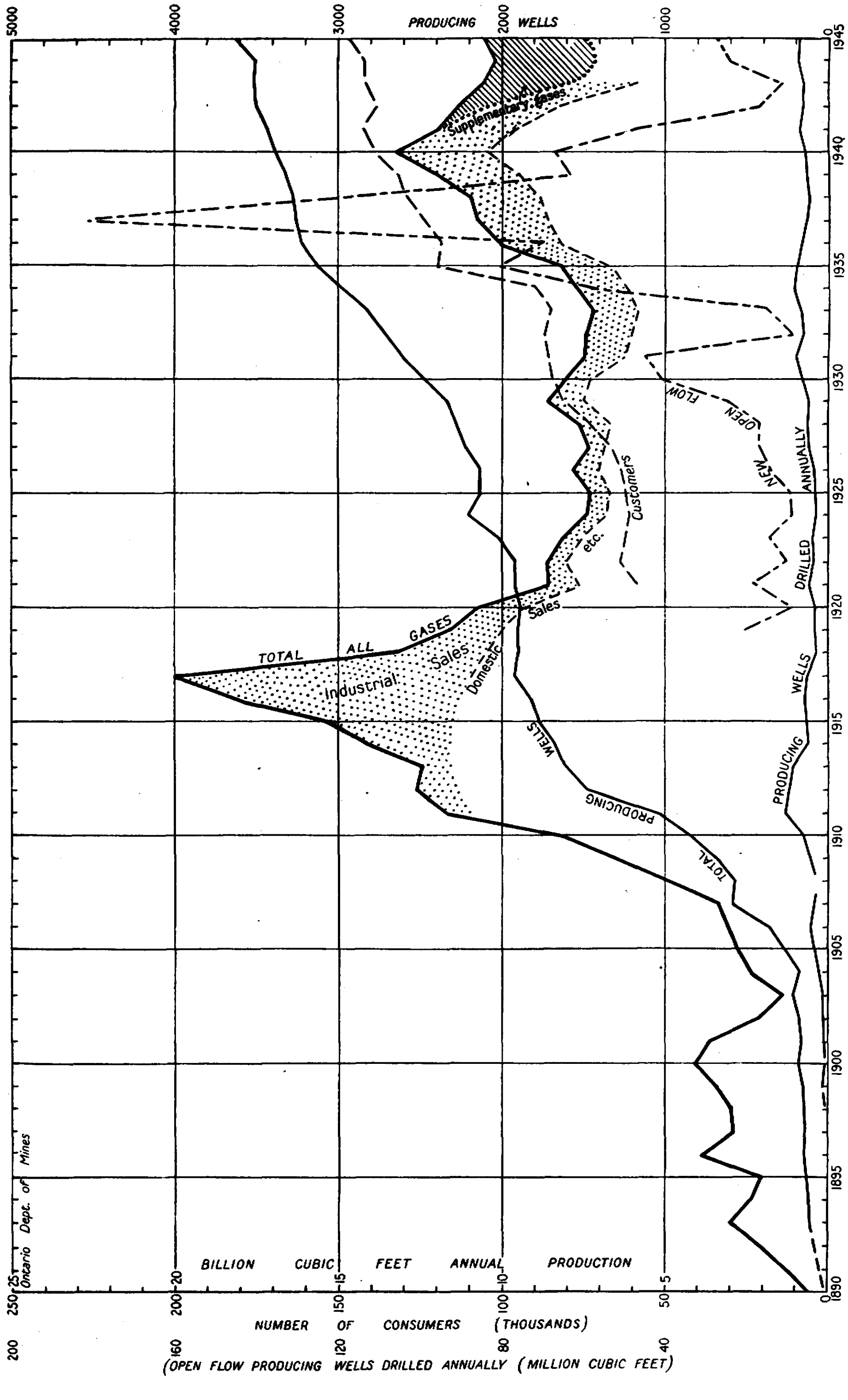
The production of natural gas in 1945 was 7,199,970 M cubic feet, which is an increase of 17,461 M cubic feet over the production of 1944, the lowest since 1909. This increase although very slight is most encouraging and is a very welcome change from the declining production of fields so evident during the war years. The increase is too small to attribute to any discovery or improvement in the industry. The Brownsville and Malahide are dead fields and will shortly be mentioned with the Leamington gas field as periods in the history of the natural gas industry. The gas in these fields has been withdrawn and has been replaced by salt water. A few wells will continue to produce some gas so long as the salt water is being pumped from them. The only natural gas fields that can be said to be in a stage of development or to show an increase in production are in Zone township, Kent county, and in Townsend township, Norfolk county. The remainder of the fields may show an occasional increase, but they have long since passed their peak of production. All this is shown in Table II.

The demand for gas service from present distribution plants is still on the increase, and the deficiency of natural gas is made up by adding gases of various kinds. More than one-third of all gas sold is a mixture of these gases, and in the winter months only the consumers in the gas fields and adjacent areas receive unmixed natural gas.

The number of domestic consumers has again increased, as has the quantity used by each consumer. The average retail price has advanced slightly, as shown in Table III. The increase in the number of consumers and the quantity consumed in the face of a diminishing natural gas supply causes great concern to those who are responsible for maintaining an adequate service to the public. The public have been appealed to by advertising in the press and by radio broadcast to cease using gas for house-heating, but the response has been anything but satisfactory. Furnace burners were removed in 1941, but various other portable room heaters are being used to supplement the coal furnace in both mild and extreme weather. Reports and records show that this results in peak demands in nearly every winter month. Information from various sources points out the inferior quality of furnace and blower coal as the main reason for this house-heating demand, but a shortage of "furnace men" is no doubt another reason.

The number of producing wells drilled shows a decrease of 36 in 1945, but the open flow of producing wells drilled shows a very welcome increase of 2,335 M cubic feet. This is the third year of increase, but unfortunately this does not nearly equal the loss in open flow of old wells.

The total leakage on all lines shows a slight increase over last year. This is a serious matter, and much investigation and work must be done to bring the leakage of gas in line with good practice. It is to be noted that there are again errors in measurement because gains are recorded. Plans for 1946 include a serious study of this problem.



Graph of the Natural Gas Industry in Ontario for the Years 1890 to 1945.

TABLE I—SUMMARY OF NATURAL GAS DISTRIBUTION, 1941–1945

	1941	[1]1942	[2]1943	[3]1944	[4]1945
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Total distribution to customers	11,343,255	10,624,148	9,519,186	9,355,852	9,694,776
Used by companies for all purposes	85,992	163,239	276,993	282,330	303,321
Used by private well-owners	74,000	74,000	74,336	39,253	69,799
Leakage in transmission lines	226,230	277,680	218,763	272,006	303,728
Leakage in distribution plants	281,361	209,470	436,729	253,650	244,787
Leakage in rural lines	17,016	17,798	22,012	21,739	27,229
Total amount distributed	12,027,854	11,366,335	10,548,019	10,224,830	10,643,640

[1]889,565 M cu. ft. of manufactured and other gas is included in these figures.
[2]2,633,611 M cu. ft. of manufactured and other gas is included in these figures.
[3]3,142,321 M cu. ft. of manufactured and other gas is included in these figures.
[4]3,443,670 M cu. ft. of manufactured and other gas is included in these figures.

TABLE II—NATURAL GAS PRODUCTION BY FIELDS, 1945

County	Field	Quantity
		M cu. ft.
Brant	Onondaga	72,666
Elgin	Bayham	23,888
	Malahide	25,445
Essex	Kingsville	27,416
Haldimand	Haldimand	1,885,760
Kent	Chatham and Camden gore	297,978
	Dover	162,286
	Tilbury	2,125,982
	Zone	665,568
Lambton	Dawn and Oil Springs	421,320
Lincoln	Lincoln	70,614
Norfolk	Norfolk	463,243
Oxford	Brownsville	30,026
Welland	Welland	331,955
Wentworth	Wentworth	60,295
Wells in surface drift	Harwich and Howard	14,000
Private wells		60,000
Total produced		7,199,970
Retail value		$4,837,585
		M cu. ft.
Gas distributed other than natural gas:		
Mixed still gas		2,266,954
Coke oven gas		467,209
Imported mixed gas		347,097
Oil gas		192,307
Propane gas		170,103
Total of other gases		3,443,670
Total of all gases distributed		10,643,640

Although drilling in the year 1945 showed in general a slight improvement over 1944, the available reserve of natural gas is decreasing each year. This in itself is serious, but the increase in the quantity that each consumer uses creates an alarming situation. The Union Gas Company of Canada, Limited, which supplies the London, Sarnia, Chatham, and Windsor areas, has entered into an agreement with the Panhandle and Eastern Gas Company to import five and a half billion cubic feet of gas per year from this company's pipe line at Detroit. This agreement now awaits the approval of the Federal Power Commission of the United States, and if this approval is received that company will have a plentiful supply of gas for many years to come. The gas supply to St. Thomas and eastward through Woodstock, Paris, Brantford, and Galt is now being maintained from November to May by introducing propane and air into the transmission lines; on mild days this is further mixed with a little surplus natural gas diverted from the Haldimand field via Hamilton. Propane costs twice as much as natural gas, and as a permanent supply it cannot be maintained.

Supplementary Gas Supplies

At the bottom of Table II will be seen the kind and quantity of gases used to supplement our failing natural gas supply. A comparison of this table with the one published last year shows an increase in every item with the exception of oil

Lowering the last "shell" of nitro-glycerine into a gas well.

gas. Coke oven gas, oil gas, and propane gas are used only in times of peak demand, whereas the mixed gas imported from Buffalo is the main source of supply to the consumers along the Niagara river. The mixed still gas is reformed still gas purchased from Imperial Oil Refineries, Limited, at Sarnia.[1] The experiment of pumping the reformed still gas underground in the exhausted Dawn gas field continues to be a success, and plans are under way to enlarge the operation.

The experience of last winter when the snow storm in December, 1944, tied up car movements by rail for many days very nearly resulted in a complete shut-down of the propane plant at Brantford. There was storage for 200,000 gallons of propane at Brantford, but this is a supply for only five days' peak demand or eight days' normal demand. It was imperative that this storage be increased, and during the summer of 1945 another storage tank of 200,000 gallons capacity was erected in time to be filled before the winter demand. This plant, built only to supplement the supply of natural gas and to operate on occasions when the peak demand was greater than the gas fields could supply, now operates every day from early November to some time in May. The capacity of the Brantford plant is 4,000 M cubic feet daily, but it is constantly overloaded.

[1]For a description of the process, see Ont. Dept. Mines, Vol. LI, 1942, pt. 5, p. 4.

The peak demand of 1945–46 did not reach that of the previous winter owing to the much milder weather.

Natural Gas Consumption and Rates

Table III shows the history of the natural gas industry in Ontario from the passing of the present natural gas legislation and regulations in 1921. An increase of 250 per cent. in consumers is indicative of the service rendered to Southwestern Ontario from the limited natural gas fields in this area. The number of employees and the wages paid have doubled since that date, and capital invested up to 1943 has increased 225 per cent. But the rate has increased by only 42 per cent. This has been accomplished by skill and management since the industry has been put on a permanent basis; for prior to 1921 the general plan of the producer, particularly in the western part of the area, was to serve industries first and secondly whatever domestic consumers it was necessary to provide for.

TABLE III—DOMESTIC CONSUMPTION OF NATURAL GAS, CAPITAL INVESTED, AND WAGES PAID, 1921-1945

Year	Retail rate, cents per M cu. ft.	No. of pay consumers	Total quantity used	Quantity used per consumer	Capital invested in all natural gas operations	No. of men employed	Wages paid
			M cu. ft.	M cu. ft.			
1921......	47	58,609	5,937,316	101.3	$17,328,757	632	$592,606
1922......	47	63,229	6,028,947	95	17,769,664	692	539,072
1923......	50	62,352	6,210,459	99.6	25,570,972	603	633,365
1924......	55	61,100	5,933,595	97.1	24,781,723	727	639,167
1925......	56	62,338	5,300,424	85.6	26,111,387	692	625,826
1926......	57	63,695	5,595,521	87.8	30,500,874	860	842,305
1927......	60	66,818	5,210,315	78	31,987,879	1,123	1,148,339
1928......	60	70,259	5,699,553	71.2	36,601,828	1,209	1,497,999
1929......	58	80,991	6,336,873	78.2	35,162,736	1,323	1,529,367
1930......	64	84,135	6,332,519	75.2	36,162,268	1,328	1,545,648
1931......	62	86,050	5,607,744	65.1	42,921,142	1,241	1,383,286
1932......	63	86,631	5,409,154	62.2	45,982,719	893	1,059,643
1933......	63	84,933	5,102,340	60	51,766,592	958	958,336
1934......	62	89,990	5,262,631	58.5	41,934,395	931	1,010,979
1935......	60	118,719	5,553,902	46.8–52	42,975,846	1,273	1,219,520
1936......	60	118,117	6,956,453	59.3	45,197,240	1,336	1,354,611
1937......	60	123,527	7,767,359	62.8	49,059,740	1,501	1,668,188
1938......	60	127,861	7,912,220	61.8	51,189,094	1,439	1,631,677
1939......	60	131,598	8,673,200	65.9	53,300,113	1,633	1,883,252
1940......	60	136,698	9,671,008	70.7	56,938,282	1,736	2,071,031
1941......	60	141,520	8,885,751	62.7	56,389,701	1,738	2,205,723
1942......	65	134,562	8,256,439	61.3	56,929,352	1,485	2,056,051
1943......	65	141,253	7,351,438	52	56,565,582	1,010	1,965,366
1944......	65	142,015	7,384,715	52	....	1,115	1,835,301
1945......	65	146,186	8,005,381	54.7	....	1,060	1,297,843

Tables IV and V record the consumption of gases of all kinds in all municipalities in Ontario. More than one-third of all gas distributed is a mixture of gases; but whatever mixture this may be it is maintained at approximately 1,000 British thermal units, and the specific gravity is maintained within a range suitable to the appliances in use in Ontario. Similar tables to these have been published annually since 1921 in order that each municipality may be informed of the quantity of natural gas that is used for domestic and industrial purposes.

The rates in each municipality are either shown in the right hand column of these tables or by a letter that refers back to the pages immediately preceding Table IV, where the details of the rate will be found.

NATURAL GAS RATES, 1945

Classification letter	Season, company, or locality	Classification according to amounts of gas used	Net rate[1] and seasonal discount
A		Up to 10 M cu. ft.	85c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.
B	October to April	Up to 10 M cu. ft.	55c. per M cu. ft.
		From 10 M to 20 M cu. ft.	60c. per M cu. ft.
		Over 20 M cu. ft.	70c. per M cu. ft.
	May to September		80c. per M cu. ft.
C	October to April	Up to 10 M cu. ft.	50c. per M cu. ft.
		From 10 M to 20 M cu. ft.	55c. per M cu. ft.
		Over 20 M cu. ft.	65c. per M cu. ft.
	May to September		75c. per M cu. ft.
D	October to April	Up to 10 M cu. ft.	40c. per M cu. ft.
		From 10 M to 20 M cu. ft.	45c. per M cu. ft.
		Over 20 M cu. ft.	55c. per M cu. ft.
	May to September		70c. per M cu. ft.
E	October to April	Up to 10 M cu. ft.	60c. per M cu. ft.
		From 10 M to 20 M cu. ft.	65c. per M cu. ft.
		Over 20 M cu. ft.	75c. per M cu. ft.
	May to September		85c. per M cu. ft.
F		Less than 1 M cu. ft.	$1.25 per M cu. ft., less discount of 25c.
		1 M cu. ft. and over	$1.05 per M cu. ft., less discount of 25c.
	Where imported mixed gas is used		Plus pro rata share of duty.
	Summer consumers	Less than 1 M cu. ft.	$1.75 per M cu. ft., less discount of 25c.
		1 M cu. ft. and over	$1.35 per M cu. ft., less discount of 5c.
G		Minimum bill	80c.
		Up to 10 M cu. ft.	80c. per M cu. ft.
		From 10 M to 25 M cu. ft.	65c. per M cu. ft.
		Over 25 M cu. ft.	55c. per M cu. ft.
H		Up to 5 M cu. ft.	$1.00 per M cu. ft.
		From 5 M to 10 M cu. ft.	90c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.
I		Up to 5 M cu. ft.	$1.00 per M cu. ft.
		From 5 M to 10 M cu. ft.	90c. per M cu. ft.
		From 10 M to 15 M cu. ft.	80c. per M cu. ft.
		From 15 M to 25 M cu. ft.	70c. per M cu. ft.
		Over 25 M cu. ft.	60c. per M cu. ft.
J		Up to 200 cu. ft.	40c. per hundred cu. ft.
		From 200 cu. ft. to 5 M cu. ft.	70c. per M cu. ft.
		From 5 M to 10 M cu. ft.	60c. per M cu. ft.
		Over 10 M cu. ft.	45c. per M cu. ft.
	October to April, discount	On bills under $5.00	15 per cent.
		On bills between $5.00 and $10.00	10 per cent.
	May to September, discount	On bills under $5.00	10 per cent.
K		Up to 200 cu. ft.	40c. per hundred cu. ft.
		From 200 cu. ft. to 5 M cu. ft.	75c. per M cu. ft.
		From 5 M to 10 M cu. ft.	65c. per M cu. ft.
		Over 10 M cu. ft.	50c. per M cu. ft.
	October to April, discount[2]	On bills under $5.00	15 per cent.
		On bills between $5.00 and $10.00	10 per cent.
	May to Sept., discount[2]	On bills under $5.00	10 per cent.

[1]All gas distributed by the Dominion Natural Gas Company, Limited, except on the Port Rowan system, is subject to a surcharge of 5 cents per M cubic feet.

[2]Discounts apply only to bills of the Dominion Natural Gas Company, Limited.

NATURAL GAS RATES, 1945—*Continued*

Classification letter	Season, company, or locality	Classification according to amounts of gas used	Net rate and seasonal discount
L	Fonthill-Ridgeville Gas Co.	First 100 cu. ft., minimum charge	85c.
		Over 100 cu. ft.	75c. per M cu. ft.
	Dominion Natural Gas Co.		75c. per M cu. ft.
M		Minimum bill	75c.
		Up to 15 M cu. ft.	75c. per M cu. ft.
		Over 15 M cu. ft.	55c. per M cu. ft.
N		1 M cu. ft. or less	85c.
		From 1 M to 10 M cu. ft.	80c. per M cu. ft.
		From 10 M to 25 M cu. ft.	65c. per M cu. ft.
		Over 25 M cu. ft.	55c. per M cu. ft.
O	Port Colborne	Minimum bill	$1.00
		Up to 5 M cu. ft.	80c. per M cu. ft.
		From 5 M to 10 M cu. ft.	70c. per M cu. ft.
		Over 10 M cu. ft.	55c. per M cu. ft.
	Summer residents	Minimum charge	$2.00 per M cu. ft.
P		200 cu. ft. or less	$1.00
		Over 200 cu. ft.	60c. per M cu. ft.
Q	Grimsby and Grimsby Beach	Minimum bill	$1.00
		Up to 5 M cu. ft.	85c. per M cu. ft.
		From 5 M to 10 M cu. ft.	75c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.
	Smithville	Minimum bill	90c.
		Up to 5 M cu. ft.	75c. per M cu. ft.
		From 5 M to 10 M cu. ft.	70c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.
R	November to April	Up to 10 M cu. ft.	65c. per M cu. ft.
		Over 10 M cu. ft.	55c. per M cu. ft.
	May to October	Up to 10 M cu. ft.	70c. per M cu. ft.
		Over 10 M cu. ft.	55c. per M cu. ft.
S		Up to 5 M cu. ft.	$1.00 per M cu. ft.
		From 5 M to 10 M cu. ft.	90c. per M cu. ft.
		Over 10 M cu. ft.	60c. per M cu. ft.
T	Central Pipe Line Co.	Minimum bill	$1.90
		First 200 cu. ft.	55c. per hundred cu. ft.
		Next 800 cu. ft.	10c. per hundred cu. ft.
		Next 1,000 cu. ft.	60c. per M cu. ft.
		Next 4,000 cu. ft.	$1.00 per M cu. ft.
		Over 6,000 cu. ft.	$2.00 per M cu. ft.
U		1 M cu. ft. or less	95c. per M cu. ft.
		From 1 M to 10 M cu. ft.	60c. per M cu. ft.
		From 10 M to 15 M cu. ft.	55c. per M cu. ft.
		Over 15 M cu. ft.	50c. per M cu. ft.
V		1 M cu. ft. or less	80c. per M cu. ft.
		From 1 M to 5 M cu. ft.	60c. per M cu. ft.
		Over 5 M cu. ft.	50c. per M cu. ft.
W	October to April	Up to 10 M cu. ft.	40c. per M cu. ft.
		From 10 M to 20 M cu. ft.	45c. per M cu. ft.
		Over 20 M cu. ft.	55c. per M cu. ft.
	May to September		65c. per M cu. ft.
Y		Up to 200 cu. ft.	40c. per 100 cu. ft.
		From 200 cu. ft. to 5 M cu. ft.	70c. per M cu. ft.
		From 5 M to 10 M cu. ft.	60c. per M cu. ft.
		Over 10 M cu. ft.	45c. per M cu. ft.

TABLE IV—GAS CONSUMPTION IN TOWNS AND CITIES, 1945

Town or city	Population	No. of consumers		Quantity consumed			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
				M cu. ft.	M cu. ft.	M cu. ft.	
Alvinston	620	251	....	15,503	....	....	K
Ancaster	566	227	....	12,158	....	....	[1]70c. (M.B.[2] $1.00)
Appin	125	44	....	2,732	....	....	K
Attercliffe	47	35	....	1,000	....	....	50c.–60c.
Aylmer	2,474	843	....	31,623	....	....	T
Beachville	426	28	....	3,215	....	....	65c. (M.B. $1.00)
Belle River	845	258	....	21,105	....	487	B (M.R.[3] 20c.)
Belmont	500	129	....	6,220	....	....	$1.00
Binbrook	195	6	....	507	....	....	[1]60c.
Blenheim	1,873	687	....	65,743	....	1,407	C (M.R. 20c.)
Bothwell	605	187	....	16,552	....	....	Y
Brantford	34,372	6,368	....	244,932	....	22,957	[1]G
Brigden	386	185	....	14,096	....	1,246	B (M.R. 10c.)
Burlington	4,311	715	....	28,860	....	944	H
Byron	200	98	....	5,349	....	307	K
Cainsville	600	35	....	1,130	....	....	[1]G
Caledonia	1,395	550	4	43,508	280	1,966	60c.
Cayuga	652	210	....	18,310	....	809	[1]60c. (M.R. 15c.)
Chatham	17,807	5,338	....	472,999	....	30,566	J
Chippawa	1,266	349	3	12,896	715	....	F
Clandrasil	116	31	3	1,576	510	....	60c.
Comber	484	165	....	16,642	....	820	C (M.R. 20c.)
Cottam	385	93	1	6,648	140	825	[1]60c. (M.B. 50c.)
Courtland	341	77	....	6,035	....	....	[1]60c. (M.B. 50c.)
Courtright	357	141	....	12,171	....	....	B (M.R. 20c.)
Delhi	2,093	672	2	53,163	441	....	60c. (M.B. 60c., M.R. 10c.)
Dorchester	456	145	....	6,792	....	....	E (M.B. 50c., M.R. 10c.)
Dresden and Tupperville	1,762	625	....	55,786	....	2,565	G (M.R. 20c.)
Dundas	5,588	1,399	....	66,694	....	8,776	70c. (M.B. $1.00)
Dunnville	4,305	1,183	1	106,460	108	6,382	[1]60c. (M.R. 15c.)
Dutton	791	255	1	18,356	140	856	[1]V
Echo Place	735	248	....	7,994	....	....	[1]G (M.B. 70c., M.R. 10c.)
Eden	153	35	....	2,437	....	230	[1]60c. (M.B. 50c., M.R. 10c.)
Essex	1,986	595	....	55,150	....	3,668	B (M.R. 20c.)
Fenwick	404	136	....	6,659	....	433	[1]75c. (M.R. 25c.)
Fingal and Shedden	161	143	1	8,267	60	297	[1]B (M.B. 50c.)
Fisherville	171	39	....	2,903	....	....	50c.–55c.
Florence	137	73	....	6,723	....	688	Y
Fonthill	1,009	331	....	12,829	....	333	L
Fort Erie	7,069	1,958	4	109,890	669	2,456	F
Galt	14,693	2,708	....	92,390	....	26,401	[1]G (M.B. 80c., M.R. 10c.)
Glencoe	752	260	....	25,153	....	595	K
Grimsby	1,993	517	....	17,322	....	2,928	Q
Grimsby Beach	400	130	....	7,375	....	....	Q
Hagersville	1,588	507	....	39,355	....	117	[1]60c. (M.B. 35c., M.R. 15c.)
Hamilton	174,222	13,237	....	434,031	....	184,721	M
Hespeler	3,021	621	....	21,971	....	2,959	[1]N
Highgate	301	112	1	8,223	49	....	[1]C (M.R. 20c.)
Humberstone	3,287	778	....	38,587	....	508	[1]O
Ingersoll	5,823	1,344	....	64,707	....	8,186	[1]G

[1]Plus a surcharge of 5 cents per M cubic feet for all gas distributed by the Dominion Natural Gas Company, Limited, except on the Port Rowan system.

[2]M.B.—Minimum monthly bill.

[3]M.R.—Meter rental.

TABLE IV—GAS CONSUMPTION IN TOWNS AND CITIES, 1945—*Continued*

Town or city	Population	No. of consumers		Quantity consumed			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
				M cu. ft.	M cu.ft.	M cu. ft.	
Inwood	175	91	....	5,601	....	....	A
Jarvis	557	249	....	22,579	....	....	[1]60c. (M.R. 10c.)
Kingsville	2,335	735	....	60,933	....	1,147	[1]U
Lambeth	475	154	....	10,661	....	399	[1]K
Leamington	5,456	1,931	....	177,554	....	3,625	[1]60c.
London	81,158	17,469	....	812,934	....	131,036	K
Lynedoch	151	75	4	6,642	824	....	[1]60c.
Merlin	219	167	....	17,204	....	260	D
Merritton	3,450	649	....	25,328	....	9,711	[1]75c. (M.R. 25c.)
Mount Brydges	462	134	....	8,732	....	....	K
Niagara Falls	19,138	4,634	4	157,844	954	50,842	F
Norwich	1,199	130	....	6,141	....	....	65c. (M.B.$1.00)
Oil Springs	426	158	....	10,252	....	....	R
Otterville	481	113	....	6,016	....	....	65c. (M.B.$1.00)
Paris	4,524	1,052	....	38,944	....	2,138	[1]G
Petrolia	2,684	858	....	67,736	....	4,517	T
Port Burwell	513	215	1	7,820	259	....	T
Port Colborne	7,187	1,749	1	88,607	200	477	[1]O
Port Dover	2,001	672	....	61,231	....	....	[1]60c.
Port Rowan	584	261	3	20,138	528	....	60c.
Port Ryerse	....	7	7	2,385	1,431	....	[1]60c.
Preston	6,707	1,215	....	42,190	....	15,314	[1]G
Putnam	....	60	....	3,358	....	1,837	E
Ridgetown	1,911	713	....	70,576	....	1,913	C
Rodney	718	250	3	19,121	390	....	[1]V
St. Anns	185	33	....	1,377	....	....	60c.-$1.35
St. Catharines	34,541	6,792	3	281,121	453	84,406	[1]75c. (M.R. 25c.)
St. George	486	137	....	5,788	....	....	[1]80c.
St. Thomas	17,773	3,233	....	127,927	....	1,330	[1]K
St. Williams	166	121	....	7,045	....	419	60c.
Sarnia	20,082	6,211	1	363,317	116	46,888	B (M.R. 10c.)
Selkirk	167	136	....	10,117	....	....	[1]60c.
Simcoe	6,047	2,511	2	228,860	191	34,740	[1]60c.
Smithville	529	216	....	10,644	....	....	Q
Sombra and Port Lambton	688	202	....	14,291	....	....	B (M.R. 20c.)
Springfield	401	115	....	3,884	....	....	T
Springford	188	28	....	2,068	....	....	65c. (M.B.$1.00)
Stoney Creek	1,051	245	....	11,554	....	....	M (M.B. 75c.)
Straffordville	267	120	....	4,748	....	....	T
Thamesville	777	277	....	24,758	....	1,150	Y
Thorold	5,517	1,243	....	48,808	....	3,211	[1]75c. (M.R. 25c.)
Tilbury	1,995	661	....	63,843	....	590	C (M.R. 20c.)
Tillsonburg	4,081	1,412	....	109,251	....	2,709	[1]63c.
Vienna	206	83	2	3,523	488	....	T
Vittoria	257	103	....	6,273	....	....	[1]60c.
Wallaceburg	5,088	1,679	....	145,185	....	206,561	C (M.R. 20c.)
Wallacetown	175	54	....	3,772	....	32,770	[1]V
Waterdown	916	75	....	2,497	....	....	X
Waterford	1,352	325	....	22,863	....	....	[1]P
Welland	15,780	4,452	7	150,096	759	16,274	F
Wellandport	....	8	3	209	180	....	60c.
West Lorne	791	197	1	14,472	32	152	[1]V
Wheatley	716	251	....	22,819	....	....	[1]60c.
Windsor	117,031	23,132	....	1,345,156	....	543,034	K
Woodstock	12,916	2,615	....	109,770	....	1,995	[1]G
Wyoming	480	184	....	11,227	....	132	A
Total	....	135,696	63	7,238,517	9,917	1,515,010	....

TABLE V—GAS CONSUMPTION IN TOWNSHIPS, 1945

County and township	Population	No. of consumers		Quantity consumed			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
				M cu. ft.	M cu. ft.	M cu. ft.	
BRANT:							
Brantford	8,724	50	.....	2,803	....	....	[1]G
Burford	3,523	10	.....	363	....	....	[1]G
Onondaga	1,097	52	2	3,635	329	....	[1]70c.
South Dumfries	2,371	2	.....	39	....	....	[1]80c.
Tuscarora	2,654	21	.....	2,313	....	....	25c.
ELGIN:							
Aldborough	2,448	18	.....	1,130	....	1,741	[1]V
Bayham	2,929	9	.....	567	....	....	T and [1]60c.
Dunwich	1,994	52	.....	4,200	....	....	[1]V
Malahide	2,661	288	8	12,130	784	....	T
Southwold	2,790	126	.....	8,164	....	128	B
Yarmouth	5,338	81	.....	2,892	....	....	A
ESSEX:							
Gosfield North	2,186	128	1	7,366	143	....	[1]60c.
Gosfield South	2,711	650	.....	52,139	....	13,947	[1]60c.
Maidstone	2,965	87	4	12,887	1,483	....	B
Mersea	5,147	171	3	14,559	383	7,312	[1]60c.
Rochester	2,302	241	7	17,067	1,194	1,322	B
Sandwich East	9,808	55	.....	2,076	....	....	B
Sandwich South	2,396	159	.....	11,268	....	3,565	B
Tilbury North	1,767	49	2	3,484	446	12,879	C
Tilbury West	2,929	31	1	2,639	117	....	C
HALDIMAND:							
Canborough	813	96	29	6,997	4,366	295	[1]60c. (M.R.[2] 15c.)
Dunn	629	65	1	4,445	115	335	[1]60c. (M.R. 15c.)
Moulton	1,552	177	6	12,257	1,286	160	[1]60c. (M.R. 15c.)
North Cayuga	1,161	128	9	6,716	1,705	669	[1]60c.
Oneida	1,056	88	8	6,865	1,161	....	[1]60c.
Rainham	1,528	207	30	14,759	4,459	2,016	[1]60c.
Seneca	1,340	157	24	10,226	3,985	295	[1]60c.
Sherbrooke	262	103	2	6,480	1,013	708	[1]60c. (M.R. 15c.)
South Cayuga	525	68	14	3,903	2,274	1,370	[1]60c. (M.R. 15c.)
Walpole	3,180	318	48	20,754	6,975	348	[1]60c. (M.R. 15c.)
HALTON:							
Nelson	4,022	19	.....	1,561	....	....	S (M.R. 50c.)
KENT:							
Camden	1,791	20	.....	1,376	....	....	C
Chatham	6,388	128	.....	8,928	....	1,449	C
Dover	4,272	453	1	49,372	158	2,465	D
Harwich	4,651	549	6	45,311	1,122	163	C
Howard	2,441	153	3	14,223	503	....	C
Orford	1,432	47	2	4,157	229	....	C
Raleigh	4,350	1,603	20	62,515	5,051	1,622	D and [1]W
Romney	1,282	116	36	10,458	9,521	1,228	D and [1]W
Tilbury East	2,929	262	66	24,202	16,932	1,385	D and [1]W
Zone	770	38	.....	1,785	....	3,883	A
LAMBTON:							
Brooke	1,944	35	.....	1,284	....	....	A
Dawn	2,136	114	4	8,632	633	385	D
Enniskillen	2,385	138	.....	7,336	....	866	B
Euphemia	1,183	10	.....	544	....	....	Y
Moore	3,328	465	.....	34,653	....	2,142	B
Plympton	2,360	6	.....	240	....	....	A
Sombra	2,630	92	.....	4,898	....	767	B

[1]Plus a surcharge of 5 cents per M cubic feet for all gas distributed by the Dominion Natural Gas Company, Limited, except on the Port Rowan system.

[2]M.R.—Meter rental.

[3]M.B.—Minimum monthly bill.

TABLE V—GAS CONSUMPTION IN TOWNSHIPS, 1945—*Continued*

County and township	Population	No. of consumers		Quantity consumed			Net rate per M cu. ft.
		Pay	Free	Pay	Free	Industrial	
				M cu. ft.	M cu. ft.	M cu. ft.	
LINCOLN:							
Caistor	1,100	45	.....	3,037	....	112	50c. (M.B. 65c.)
Gainsborough	1,921	55	13	3,561	2,030	....	60c.
Grantham	5,684	79	.....	3,633	....	....	[1]75c. (M.R. 25c.)
Louth	3,365	5	.....	242	....	....	[1]75c.
MIDDLESEX:							
Caradoc	2,644	21	.....	1,397	....	5,514	K
Delaware	1,200	4	.....	153	....	....	K
Ekfrid	1,770	22	.....	1,455	....	....	K
Lobo	1,874	1	.....	11	....	....	K
Mosa	1,345	2	.....	65	....	....	K
Westminster	8,798	130	.....	8,504	....	....	K
NORFOLK:							
Middleton	2,323	78	.....	5,434	....	....	[1]60c.
North Walsingham	2,092	1	2	37	225	....	[1]60c.
OXFORD:							
Dereham	3,145	107	.....	10,940	....	....	65c. (M.B.[3] $1.00)
East Oxford	1,850	6	.....	348	....	....	[1]G
South Norwich	....	8	.....	90	....	....	....
West Oxford	1,982	21	.....	1,109	....	....	[1]G
WATERLOO:							
North Dumfries	2,917	91	.....	1,957	....	....	[1]80c.
Waterloo	8,647	6	.....	298	....	....	[1]G
WELLAND:							
Bertie	4,050	1,042	42	65,833	7,324	....	F
Crowland	7,717	44	11	1,685	1,307	....	F
Humberstone	2,957	470	24	26,363	4,170	....	F
Pelham	2,695	45	3	2,223	589	....	L
Wainfleet	2,831	271	4	14,054	2,370	3,020	[1]75c.
Willoughby	842	20	16	1,210	2,676	....	F
WENTWORTH:							
Ancaster	4,279	203	.....	17,016	....	....	[1]70c. (M.B. $1.00)
Barton	3,302	496	.....	16,582	....	1,549	[1]60c.
Binbrook	1,192	82	18	7,561	2,898	6	[1]60c.
East Flamborough	3,848	196	.....	10,850	....	....	S (M.R. 50c.)
Glanford	1,442	114	2	11,985	475	591	[1]60c.
Saltfleet	7,250	331	.....	12,434	....	....	M
West Flamborough	2,719	9	.....	199	....	....	S (M.R. 50c.)
Total	....	10,490	472	766,864	90,231	74,237	....

Gas Wells and Their Production

Table VI shows in detail the gas wells in each township in Ontario and the drilling activity for the year. Similar tables have been published annually since the year 1921 and are available for reference.

The total of operating natural gas wells reached 3,612 in 1945, an increase of 112 over 1944, and there were 76 wells abandoned in 1945, which is 121 less than in 1944. Drilling activity was less than in 1944 with 279 wells as against

315 wells. The ratio of dry holes to producers gave a better comparison in 1945, when only 37 per cent. were dry against 41 per cent. in 1944. The open flow of 177 new producers was 27,055 M cubic feet in 1945, which is an average of 153 M cubic feet per well, as against 133 M cubic feet in 1944.

In the seventh figure column of Table VI will be found the average rock pressure throughout each township and in the sixth column the production of all wells in the township. In widely scattered gas fields, where gas is transmitted in many directions, it is out of the question to measure the production by townships. These quantities are, therefore, estimates made by those who are best informed and published only to show the approximate natural gas production. This, coupled with the rock pressure, indicates the natural gas reserves within each township. The extent of acres under lease points to the areas where exploration may be done in the future.

A study of this table shows little change in the production from old natural gas fields. The major development is in the Zone field in Kent county, at the village of Bothwell, where a gas field has been discovered one mile north of the old oil field discovered in 1863. The producing horizon is, however, 1,200 feet deeper than in the old oil field. The gas in Zone township comes from the same horizons as in the Dawn field, and like the Dawn field and unlike the Tilbury field, the gas contains no hydrogen sulphide. The development in Townsend township in Norfolk county has been steadily progressing for the past four years, with a total of 61 producing wells at the end of 1945. In 1945, 23 producing wells were drilled with a total open flow of 3,215 M cubic feet. The original rock pressure of the field was approximately 500 pounds. As the area is suffering from a gas shortage, this is a most opportune discovery.

The drilling in the old Haldimand gas field gave a few more producing wells in 1945 than in 1944 and also a small increase in their open flow, but it is doubtful if this will offset the decline in rock pressure and deliver any more gas into the pipe lines. The reduced production would tend to confirm this.

The old Welland gas field has again seen some activity; 21 producing wells were drilled, which is the same as in 1944, but the open flow of the wells drilled in 1945 was nearly three times that of 1944 and the production shows an increase of 20,538 M cubic feet. In this field, now fifty-six years in production, the porosity of the producing sandstone is not at all uniform, and while the average rock pressure is probably below 100 pounds and in many places little above pipe line pressure, new wells quite often find undrained areas with rock pressures of 200 and 300 pounds. The wholesale price of gas in this old field is now 45 cents per M cubic feet, which makes exploratory drilling very attractive.

There was little "wildcat" drilling in 1945. Two dry wells were drilled in Malden township, both of which had small shows of gas, and more drilling is expected. In East and West Gwillimbury townships, near Lake Simcoe, dry holes were drilled. The West Petroleum Company have continued their drilling one mile off shore in Lake Erie. This company has suffered a series of misfortunes in their operations. As the result of ice action their No. 1 well head was broken off at the bottom of the lake and was full of fresh water for eight months. It has not yet been recovered, although repairs have been made that will assure no further damage to this well or the field. No. 3 well, which promised to be a large one, is incomplete. The drilling tools were broken off and left in the hole shortly after encountering the upper gas pay; autumn storms drove the crew off the lake before the tools could be recovered. This company has shown great courage in pioneering in lake-drilling. The water is 35 feet deep, storms are sudden and frequent, and ice action is severe.

TABLE VI—GAS WELLS AND THEIR PRODUCTION, 1945

County	Township	No. of wells producing	No. of wells abandoned	Wells drilled			Production	Rock pressure, lbs. per sq. in.	Acres under lease	Rental paid
				No. dry	No. producing	Open flow				
						M cu. ft.	M cu. ft.			
Brant	Brantford	2					1,065	100	150	$53
	Onondaga	23	1				12,334	105	1,365	658
	Tuscarora	67	3				59,267	80	43,700	1,537
Elgin	Aldborough			1					15,746	
	Bayham	[1]31					23,888	200	20,453	2,131
	Bayham (Brownsville)	5					12,879	190	235	225
	Dunwich								211	
	Malahide	22	1	1	1	117	25,445	325	1,561	
	Yarmouth								160	
Essex	Gosfield South	27					24,918	170	583	764
	Malden			2						
	Mersea	5					2,498	280	1,050	
	Tilbury North								925	
	Tilbury West								4,500	
Haldimand	Canborough	149	7	1	10	296	141,766	75	2,460	1,797
	Dunn	55	1	1	8	885	42,414	170	3,665	764
	Moulton	104	2	4	2	23	101,797	115	2,802	1,311
	North Cayuga	221	5	6	19	1,416	210,469	135	13,222	4,097
	Oneida	[1]122	4	5	1	17	107,329	165	4,814	1,612
	Rainham	[1]319	13	1	6	205	381,301	155	12,664	6,108
	Seneca	155	2	4	4	84	119,767	70	7,502	2,370
	Sherbrooke	17					20,540	175	160	
	South Cayuga	90	1	4	2	52	83,924	125	2,134	175
	Walpole	565	7	17	42	2,684	676,453	180	21,362	13,190

TABLE VI—GAS WELLS AND THEIR PRODUCTION, 1945—*Continued*

County	Township	No. of wells producing	No. of wells abandoned	Wells drilled: No. dry	Wells drilled: No. producing	Wells drilled: Open flow	Production	Rock pressure, lbs. per sq. in.	Acres under lease	Rental paid
						M cu. ft.	M cu. ft.			
Kent	Camden			2					10,987	
	Camden gore	3		2				690	11,493	
	Chatham	25		1			297,978	565	23,076	
	Chatham gore								1,865	
	Dover	16	4				162,286	130	3,430	1,113
	Harwich								1,712	
	Howard								1,840	
	Raleigh	20	1				65,905	150	3,393	700
	Raleigh (Declute)	39					461,428	284	1,000	400
	Romney	138	8		4	1,048	578,321	150	2,509	75
	Tilbury East	119	5				1,481,756	150	9,630	950
	Zone	34		6	16	11,548	665,568	650	18,049	
Lambton	Brooke								302	
	Dawn	31	1				408,052	375	12,287	
	Enniskillen	[1]4					13,268		605	125
	Euphemia			1					6,126	
	Moore								225	
	Sombra								7,523	
Lincoln	Caistor	[1]84	1		4	185	64,711	80	5,539	1,910
	Gainsborough	[1]13					5,903	65	860	340
Middlesex	Ekfrid								505	
	London								60	
	Lobo								55	
	Mosa			4					19,740	
	Westminster								123	
Norfolk	Charlotteville	15					17,569	190		
	Houghton	4					15,000	400		
	Middleton	39		2	1	3,500	48,705	180	1,788	600
	North Walsingham	8		1			9,370	225		
	South Walsingham	19					29,992	365	805	400
	Townsend	61		17	23	3,215	106,891	340	895	729
	Windham	24					27,191	235	450	250
	Woodhouse	99		3	4	317	208,525	210	11,251	2,731

Oxford	Dereham (Brownsville)	14	2				17,157	325	100	178
	South Norwich	2		1			90	400	235	
Simcoe	West Gwillimbury			2						
Welland	Bertie	179	2	5	12	740	143,179	85	23,005	7,403
	Crowland	32	1		5	405	19,937	105	2,700	197
	Humberstone	75	3		1	60	65,492	50	2,737	825
	Wainfleet	41	1	3	3	83	65,026	100	3,829	1,300
	Willoughby	51					38,321	115	1,254	576
Wentworth	Beverly	1		2				30		
	Binbrook	44					48,582	53	87	
	Glanford	10					11,713	40		
York	East Gwillimbury			1						
Surface wells	Harwich and Howard	69					[2]14,000			
Private wells		[3]320		2	9	175	[3]60,000			
Used by gas companies (not detailed)	Various fields								142,327	249,001
Total		3,612	76	102	177	27,055	7,199,970		495,821	$306,595

[1]Wells reopened and added to producers (11) are as follows: Enniskillen, 1; Bayham, 1; Oneida, 1; Rainham, 2; Caistor, 4; Gainsborough, 2.
[2]This gas is not metered, and therefore must be estimated. The wells are owned privately, and the gas is used for domestic purposes.
[3]Estimated.

Leakage

Tables VII, VIII, and IX show the leakage in distribution plants, rural lines, and transmission lines in Ontario in 1945. A comparison of these tables with those for the year 1944 shows that leakage is on the increase.

In line with the remarks in last year's report on leakage, the distributing companies made many leakage surveys and did much repair work to their lines, which had deteriorated owing to the shortage of labour during the war years. The repair work is mostly done in the summer months, and the results are not apparent in the Department's reports until a full year can be observed. It will be noted that some distribution plants still show a gain instead of a loss. It is notable that for two years in succession the distribution plants in Byron, Chatham, Comber, Glencoe, Mount Brydges, Sarnia, Simcoe, and Thamesville show a gain. It has been claimed that, owing to seasonal differences and continuous meter reading, variations in the month of December may cause this gain in certain places, but this cannot happen in two successive years and in selected places. It is apparent that this is an error in measuring gas and that it can be corrected by the makers of the orifice or positive meters, for these meters can be made to measure accurately.

The leakage in the towns of Leamington and Dunnville are again the greatest, being from four to five times the allowable. Hagersville, Dutton, Belmont, St. Catharines, Highgate, Thorold, Kingsville, Preston, Woodstock, and Ingersoll are excessive.

There has been no satisfactory standard set as good operating practice for allowable leakage in transmission lines. Under normal circumstances leakage on high pressure transmission lines varies with the gauge pressure on the line. It may be noted that the transmission line from the Dawn gas field carrying a pressure of 80 pounds shows a gain in volume, which, of course, is quite impossible. This and all other leakage problems will be made the subject of investigation by the inspectors of this Department during the coming season.

TABLE VII—LEAKAGE IN DISTRIBUTION PLANTS, 1945

Town or city	Company	Equivalent miles of 3-inch pipe in distribution plants	Leakage for year		Average No. of consumers	Leakage per consumer	Pressure, ozs. per sq. in.
			Actual	Allowable			
			M cu. ft.	M cu. ft.		cu. ft.	
Alvinston	Union Gas Co.	6.2	201	1,240	251	800	6
Ancaster	Dom. Nat. Gas Co.	1.4	103	280	87	1,180	4
Appin	Union Gas Co.	.98	52	186	44	1,110	5
Beachville	Beachville Gas Synd.	28.5	373	5,700	28	13,320	4
Belle River	Union Gas Co.	4.48	210	896	258	810	5
Belmont	Belmont Gas Co.	8	3,052	1,600	154	19,710	6
Blenheim	Union Gas Co.	13.37	1,722	2,674	687	2,510	5
Bothwell	Union Gas Co.	5.54	108	1,108	187	580	5
Brantford	Dom. Nat. Gas Co.	94.25	1,461	18,850	6,368	230	4
Brigden	Union Gas Co.	3.9	477	780	185	20,580	6
Byron	Union Gas Co.	3.03	(1)	606	98	....	6
Cainsville	Dom. Nat. Gas Co.	5.57	363	1,114	35	10,370	4
Caledonia	Port Colborne-Welland Gas and Oil Co.	8	1,543	1,600	550	2,810	4
Cayuga	Dom. Nat. Gas Co.	5.86	917	1,172	210	4,370	4
Chatham	Union Gas Co.	85.42	(1)	17,084	5,338	....	6
Comber	Union Gas Co.	3.86	(1)	772	165	....	6
Corunna	Union Gas Co.	3.23	189	646	251	790	6
Courtright	Union Gas Co.	4.42	494	884	141	3,500	6
Delhi	Dom. Nat. Gas Co.	7.08	973	1,416	672	1,450	4
Dorchester	Dom. Nat. Gas Co.	2.86	1,437	572	145	990	4

[1]These distribution plants show a total gain of 10,927 M cubic feet.

TABLE VII—LEAKAGE IN DISTRIBUTION PLANTS, 1945—*Continued*

Town or city	Company	Equivalent miles of 3-inch pipe in distribution plants	Leakage for year		Average No. of consumers	Leakage per consumer	Pressure, ozs. per sq. in.
			Actual	Allowable			
			M cu. ft.	M cu. ft.		cu. ft.	
Dresden	Union Gas Co.	13.05	1,913	2,610	625	3,060	5
Dunnville	Dom. Nat. Gas Co.	13.87	15,723	2,774	1,169	13,450	4
Dutton	Dom. Nat. Gas Co.	8.16	5,111	1,632	255	20,040	4
Essex	Union Gas Co.	11.71	958	2,342	595	1,610	5
Fenwick	Dom. Nat. Gas Co.	1.51	194	302	136	1,430	4
Florence	Union Gas Co.	1.87	21	374	73	290	5
Fonthill	Fonthill-Ridgeville Gas Co.	6.54	1,401	1,308	343	4,080	6
Glencoe	Union Gas Co.	7.85	(1)	1,570	260	....	5
Hagersville	Dom. Nat. Gas Co.	7.38	4,801	1,476	507	9,470	4
Hamilton	United Gas and Fuel Co.	117.29	3,996	23,458	13,237	300	4
Hespeler	Dom. Nat. Gas Co.	8.97	2,468	1,794	621	3,970	4
Highgate	Dom. Nat. Gas Co.	2	792	400	112	7,080	4
Ingersoll	Dom. Nat. Gas Co.	20.82	7,277	4,164	1,344	5,400	4
Inwood	Union Gas Co.	2.11	3	422	91	30	5
Jarvis	Dom. Nat. Gas Co.	4.05	3,449	810	249	13,850	4
Kingsville	Dom. Nat. Gas Co.	13.49	4,633	2,698	720	6,430	4
Lambeth	Dom. Nat. Gas Co.	3.84	1,036	768	154	6,730	4
Leamington	Leamington, Town of	25.47	21,311	5,094	1,938	10,990	6
London	City Gas Co.	322	39,707	64,400	17,503	2,270	5
Merlin	Union Gas Co.	2.68	282	536	167	1,690	6
Merritton	Dom. Nat. Gas Co.	4.52	1,182	904	649	1,820	4
Mount Brydges	Union Gas Co.	3.63	(1)	726	134	....	5
North Pelham	Dom. Nat. Gas Co.	.72	171	144	16	10,690	4
Norwich	Norotto Gas Co.	25.5	4,448	5,100	130	34,220	5
Paris	Dom. Nat. Gas Co.	14.92	9,016	2,984	1,052	8,570	4
Petrolia	Union Gas Co.	17.63	3,923	3,526	858	4,570	6
Port Colborne	Dom. Nat. Gas Co.	30.4	9,512	608	1,749	5,440	4
Port Dover	Dom. Nat. Gas Co.	7.94	382	1,588	672	570	4
Port Lambton	Union Gas Co.	2.07	(1)	414	100	....	5
Preston	Dom. Nat. Gas Co.	20.96	7,398	4,192	1,215	6,090	4
Ridgetown	Union Gas Co.	17.9	(1)	3,580	713	....	5
Rodney	Dom. Nat. Gas Co.	5.39	1,744	1,078	250	6,980	4
St. Catharines	Dom. Nat. Gas Co.	68.8	29,371	1,376	6,792	4,320	4
St. George	Dom. Nat. Gas Co.	2.11	(1)	422	137	....	4
St. Thomas	Dom. Nat. Gas Co.	55.85	12,019	11,170	3,233	3,720	4
Sarnia	Union Gas Co.	98.44	(1)	19,688	6,211	....	5
Shedden and Fingal	Dom. Nat. Gas Co.	6.11	1,737	1,222	143	12,140	4
Simcoe	Dom. Nat. Gas Co.	29.69	(1)	5,938	2,511	....	4
Sombra	Union Gas Co.	2.64	572	528	75	7,630	5
South London	Dom. Nat. Gas Co.	8.87	466	1,774	416	1,120	4
Thamesville	Union Gas Co.	6.89	(1)	1,378	277	....	5
Thorold	Dom. Nat. Gas Co.	13.19	5,873	2,638	1,243	4,720	4
Tilbury	Union Gas Co.	9.52	1,034	1,904	661	1,560	5
Tillsonburg	Dom. Nat. Gas Co.	23.49	5,575	4,698	1,412	3,940	4
Wallaceburg	Union Gas Co.	25.11	1,005	5,022	1,679	590	6
Waterford	Dom. Nat. Gas Co.	5.88	213	1,176	325	660	4
West Lorne	Dom. Nat. Gas Co.	3.89	949	778	197	4,820	4
Wheatley	Dom. Nat. Gas Co.	3.46	891	692	251	3,550	4
Windsor	Union Gas Co.	518.75	12,904	103,740	23,132	560	5
Woodburn	Dom. Nat. Gas Co.	2.03	847	406	47	18,020	4
Woodstock	Dom. Nat. Gas Co.	48.45	14,878	9,690	2,615	5,690	4
Wyoming	Union Gas Co.	5.18	853	1,036	184	4,640	6
Total	....	1,980.54	255,714	378,232	115,032	....	....

	M cu. ft.
Actual leakage	255,714
Gain[1]	10,927
Net loss	244,787

TABLE VIII—LEAKAGE ON RURAL LINES, 1945

Division	Equivalent feet of 3-inch pipe in all rural lines	Leakage for year		Average No. of consumers	Leakage per consumer	Average pressure on pipe lines	
		Actual	Allowable			Low pressure	High pressure
		M cu. ft.	M cu. ft.		cu. ft.	ozs.	lbs.
Windsor system...	122,651	5,792	4,648	552	10,154	5	....
Sarnia system....	317,126	11,867	12,432	178	36,271	5	....
London system...	14,481	130	548	50	5,100	5	....
Ridgetown system.	128,724	4,881	4,873	517	9,098	....	5
Raleigh standard line (Blake system).......	6,120	4,559	1,224	82	55,085	4	....
Total........	589,102	27,229	23,725	1,379	....	....	....

TABLE IX—LEAKAGE IN TRANSMISSION LINES, 1945

	Equivalent miles of 3-inch pipe	Volume received	Volume delivered	Actual leakage	Average pressure on pipe lines
		M cu. ft.	M cu. ft.	M cu. ft.	lbs. per sq. in.
Gas field to Sarnia and Petrolia.............	413.5	3,240,845	3,198,608	42,237	40–80
Glenwood to Hamilton...	710.05	1,519,214	1,442,492	76,722	60
Glenwood to Leamington.	54.65	437,085	414,604	22,481	65
Gas field to Ridgetown...	7.8	251,600	236,177	15,423	25–80
Gas field to Bothwell.....	882.32	50,810	50,688	122	30–50
Gas field to Windsor.....	356.5	2,049,887	1,949,986	99,901	30–80
Galt line (to Hespeler)....	14.45	222,518	211,959	10,559	20
Hamilton line...........	70.52	160,602	151,653	8,949	15–50
Tilbury East field line....	111.4	6,440	6,242	198	100
Dawn field to London....	322.76	1,109,986	1,110,722	(1)	40–80
Leamington West........	20	162,950	144,810	18,140	15
Winger to St. Catharines..	49.38	529,576	519,844	9,732	50
Total..............	3,013.33	9,741,513	9,437,785	304,464	....

[1]This transmission line shows a gain of 736 M cubic feet.

	M cu. ft.
Actual leakage...	304,464
Gain[1]...	736
Net loss..	303,728

Licenses Issued in 1945

The Natural Gas Conservation Act, R. S. O. 1937, The Well Drillers' Act, R. S. O. 1937, and the Regulations made under these Acts require that the several operations carried out shall be done under license. Tables X to XIV show a list of those to whom licenses were issued during 1945. The licenses required under the above Acts and the cost of each are as follows:—

To Lease and Prospect for Natural Gas.........................	$5.00
To Drill or Bore for Natural Gas or Oil.........................	5.00
To Produce Natural Gas..................................	10.00
To Distribute Natural Gas.................................	10.00
To Operate Natural Gas Pipe-Lines.........................	10.00

TABLE X—OPERATORS LICENSED TO LEASE AND PROSPECT FOR NATURAL GAS, 1945

License No.	Name	Address
6138	Adams, L. L.	Kitchener, Ont.
6163	Anderson, C. W.	Toronto, Ont.
6104	Back, M.	Toronto, Ont.
6130	Barnhart, C.	Chatham, Ont.
6149	Bessey, C. J.	Niagara Falls, Ont.
6139	Blackwell, G. A.	Port Colborne, Ont.
6102	Brooker, O.	Leamington, Ont.
6173	Camlachie Oils Explorations, Ltd.	Toronto, Ont.
6136	Canolkla Drillers, Ltd.	Kitchener, Ont.
6112	Chalton, W. E.	Ingersoll, Ont.
6147	Coates, W. A.	Tillsonburg, Ont.
6117	Collard, A. P.	Dunville, Ont.
6118	Coste, E. F.	Toronto, Ont.
6119	Coste, Eugene, and Co.	Toronto, Ont.
6125	Coste, L. A.	Toronto, Ont.
6177	Cronk, S. W.	Fisherville, Ont.
6141	Dolphin, H. J.	Strathroy, Ont.
6148	Drake, E. A.	Walkerville, Ont.
6154	Evans, G. R.	Tillsonburg, Ont.
6133	Evans, H. L.	Tillsonburg, Ont.
6134	Forrest, W. L.	Goderich, Ont.
6161	Freer, C.	Kerrwood, Ont.
6116	Fretz, C. G.	Ridgeway, Ont.
6113	Gillis, A.	Selkirk, Ont.
6123	House, C. C.	Stevensville, Ont.
6168	Imperial Oil, Ltd.	Toronto, Ont.
6150	Irvine, E.	Toronto, Ont.
6115	Jamieson, A. H.	Tillsonburg, Ont.
6110	Jasperson, Bon	Kingsville, Ont.
6144	Jenkins, S. S.	Buffalo, N.Y.
6166	Joelson, J. L.	Brantford, Ont.
6121	Jones, J. P.	Toronto, Ont.
6160	Katzenmeir, W. H.	Rodney, Ont.
6169	Kennedy, W. D.	Detroit, Mich.
6135	Kidd, L. W.	Listowel, Ont.
6101	Kiff, H.	Leamington, Ont.
6107	Kiff, W.	Leamington, Ont.
6151	Liley, A. E.	Detroit, Mich.
6111	Lymburner Bros. and Webber	Dunnville, Ont.
6142	McGill, J.	Bothwell, Ont.
6103	McKillop, Wm.	Hamilton, Ont.
6171	McPherson, Ross	Windsor, Ont.
6159	Mehlenbacher, L. B.	Cayuga, Ont.
6106	Morris, E. R.	St. Louis, Mich.
6137	Newton, C. F.	Dundas, Ont.
6188	Oag, E. V.	Toronto, Ont.
6108	Patton, W. J.	Toronto, Ont.
6162	Quinn, M. M.	Buffalo, N.Y.
6124	Rahn, C. H.	Grimsby, Ont.
6128	Reaume, H.	Chatham, Ont.
6105	Reicheld, F. W.	Jarvis, Ont.
6131	Reichheld, O. E.	Chatham, Ont.
6174	Roth, E. A.	Detroit, Mich.
6176	Sackett, E. H.	Buffalo, N.Y.
6126	Sadlier, L.	Chatham, Ont.
6127	Scullard, F. B.	Chatham, Ont.
6152	Sider, Ralph	Ridgeway, Ont.
6114	Smiley, T.	Blackheath, Ont.
6194	Smith, James H.	St. Thomas, Ont.
6129	Stevens, W.	Chatham, Ont.
6145	Stewart, E.	Jarvis, Ont.
6233	Stover, R. M.	Highgate, Ont.
6132	Thompson, J.	Chatham, Ont.
6109	Tidy, C. P.	Toronto, Ont.
6157	Treleaven, A.	London, Ont.

TABLE X—OPERATORS LICENSED TO LEASE AND PROSPECT FOR NATURAL GAS, 1945—*Continued*

License No.	Name	Address
6172	Tyrill, E. W.	Fort Erie North, Ont.
6140	Walker, C. R.	Windsor, Ont.
6160	Walsh, J. F.	Buffalo, N.Y.
6122	Welland County Gas Syndicate	Stevensville, Ont.
6156	West Petroleum, Ltd.	Toronto, Ont.
6170	Whittal, F.	Amherstburg, Ont.
6155	Wilson, E. R.	Peterborough, Ont.

TABLE XI—OPERATORS LICENSED TO DRILL OR BORE FOR NATURAL GAS OR OIL, 1945

License No.	Name	Address
1451	Ashton, J. L.	Chatham, Ont.
1452	Ashton, J. L.	Chatham, Ont.
1473	Boileau, E.	Montreal, Que.
1474	Boileau, E.	Montreal, Que.
1475	Boileau, E.	Montreal, Que.
1410	Collard, A. P.	Dunnville, Ont.
1434	Culver, Marvin	Selkirk, Ont.
1477	Culver and Havill	Stevensville, Ont.
1436	Dennis, Gordon A.	Selkirk, Ont.
1426	Dolphin, N. P.	Strathroy, Ont.
1453	Dominion Petroleum Co., Ltd.	Glencoe, Ont.
1444	Earl, S. B.	Kerrwood, Ont.
1402	Elk Development Syndicate	Dunnville, Ont.
1448	Emerson, Harry L.	Dunnville, Ont.
1449	Emerson and Rose	Wainfleet, Ont.
1429	Evans, Harry	Tillsonburg, Ont.
1430	Evans, Harry	Tillsonburg, Ont.
1481	Evans, Harry	Tillsonburg, Ont.
1482	Evans, Harry	Tillsonburg, Ont.
1495	Garringer, W.	Dunnville, Ont.
1483	Harris, W.	Jarvis, Ont.
1472	Hodgson, R.	Cayuga, Ont.
1445	Holmes, E. B.	Bothwell, Ont.
1459	Hoover, A. E.	Selkirk, Ont.
1460	Hoover, A. E.	Selkirk, Ont.
1461	Hoover and Donald	Selkirk, Ont.
1413	House, C. C.	Stevensville, Ont.
1414	House, C. C.	Stevensville, Ont.
1476	Hussey, W. J.	Petrolia, Ont.
1480	Imperial Oil, Ltd.	Toronto, Ont.
1469	Irving, D.	Dunnville, Ont.
1408	Jackson, P. L., and Co.	Dunnville, Ont.
1409	Jackson, P. L., and Co.	Dunnville, Ont.
1463	James and Dempster	Selkirk, Ont.
1397	Jasperson, Bon	Kingsville, Ont.
1398	Kiser Bros.	Chatham, Ont.
1399	Kiser Bros.	Chatham, Ont.
1400	Kiser Bros.	Chatham, Ont.
1401	Kiser Bros.	Chatham, Ont.
1465	Lather, D.	Thamesville, Ont.
1403	Lymburner Bros. and Webber	Dunnville, Ont.
1416	McKechnie, S.	Dunnville, Ont.
1417	McKechnie, S.	Dunnville, Ont.
1418	McKechnie, S.	Dunnville, Ont.
1419	McKechnie, S.	Dunnville, Ont.
1420	McKechnie, S.	Dunnville, Ont.
1421	McKechnie, S.	Dunnville, Ont.
1422	McKechnie, S.	Dunnville, Ont.

TABLE XI—OPERATORS LICENSED TO DRILL OR BORE FOR NATURAL GAS OR OIL, 1945—*Continued*

License No.	Name	Address
1423	McKechnie, S.	Dunnville, Ont.
1424	McKechnie, S.	Dunnville, Ont.
1425	McKechnie, S.	Dunnville, Ont.
1394	McKillop, Wm.	Hamilton, Ont.
1462	McLister, J. J.	Dunnville, Ont.
1437	McMaster, W. R.	Caledonia, Ont.
1454	McPherson, Ross	Windsor, Ont.
1464	Mandley, Roy	Dunnville, Ont.
1396	Morris, E. R.	St. Louis, Mich.
1446	Mott, G. L.	Lynden, Ont.
1438	Nagel, E.	Stevensville, Ont.
1467	Nauman, T. J. and H. V.	Fisherville, Ont.
1405	Patterson and Culver	Dunnville, Ont.
1404	Patterson, Culver, and Patterson	Dunnville, Ont.
1407	Perkins, J. E.	Dunnville, Ont.
1431	Port Colborne-Welland Gas and Oil Co., Ltd.	Port Colborne, Ont.
1478	Rawlings, G. H.	Chatham, Ont.
1427	Ricker, Arthur	Canboro', Ont.
1406	Roth, F.	Dunnville, Ont.
1412	Rugg, P. E.	Ridgeway, Ont.
1456	Shank, E.	Selkirk, Ont.
1457	Shank, E.	Selkirk, Ont.
1458	Shaw, S. D.	Chatham, Ont.
1411	Smith and Ehde	Lowbanks, Ont.
1443	Stanley and McCrie	Bothwell, Ont.
1435	Stewart, Elgin	Jarvis, Ont.
1470	Stover and Rawlings	Chatham, Ont.
1471	Stover and Rawlings	Chatham, Ont.
1441	Stubble, H. H.	Chatham, Ont.
1395	Swayze and Nauman	Simcoe, Ont.
1455	Swent, W. N.	Selkirk, Ont.
1428	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
1450	Walter Gas Syndicate, Ltd.	Simcoe, Ont.
1468	Warren, Gordon R.	Canboro', Ont.
1442	W. C. Patterson Gas Co., Ltd.	Jamestown, N.Y.
1466	Werner, D.	Fisherville, Ont.
1447	Wilson-Sullivan Development Co., Ltd.	Sarnia, Ont.
1393	Windover, Wm.	Sarnia, Ont.

TABLE XII—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1945

License No.	Name	Address
1806	Achilles Oil and Gas Synd. and P. L. Jackson	Toronto, Ont.
1824	Ajax Oil and Gas Co., Ltd.	Toronto, Ont.
1845	Aloka Oil and Gas Co., Ltd.	Toronto, Ont.
1841	Amer-Can Gas and Oil Co.	Chatham, Ont.
1863	Barnhart, E.	Stevensville, Ont.
1833	Bates, G. J. and N.	Humberstone, Ont.
1878	Beacon Natural Gas Syndicate	Kitchener, Ont.
1807	Beaver Oil and Gas Synd. and P. L. Jackson	Toronto, Ont.
1937	Benner, K. W.	Fisherville, Ont.
1924	Bertie Township Gas and Oil Syndicate	Fisherville, Ont.
1940	Bliss, D. E.	Tillsonburg, Ont.
1849	Brindley and Harper	Dunnville, Ont.
1877	Broadway Gas Syndicate	Cayuga, Ont.
1835	Buck, C. S.	Port Rowan, Ont.
1901	Burchell Natural Gas and Oil Syndicate	Listowel, Ont.
1831	Canadian Natural Gas Syndicate	Simcoe, Ont.
1916	Canfield Gas Syndicate	Windsor, Ont.
1836	Canfield Natural Gas Co., Ltd.	Dunnville, Ont.
1905	Cartwright, S. E.	Detroit, Mich.
1842	Central Pipe Line Co., Ltd.	Chatham, Ont.

TABLE XII—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1945—*Continued*

License No.	Name	Address
1927	Central Seneca Gas Syndicate	Cayuga, Ont.
1880	Columbia Natural Gas and Oil Co., Ltd.	Hamilton, Ont.
1921	Coronation Gas Syndicate	Stevensville, Ont.
1888	Dain City Gas Syndicate	Welland, Ont.
1832	Dawson, Ralph	Merlin, Ont.
1872	Delhi Gas Syndicate	Cayuga, Ont.
1892	Dereham Gas and Oil Co., Ltd.	Toronto, Ont.
1817	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
1808	Dorset Oil and Gas Synd. and P. L. Jackson	Toronto, Ont.
1899	Dunn Natural Gas Co., Ltd.	St. Catharines, Ont.
1902	Dunnville-Detroit Gas Syndicate	Detroit, Mich.
1827	Economy Natural Gas Syndicate	Stratford, Ont.
1934	Elgin Prospecting Syndicate	Sherkston, Ont.
1812	Elk Development Syndicate	South Cayuga, Ont.
1850	Emerson, Harry L.	Dunnville, Ont.
1844	Featherstone, Roy	Caledonia, Ont.
1847	Fisherville Gas Co.	Fisherville, Ont.
1879	Fleet Aircraft, Ltd.	Fort Erie North, Ont.
1884	Fletcher, E.	Glandford Station, Ont.
1903	Gas Producers Syndicate	Detroit, Mich.
1881	Gifford, A., and Son	Cayuga, Ont.
1822	Glenney, Elizabeth A.	Dunnville, Ont.
1811	Grand River Gas and Oil Syndicate	Canfield, Ont.
1852	Grimsby Natural Gas Co., Ltd.	Grimsby, Ont.
1871	Haldimand Gas Syndicate	Cayuga, Ont.
1865	Haldimand Natural Gas Syndicate	Stevensville, Ont.
1920	Heath-Pryor Gas Producers	Detroit, Mich.
1928	Hiawatha Gas and Oil Co.	Hamilton, Ont.
1840	Highbank Oil, Ltd.	Chatham, Ont.
1890	Houk Syndicate	Dunnville, Ont.
1838	House, C. C.	Stevensville, Ont.
1885	Ideal Gas Syndicate	Fisherville, Ont.
1818	Jackson, P. L.	Dunnville, Ont.
1820	Jackson and Graff Syndicate	Dunnville, Ont.
1810	Jasperson, Bon	Kingsville, Ont.
1904	Jenkins, S. S.	Buffalo, N.Y.
1933	Kerr, R.	York, Ont.
1914	Lake Erie Gas Co.	Toronto, Ont.
1913	Lake Shore Gas and Oil Syndicate	Stevensville, Ont.
1823	Lincoln Natural Gas, Ltd.	Fort Erie North, Ont.
1893	Little, R. W.	Toronto, Ont.
1906	Locators Oils, Ltd.	Toronto, Ont.
1866	Lomac Gas and Oil Co., Ltd.	Port Stanley, Ont.
1895	McDougall, S. A.	Toronto, Ont.
1851	McKechnie, S.	Dunnville, Ont.
1873	Mehlenbacher, L. B.	Cayuga, Ont.
1923	Midfield Gas Corp., Ltd.	Toronto, Ont.
1843	Minor and Luck	Cheltenham, Ont.
1869	Mohawk Gas and Oil Syndicate	Hamilton, Ont.
1925	Monarch Gas and Oil Syndicate	Fisherville, Ont.
1919	Morningstar, Roy	Stevensville, Ont.
1926	Niagara Gas Syndicate	Fisherville, Ont.
1819	Niece, E.	Lowbanks, Ont.
1814	North Cayuga Gas Syndicate	Cayuga, Ont.
1815	North Shore Gas Co.	Selkirk, Ont.
1816	Patterson and Culver	Dunnville, Ont.
1923	Peacock Point Gas and Oil Syndicate	Fisherville, Ont.
1862	Petrol Oil and Gas Co., Ltd.	Toronto, Ont.
1839	Pine Ridge Gas Co., Ltd.	Port Stanley, Ont.
1896	Port Colborne-Welland Gas and Oil Co., Ltd.	Port Colborne, Ont.
1828	Povec Gas Syndicate	Tillsonburg, Ont.
1861	Prairie Gas and Oil Co., Ltd.	Toronto, Ont.
1826	Provincial Gas Co., Ltd.	Fort Erie North, Ont.
1870	Rainham Gas Syndicate	Cayuga, Ont.
1805	Reicheld, F. W.	Jarvis, Ont.
1854	Ricker, A.	Canboro', Ont

TABLE XII—OPERATORS LICENSED TO PRODUCE NATURAL GAS, 1945—*Continued*

License No.	Name	Address
1829	Romney Oil and Gas Co., Ltd.	Toronto, Ont.
1857	Roth, F. and H.	Dunnville, Ont.
1897	Rowe, E. P., Estate	Toronto, Ont.
1848	Royal Gas Syndicate	Stevensville, Ont.
1809	Ryrsie Oil and Gas Synd. and P. L. Jackson	Toronto, Ont.
1893	Salina Gas Co., Ltd.	Chatham, Ont.
1931	Sandusk Gas Syndicate	Fisherville, Ont.
1900	Sarnia Oil and Gas Co., Ltd.	Toronto, Ont.
1912	Sherk, Perry	Sherkston, Ont.
1918	Sherk and Carruthers	Sherkston, Ont.
1911	Sherk and Learn	Sherkston, Ont.
1889	Sherk and Nagel	Stevensville, Ont.
1908	Shurr and Shank	Jarvis, Ont.
1864	Sider, A. and J.	Stevensville, Ont.
1938	Sider, Norman	Sherkston, Ont.
1821	Smith and Ehde	Lowbanks, Ont.
1867	Springvale Gas and Oil Co., Ltd.	Hagersville, Ont.
1922	Standard Gas and Oil Syndicate	Fisherville, Ont.
1891	Star Gas Syndicate	Ridgeway, Ont.
1846	Sterling Gas Co., Ltd.	Guelph, Ont.
1907	Stevensville Natural Gas and Fuel Co.	Stevensville, Ont.
1941	Stewart, Elgin	Jarvis, Ont.
1915	Stewart and Stewart	Jarvis, Ont.
1834	Stover, F. H., and Associates	Chatham, Ont.
1929	Stromwell Gas Co.	Tillsonburg, Ont.
1853	Sundy Gas Wells	Dunnville, Ont.
1886	Superior Gas Syndicate	Fisherville, Ont.
1858	Tanner, F. O.	Detroit, Mich.
1930	Till Gas Syndicate	Tillsonburg, Ont.
1856	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
1830	Victoria Gas Co.	Dunnville, Ont.
1917	Victory Oil and Gas Co.	London, Ont.
1859	Wainfleet Gas Co., Ltd.	Jamestown, N.Y.
1876	Walpole Gas Syndicate No. 1	Cayuga, Ont.
1875	Walpole Gas Syndicate No. 2	Cayuga, Ont.
1887	Walter Gas Syndicate, Ltd.	Simcoe, Ont.
1860	W. C. Patterson Gas Co., Ltd.	Jamestown, N.Y.
1837	Welland County Gas Syndicate	Stevensville, Ont.
1898	Western Ontario Natural Gas Co., Ltd.	St. Catharines, Ont.

TABLE XIII—OPERATORS LICENSED TO DISTRIBUTE NATURAL GAS, 1945

License No.	Name	Address
735	Beachville Gas Syndicate	Beachville, Ont.
706	Belmont Gas Co.	Windsor, Ont.
689	Canfield Natural Gas Co., Ltd.	Dunnville, Ont.
690	Central Pipe Line Co., Ltd	Chatham, Ont.
697	City Gas Co. of London	London, Ont.
685	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
705	Dunn Natural Gas Co., Ltd.	St. Catharines, Ont.
699	Emerson, Harry L.	Dunnville, Ont.
691	Fisherville Gas Co.	Fisherville, Ont.
701	Fonthill-Ridgeville Gas Co., Ltd.	Portland, Ind.
693	Grimsby Natural Gas Co., Ltd.	Grimsby, Ont.
703	Houk Syndicate	Dunnville, Ont.
723	Jackson, P. L.	Dunnville, Ont.
684	Jasperson, Bon	Kingsville, Ont.
702	Leamington, Town of	Leamington, Ont.
686	Midfield Gas Corp., Ltd.	Toronto, Ont.
692	Norotto Gas Co., Ltd.	Norwich, Ont.
683	Oil Springs Oil and Gas Co., Ltd.	Oil Springs, Ont.
694	Oxford Pipe Line Co., Ltd.	Toronto, Ont.

TABLE XIII—OPERATORS LICENSED TO DISTRIBUTE NATURAL GAS, 1945—*Continued*

License No.	Name	Address
704	Port Colborne-Welland Gas and Oil Co., Ltd.	Port Colborne, Ont.
687	Provincial Gas Co., Ltd.	Fort Erie North, Ont.
700	Springvale Gas and Oil Co., Ltd.	Hagersville, Ont.
707	Sundy Gas Wells	Dunnville, Ont.
695	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
682	United Gas and Fuel Co. of Hamilton, Ltd.	Hamilton, Ont.
698	W. C. Patterson Gas Co., Ltd.	Jamestown, N.Y.
681	Wentworth Gas Co., Ltd.	Hamilton, Ont.
696	Windsor Gas Co., Ltd.	Windsor, Ont.

TABLE XIV—OPERATORS LICENSED TO OPERATE PIPE LINES, 1945

License No.	Name	Address
143	Central Pipe Line Co., Ltd.	Chatham, Ont.
142	Dominion Natural Gas Co., Ltd.	Buffalo, N.Y.
144	Oxford Pipe Line Co., Ltd.	Toronto, Ont.
145	Union Gas Co. of Canada, Ltd.	Chatham, Ont.
141	Wentworth Gas Co., Ltd.	Hamilton, Ont.

Logs of Wells

Logs as submitted by the drillers for the 300 gas and oil wells completed during 1945 and a few additional logs that have come to hand of wells drilled in previous years are published in the following pages. All information regarding water, oil, and gas horizons are given, but at the request of companies doing exploratory work the open flow of gas wells is not shown. In compliance with the Regulations made under authority of The Well Drillers' Act, R. S. O. 1937, Chapter 50, samples of rock cuttings have been taken from representative wells and are stored in the vaults of the Department of Mines. As time permits, these will be examined and the descriptive logs placed on record for future reference. As explained in last year's report, the practice of showing the thickness of each formation has been changed to that of showing the depth to the bottom of each formation, in order to be uniform with the practice of operating companies and facilitate their work.

ABBREVIATIONS

Con.	Concession.
E.	East.
E.P.R.	East of Plank Road.
F.C.	From Canboro'.
Ft.	Feet.
G.R.	Grand river.
L.E.S.	Lake Erie survey.
N.	North.
N.D.R.	North of Dover Road.
N.F.R.	North of Forks Road.
N.R.S.	Niagara River survey.
N.T.R.	North of Talbot Road.
Pt.	Part.
R.T.S.	River Thames survey.
S.	South.
S.D.R.	South of Dover Road.
S.E.R.	South of Egremont Road.
S.T.R.	South of Talbot Road.
Tp.	Township.

Elgin County

IMPERIAL OIL, LTD.

H. Sznydler No. 1, lot 10, con. VIII, Aldborough tp.

Completed August 15, 1945.
Dry hole.

Formation	Depth, ft.
Surface	347
Brown lime	360
Brown and grey lime	381
Brown lime	495

Fresh water at 250 and 355 feet; black water at 364 and 490 feet.

UNION GAS CO. OF CANADA, LTD.

A. and M. McMillan No. 1, lot 10, con. I, Aldborough tp.

Completed October 6, 1945.
Dry hole.

Formation	Depth, ft
Surface	175
Lime shell and soap	195
Soap	295
Soap and lime	340
Soap	365
Brown lime	512
Sharp grey lime	530
Brown lime	666
Sharp brown and grey lime	919
Brown lime	1,051
Brown and blue lime	1,087
Blue and grey lime	1,165
Brown and blue lime	1,355
Brown and grey lime	1,385
Brown lime	1,433
Grey lime	1,490
Brown lime	1,532
Grey lime	1,550
Brown lime	1,568
Grey lime	1,586
Brown lime	1,627

Show of gas at 1,397 to 1,403 feet.
Fresh water at 175 feet; sulphur water at 512 feet; salt water at 1,585 to 1,591 feet.

ROSS MCPHERSON

D. Duncanson No. 1, lot 24, con. V N., Dunwich tp.

Completed December 31, 1945.
Dry hole.

Formation	Depth, ft.
Surface	271
Lime	351

Show of oil at 326 feet.
Fresh water at 181 feet; black water at 326 feet.

CENTRAL PIPE LINE CO., LTD.

W. Schram No. 1, lot 3, con. IV, Malahide tp.

Completed November 20, 1945.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Depth, ft.
Surface	265
Black shale	302
Grey lime	356
Grey and brown lime	398
Brown lime	545
Sharp grey lime	595
Sharp brown lime	617
Sharp sand	639
Brown lime	667
Brown and grey lime	713
Grey lime and gypsum	797
Brown lime	804
Grey lime and gypsum	812
Brown lime	836
Grey lime	841
Brown lime	861
Brown and grey lime	911
Grey lime and shale	953
Brown and grey lime	1,059
Guelph	1,086

Gas at 1,065 to 1,080 feet.
Black water at 617 feet.

CENTRAL PIPE LINE CO., LTD.

J. A. Staley, No. 1, lot 25, con. VII gore, Malahide tp.

Completed April 30, 1945.
Dry hole.

Formation	Depth, ft.
Surface	223
Brown and grey lime	264
Brown sand	280
Brown lime	282

Show of gas at 264 feet.
Fresh water at 218 feet.

Essex County

DRAKE AND WALKER

M. Gibb No. 1, lot 53, con. V, Malden tp.

Completed April 20, 1945.
Dry hole.

Formation	Depth, ft.
Surface	55
Grey and brown lime	118
White sand	149

Fresh water at 52 feet.

DRAKE AND WALKER

R. Mickle No. 1, Knapp island, Malden tp.

Completed March 25, 1945.
Dry hole.

Formation	Depth, ft.
Surface	51
Grey and brown lime	128
White sand	145

Fresh water at 48 feet.

Haldimand County

DOMINION NATURAL GAS CO., LTD.

A. Bialous and J. Trznadel No. 1, lot 1, Clement tract, Canborough tp.

Completed December 29, 1945.
Producing gas well.
Rock pressure: 250 lbs.

Formation	Depth, ft.
Surface	51
Lime and shale	257
Niagara	483
Shale	538
Clinton	569
Red Medina	610
Grey shale	663
White Medina	677
Red shale	681

Gas at 540, 559, and 579 to 584 feet.
Fresh water at 51 and 180 feet.

DOMINION NATURAL GAS CO., LTD.

R. W. Cober and D. Baker No. 1, lot 3, Dochstader tract, Canborough tp.

Completed September 15, 1945.
Producing gas well.
Rock pressure: 170 lbs.

Formation	Depth, ft.
Surface	68
Grey lime	95
Lime and shale	260
Niagara	485
Shale	540
Clinton	568
Red Medina	607
Grey shale	666
White Medina	680
Red shale	696

Gas at 542 to 549 and 673 to 680 feet.
Fresh water at 66 and 74 feet.

DOMINION NATURAL GAS CO., LTD.
R. W. Cober No. 2, lot 3, Dochstader tract, Canborough tp.

Completed December 10, 1945.
Producing gas well.
Rock pressure: 150 lbs.

Formation	Depth, ft.
Surface	65
Lime and shale	270
Niagara	490
Shale	540
Clinton	573
Red Medina	608
Grey shale	668
White Medina	680
Red shale	710

Gas at 550 to 555, 593, and 670 to 677 feet.
Fresh water at 59 and 57 feet.

DOMINION NATURAL GAS CO., LTD.
E. Glenny No. 1, lot 4, Dochstader tract, Canborough tp.

Completed July 16, 1945.
Producing gas well.
Rock pressure: 255 lbs.

Formation	Depth, ft.
Surface	94
Grey lime	114
Lime and shale	263
Niagara	488
Shale	543
Clinton	570
Red Medina	612
Grey shale	670
White Medina	682
Red shale	686

Gas at 546, 588 to 592, and 678 feet.
Fresh water at 90 feet; salt and sulphur water at 360 feet.

DOMINION NATURAL GAS CO., LTD.
E. Glenny No. 2, lot 4, Dochstader tract, Canborough tp.

Completed October 19, 1945.
Producing gas well.
Rock pressure: 140 lbs.

Formation	Depth, ft.
Surface	65
Grey lime	92
Lime and shale	256
Niagara	481
Shale	536
Clinton	564
Red Medina	604
Grey shale	662
White Medina	678
Red shale	715

Gas at 538 and 673 to 678 feet.
Fresh water at 68 feet.

DOMINION NATURAL GAS CO., LTD.
M. and A. Glenny No. 1, lot, 3, Dochstader tract Canborough tp.

Completed June 20, 1945.
Producing gas well.
Rock pressure: 330 lbs.

Formation	Depth, ft.
Surface	107
Lime and shale	273
Niagara	498
Shale	550
Clinton	578
Red Medina	618
Grey shale	676
White Medina	688
Red shale	691

Gas at 553 and 570 to 572 feet; show of gas at 603 feet.
Fresh water at 100 and 130 feet.

DOMINION NATURAL GAS CO., LTD.
M. and A. Glenny No. 2, lot 3, Dochstader tract, Canborough tp.

Completed August 16, 1945.
Producing gas well.
Rock pressure: 230 lbs.

Formation	Depth, ft.
Surface	88
Lime shell	90
Grey lime	117
Lime and shale	275
Niagara	500
Shale	552
Clinton	580
Red Medina	622
Grey shale	680
White Medina	697
Red shale	725

Gas at 598 to 600 and 692 feet.
Fresh water at 80 and 98 feet; salt water at 320 feet.

DOMINION NATURAL GAS CO., LTD.
T. Keely No. 1, lot 5, Dochstader tract, Canborough tp.

Completed November 20, 1945.
Dry hole.

Formation	Depth, ft.
Surface	68
Lime and shale	272
Niagara	497
Shale	548
Clinton	580
Red Medina	622
Grey shale	678
White Medina	691
Red shale	694

Show of gas at 599 feet.
Fresh water at 72 and 205 feet

DOMINION NATURAL GAS CO., LTD.
T. Keely No. 2, lot 5, Dochstader tract, Canborough tp.

Completed November 19, 1945.
Producing gas well.
Rock pressure: 148 lbs.

Formation	Depth, ft.
Surface	81
Grey lime	107
Lime and shale	259
Niagara	484
Shale	540
Clinton	568
Red Medina	608
Grey shale	666
White Medina	680
Red shale	715

Gas at 546, 586 to 588, and 672 to 677 feet.
Fresh water at 85 feet.

DOMINION NATURAL GAS CO., LTD.
T. Keely No. 3, lot 5, Dochstader tract, Canborough tp.

Completed December 21, 1945
Producing gas well.
Rock pressure: 280 lbs.

Formation	Depth, ft.
Surface	96
Grey lime	116
Lime and shale	260
Niagara	485
Shale	545
Clinton	573
Red Medina	612
Grey shale	670
White Medina	682
Red shale	717

Gas at 548 to 552, 575 to 580, 590 to 592, and 675 to 680 feet.
Fresh water at 90 feet.

SUNDY GAS WELLS

M. Sundy No. 4, lot 1, Indian reserve, Canborough tp.

Completed October 24, 1945.
Producing gas well.
Rock pressure: 150 lbs.

Formation	Depth, ft.
Surface	77
Lime and shale	337
Niagara	537
Shale	567
Clinton	595
Red Medina	630
Grey shale	690
White Medina	700
Red shale	730

Gas at 582 feet.
Fresh water at 80 feet.

DOMINION NATURAL GAS CO., LTD

N. Bowden No.2, lot 2, con. I. S.D.R., Dunn tp.

Completed January 11, 1945.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Depth, ft.
Surface	31
Flint	40
Lime	95
Lime and shale	420
Niagara	640
Shale	704
Clinton	738
Red Medina	778
Grey shale	833
White Medina	848
Red shale	850

Gas at 734 to 738 feet.
Fresh water at 85 feet; black water at 200 feet.

DOMINION NATURAL GAS CO., LTD.

B. J. Docker No. 1, lot 4, con. IV, Dunn tp.

Completed September 8, 1945.
Producing gas well.
Rock pressure: 390 lbs.

Formation	Depth, ft.
Surface	13
Flint	48
Lime and shale	430
Niagara	655
Shale	715
Clinton	745
Red Medina	775

Gas at 733 to 738 and 763 to 770 feet.
Fresh water at 21 feet; black water at 200 feet.

DOMINION NATURAL GAS CO., LTD.

B. J. Docker No. 2, lot 4, con.IV, Dunn tp.

Completed October 23, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	20
Flint	43
Lime and shale	420
Niagara	645
Shale	708
Clinton	738
Red Medina	778
Grey shale	833
White Medina	848
Red shale	850

Gas at 738 to 744 feet.
Fresh water at 21 feet; black water at 190 feet.

DOMINION NATURAL GAS CO., LTD

B. J. Docker No. 3, lot 4, con. IV, Dunn tp.

Completed December 6, 1945.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Depth, ft.
Surface	19
Flint	45
Lime and shale	420
Niagara	645
Shale	715
Clinton	745
Red Medina	785
Grey shale	840
White Medina	861
Red shale	897

Gas at 764 to 768 and 851 to 858 feet.
Fresh water at 45 feet; black water at 190 feet.

DOMINION NATURAL GAS CO., LTD.

C. Finkbeiner No. 1, lot 3, con. I, S. D. R., Dunn tp.

Completed March 12, 1945.
Producing gas well.
Rock pressure: 315 lbs.

Formation	Depth, ft.
Surface	36
Flint	45
Lime	105
Lime and shale	425
Niagara	650
Shale	714
Clinton	744
Red Medina	784
Grey shale	839
White Medina	860
Red shale	861

Gas at 747 to 751 feet.
Fresh water at 85 feet; black water at 210 feet.

DOMINION NATURAL GAS CO., LTD.

C. Finkbeiner No. 2, lot 3, con. I, S. D. R., Dunn tp.

Completed April 16, 1945.
Producing gas well.
Rock pressure: 330 lbs.

Formation	Depth, ft.
Surface	31
Flint	45
Lime	85
Lime and shale	422
Niagara	647
Shale	712
Clinton	742
Red Medina	782
Grey shale	837
White Medina	852
Red shale	855

Gas at 715 to 718 and 768 to 770 feet.
Fresh water at 50 and 145 feet.

DOMINION NATURAL GAS CO., LTD.

G. Schwanz No. 1, lot 3, con. IV, Dunn tp.

Completed June 1, 1945.
Producing gas well.
Rock pressure: 390 lbs.

Formation	Depth, ft.
Surface	28
Flint	53
Lime and shale	420
Niagara	645
Shale	712
Clinton	742
Red Medina	782
Grey shale	837
White Medina	852
Red shale	860

Gas at 744 to 746 feet; show of gas at 836 to 837 feet.
Fresh water at 76 and 105 feet.

DOMINION NATURAL GAS CO., LTD.
G. Schwanz No. 2, lot 3, con. IV, Dunn tp.

Completed July 16, 1945.
Producing gas well.
Rock pressure: 310 lbs.

Formation	Depth, ft.
Surface	23
Flint	48
Lime and shale	420
Niagara	645
Shale	715
Clinton	747
Red Medina	787
Grey shale	842
White Medina	859
Red shale	860

Gas at 742 to 747 feet.
Fresh water at 31 feet.

P. L. JACKSON
M. Borbath No. 1, south side of Port Maitland Rd., Dunn tp.

Completed May 28, 1945.
Producing gas well.
Rock pressure: 135 lbs.

Formation	Depth, ft.
Surface	35
Lime and shale	310
Niagara	570
Shale	630
Clinton	660
Red Medina	695
Shale	775
White Medina	787
Red shale	802

Gas at 785 feet.
Fresh water at 85 feet.

W. C. PATTERSON GAS CO., LTD.
F. Clark No. 1, lot 6, con. I, N.D.R., Dunn tp.

Completed March 23, 1945.
Dry hole.

Formation	Depth, ft.
Surface	53
Shale	65
Lime and shale	360
Niagara	585
Clinton	617
Red Medina	655
Shale	710
White Medina	725
Red shale	730

Show of gas at 650 feet.
Fresh water at 90 feet; sulphur water at 120 feet.

DOMINION NATURAL GAS CO., LTD.
M. A. Poole No. 2, lot 9, range II, G. R., Moulton tp.

Completed May 28, 1945.
Producing gas well
Rock pressure: 140 lbs.

Formation	Depth, ft.
Surface	80
Shale	310
Niagara	550
Shale	595
Clinton	625
Red Medina	660
Grey shale	720
White Medina	734
Red shale	769

Show of gas at 645 feet; gas at 731 to 734 feet.
Fresh water at 77 and 91 feet.

DOMINION NATURAL GAS CO., LTD.
M. A. Poole No.3, lot 9, range II, G. R., Moulton tp.

Completed July 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	74
Shale	314
Niagara	537
Shale	585
Clinton	613
Red Medina	653
Grey shale	713
White Medina	723
Red shale	724

Fresh water at 70 and 90 feet.

DOMINION NATURAL GAS CO., LTD.
J. and M. Rohaly No. 1, lot 3, range N.F.R., Moulton tp.

Completed August 30, 1945.
Dry hole.

Formation	Depth, ft.
Surface	100
Shale	250
Niagara	450
Shale	500
Clinton	535
Red Medina	575
Grey shale	630
White Medina	640
Red shale	641

Fresh water at 100 and 110 feet.

DOMINION NATURAL GAS CO., LTD.
J. Upper No 1, lot 4, range N. F. R., Moulton tp.

Completed October 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	88
Shale	263
Niagara	483
Shale	530
Clinton	560
Red Medina	595
Grey shale	654
White Medina	666
Red shale	668

Show of gas at 548 and 666 feet.
Fresh water at 80 and 125 feet.

H. EMERSON
K. C. Harrington No. 1, lot 18, con. I.F.C., Moulton tp.

Completed February 15, 1945.
Producing gas well.
Rock pressure: 90 lbs.

Formation	Depth, ft.
Surface	80
Shale	170
Niagara	380
Shale	435
Clinton	465
Red Medina	520
Shale	580
White Medina	593
Shale	618

Gas at 585 feet.
Black water at 25 feet.

HOUK SYNDICATE

R. Root No. 1, Dunnville, Moulton tp.

Completed August 23, 1938.
Producing gas well.
Rock pressure: 125 lbs.

Formation	Depth, ft.
Surface	80
Lime and shale	280
Niagara	500
Lime and shale	559
Clinton	592
Red Medina	632
Grey shale	687
White Medina	699
Red shale	749

Gas at 567 and 696 feet.
Fresh water at 75 feet; sulphur water at 230 feet.

SMITH AND EHDE

A. Deamude No. 1, lot 6, gore B, Moulton tp.

Completed April 12, 1945.
Dry hole

Formation	Depth, ft.
Surface	106
Lime and shale	311
Niagara	514
Guelph	525
Shale	588
Clinton	620
Red Medina	663
Grey shale	716
White Medina	726
Red shale	728

Fresh water at 106 feet; sulphur water at 300 feet.

DOMINION NATURAL GAS CO., LTD.

H. Gifford No. 3, lot 14, con. II, North Cayuga tp.

Completed March 24, 1945.
Producing gas well.
Rock pressure: 215 lbs.

Formation	Depth, ft.
Surface	57
Lime and shale	306
Niagara	539
Shale	591
Clinton	622
Red Medina	662
Grey shale	714
White Medina	730
Red shale	734

Gas at 599, 618, and 717 to 719 feet.
Fresh water at 80 feet; sulphur water at 115 feet.

DOMINION NATURAL GAS CO., LTD.

J. H. Gifford No. 1, lot 14, con. III, North Cayuga tp.

Completed June 11, 1945.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Depth, ft.
Surface	59
Lime and shale	312
Niagara	546
Shale	596
Clinton	626
Red Medina	664
Grey shale	719
White Medina	738
Red shale	740

Show of gas at 599 feet; gas at 624 to 630 and 630 to 635 feet.
Fresh water at 60 feet.

DOMINION NATURAL GAS CO., LTD.

J. H. Gifford No. 2, lot 14, con. III, North Cayuga tp.

Completed July 12, 1945.
Producing gas well.
Rock pressure: 275 lbs.

Formation	Depth, ft.
Surface	60
Lime and shale	302
Niagara	534
Shale	584
Clinton	664
Red Medina	704
Grey shale	759
White Medina	781
Red shale	803

Show of gas at 588 feet; gas at 592 to 597, 614 to 629, and 723 to 728 feet.
Fresh water at 67 feet; black water at 160 feet.

DOMINION NATURAL GAS CO., LTD.

N. S. Link No. 1, lot 10, Jones tract, North Cayuga tp.

Completed December 27, 1945.
Dry hole.

Formation	Depth, ft.
Surface	15
Flint	30
Lime and shale	416
Niagara	647
Shale	704
Clinton	730
Red Medina	772
Grey shale	831
White Medina	845
Red shale	849

Fresh water at 47 feet; black water at 90 feet.

DOMINION NATURAL GAS CO., LTD.

J. E. Rae No. 2, lot 13, con. III, North Cayuga tp.

Completed November 29, 1945.
Producing gas well.
Rock pressure: 295 lbs.

Formation	Depth, ft.
Surface	58
Lime and shale	305
Niagara	537
Shale	590
Clinton	622
Red Medina	659
Grey shale	713
White Medina	733
Red shale	737

Gas at 598 and 622 to 627 feet.
Fresh water at 61 feet; sulphur water at 90 feet.

DOMINION NATURAL GAS CO., LTD.

J. E. Rae No. 1, N. pt. lot 14, con. III, North Cayuga tp.

Completed August 14, 1945.
Dry hole.

Formation	Depth, ft.
Surface	73
Lime and shale	312
Niagara	542
Shale	593
Clinton	624
Red Medina	663
Grey shale	717
White Medina	735
Red shale	738

Show of gas at 602, 621, and 734 feet.
Fresh water at 75 feet.

DOMINION NATURAL GAS CO., LTD.
J. E. Rae No. 1, S. pt. lot 14, con. III, North Cayuga tp.

Completed October 24, 1945.
Producing gas well.
Rock pressure: 265 lbs.

Formation	Depth, ft.
Surface	67
Lime and shale	306
Niagara	536
Shale	586
Clinton	617
Red Medina	655
Grey shale	713
White Medina	733
Red shale	737

Gas at 628 and 643 to 653 feet.
Fresh water at 69 feet; sulphur water at 210 feet.

DOMINION NATURAL GAS CO., LTD.
J. E. Rae No. 2, N. pt. lot 14, con, III, North Cayuga tp.

Completed September 18, 1945.
Producing gas well.
Rock pressure: 320 lbs.

Formation	Depth, ft.
Surface	65
Lime and shale	315
Niagara	545
Shale	596
Clinton	626
Red Medina	663
Grey shale	715
White Medina	733
Red shale	737

Show of gas at 604 feet; gas at 626 to 631 feet; show of gas at 733 feet.
Fresh water at 65 feet.

DOMINION NATURAL GAS CO., LTD.
J. E. Rae No. 1, lot 15, con. III, North Cayuga tp.

Completed January 29, 1945.
Dry hole.

Formation	Depth, ft.
Surface	67
Lime and shale	319
Niagara	549
Shale	601
Clinton	637
Red Medina	674
Grey shale	724
White Medina	737
Red shale	739

Show of gas at 633 to 635 feet.
Fresh water at 66 feet; sulphur water at 120 feet.

DOMINION NATURAL GAS CO., LTD.
J. W. Tate No. 1, lot 18, Jones tract, North Cayuga tp.

Completed October 26, 1945.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Depth, ft.
Surface	19
Flint	41
Lime and shale	410
Niagara	640
Shale	689
Clinton	712
Red Medina	755
Grey shale	813
White Medina	828
Red shale	831

Gas at 728 to 742 feet.
Black water at 42 and 160 feet.

DOMINION NATURAL GAS CO., LTD.
J. W. Tate No. 2, lot 18, Jones tract, North Cayuga tp.

Completed November 22, 1945.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Depth, ft.
Surface	23
Flint	42
Lime and shale	412
Niagara	647
Shale	700
Clinton	723
Red Medina	770
Grey shale	825
White Medina	840
Red shale	849

Gas at 744 to 748 feet.
Fresh water at 42 feet; black water at 130 feet.

DOMINION NATURAL GAS CO., LTD.
F. Williams No.1, lot 13, con. II, North Cayuga tp.

Completed May 3, 1945.
Producing gas well.
Rock pressure: 215 lbs.

Formation	Depth, ft.
Surface	49
Lime and shale	295
Niagara	527
Shale	580
Clinton	610
Red Medina	651
Grey shale	702
White Medina	720
Red shale	723

Gas at 605 to 610 and 631 to 635 feet.
Fresh water at 50 feet; sulphur water at 190 feet.

GRAND RIVER GAS AND OIL SYNYDICATE
F. Murphy No. 1, lot 10, con. II, North Cayuga tp.

Completed June 27, 1945.
Producing gas well.
Rock pressure: 320 lbs.

Formation	Depth, ft.
Surface	62
Lime and shale	285
Niagara	485
White lime	535
Shale	577
Clinton	607
Red Medina	642
Blue shale	707
White Medina	717
Red shale	728

Gas at 582, 602, and 632 feet.
Fresh water at 80 feet; sulphur water at 100 feet.

GRAND RIVER GAS AND OIL SYNDICATE
J. Murphy No. 1, lot II, con. II, North Cayuga tp.

Completed August 28, 1945.
Producing gas well.
Rock pressure: 280 lbs.

Formation	Depth, ft.
Surface	66
Lime and shale	296
Niagara	497
White lime	547
Shale	589
Clinton	612
Red Medina	647
Blue shale	712
White Medina	720
Red shale	732

Gas at 630 and 717 feet.
Black water at 105 feet.

GRAND RIVER GAS AND OIL SYNDICATE
N. Murphy No. 1, lot 11, con. III, North Cayuga tp.

Completed October 26, 1945.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Depth, ft.
Surface	66
Lime and shale	301
Niagara	501
White lime	551
Shale	587
Clinton	610
Red Medina	645
Blue shale	710
White Medina	720
Red shale	725

Gas at 637 feet.
Black water at 105 feet.

GRAND RIVER GAS AND OIL SYNDICATE
Mrs. J. Smith No. 1, lot 11, con. III, North Cayuga tp.

Completed December 11, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	75
Lime and shale	310
Niagara	510
White lime	560
Shale	590
Clinton	618
Red Medina	653
Blue shale	718
White Medina	730
Red shale	733

Gas at 658, 665, and 678 feet.
Fresh water at 75 feet; black water at 100 feet.

L. B. MEHLENBACHER
R. Drinkwater No. 1, lot 43, con. II, North Cayuga tp.

Completed May 1, 1945.
Producing gas well.
Rock pressure: 325 lbs.

Formation	Depth, ft.
Surface	12
Flint	42
Lime and shale	430
Niagara	630
Blue shale	645
Guelph	657
Shale	717
Clinton	743
Red Medina	783
Grey shale	840
White Medina	855
Red shale	857

Gas at 720, 743, and 750 feet.

L. B. MEHLENBACHER
R. Drinkwater No. 2, lot 43, con. II, North Cayuga tp.

Completed November 1, 1945.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Depth, ft.
Surface	13
Flint	43
Lime and shale	410
Niagara	620
Guelph	650
Shale	710
Clinton	735
Red Medina	773
Grey shale	831
White Medina	843
Red shale	844

Gas at 725 feet.

L. B. MEHLENBACHER
A. Kindreé No. 2, lot 43, con. II, North Cayuga tp.

Completed March 16, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	24
Flint	40
Lime and shale	418
Niagara	618
Shale	630
Guelph	651
Shale	711
Clinton	741
Red Medina	776
Grey shale	836
White Medina	848
Red shale	850

Gas at 716 and 751 feet.
Fresh water at 50 feet.

L. B. MEHLENBACHER
A. Kindree No. 3, lot 43, con. II, North Cayuga tp.

Completed December 22, 1945.
Dry hole.

Formation	Depth, ft.
Surface	23
Flint	51
Lime and shale	420
Niagara	630
Shale	645
Guelph	657
Shale	715
Clinton	740
Red Medina	778
Grey shale	834
White Medina	846
Red shale	850

Fresh water at 42 feet; black water at 520 feet.

L. B. MEHLENBACHER
M. Kindree No. 2, lot 44, con. II, North Cayuga tp.

Completed May 30, 1945.
Dry hole.

Formation	Depth, ft.
Surface	18
Flint	65
Lime and shale	430
Niagara	630
Shale	638
Guelph	663
Shale	723
Clinton	746
Red Medina	786
Grey shale	842
White Medina	857
Red shale	862

Fresh water at 85 feet.

L. B. MEHLENBACHER
M. Kindree No. 3, lot 44, con. II, North Cayuga tp.

Completed September 1, 1945.
Producing gas well.
Rock pressure: 305 lbs.

Formation	Depth, ft.
Surface	8
Flint	63
Lime and shale	435
Niagara	640
Blue shale	648
Guelph	668
Shale	723
Clinton	748
Red Medina	793
Grey shale	858
White Medina	873
Red shale	878

Gas at 753 and 758 feet.
Sulphur water at 29 and 90 feet.

L. B. MEHLENBACHER

M. Kindree No. 4, lot 44, con. II, North Cayuga tp.

Completed August 30, 1945.
Producing gas well.
Rock pressure: 305 lbs.

Formation	Depth, ft.
Surface	8
Flint	63
Lime and shale	435
Niagara	640
Blue shale	648
Guelph	668
Shale	723
Clinton	748
Red Medina	793
Grey shale	858
White Medina	873
Red shale	878

Gas at 753 and 758 feet.
Sulphur water at 28 and 90 feet.

WADEL BROS.

Wadel Bros. No. 1, village of Cayuga, North Cayuga tp.

Completed February 6, 1945.
Dry hole.

Formation	Depth, ft.
Surface	38
Lime and shale	300
Niagara	518
Shale	556
Clinton	583
Red Medina	623
Grey shale	680
White Medina	690
Red shale	695

Fresh water at 53 feet; black water at 85 feet.

WALPOLE GAS SYNDICATE No. 1

R. Kohler No. 3, lot 31, con. I N.T.R., North Cayuga tp.

Completed March 29, 1945.
Producing gas well.
Rock pressure: 210 lbs.

Formation	Depth, ft.
Surface	40
Lime and shale	280
Niagara	510
Shale	555
Clinton	585
Red Medina	630
Grey shale	686
White Medina	698
Red shale	700

Gas at 575 and 602 feet.
Black water at 150 feet.

WALPOLE GAS SYNDICATE No. 1

R. Kohler No. 4, lot 31, con. I, N.T.R., North Cayuga tp.

Completed June 5, 1945.
Dry hole.

Formation	Depth, ft.
Surface	58
Lime and shale	257
Niagara	510
Shale	555
Clinton	585
Red Medina	630
Grey shale	686
White Medina	698
Red shale	700

DOMINION NATURAL GAS CO., LTD.

A. Ackwood No. 4, block B, Anderson Van Avery block, Oneida tp.

Completed October 4, 1945.
Producing gas well.
Rock pressure: 142 lbs.

Formation	Depth, ft.
Surface	59
Lime and shale	218
Niagara	441
Shale	495
Clinton	521
Red Medina	559
Grey shale	609
White Medina	619
Red shale	621

Gas at 503 and 510 feet.
Fresh water at 100 feet; sulphur water at 205 feet.

DOMINION NATURAL GAS CO., LTD.

G. Bundy No. 1, lot 42, con. V, Oneida tp.

Completed July 14, 1945.
Dry hole.

Formation	Depth, ft.
Surface	59
Lime and shale	280
Niagara	493
Shale	553
Clinton	577
Red Medina	615
Grey shale	665
White Medina	678
Red shale	682

Show of gas at 570 feet.
Fresh water at 66 and 90 feet.

DOMINION NATURAL GAS CO., LTD.

A. T. and M. Smith No. 1, lot 30, E.P.R., Oneida tp.

Completed June 29, 1945.
Dry hole.

Formation	Depth, ft.
Surface	7
Flint	29
Lime and shale	415
Niagara	656
Shale	708
Clinton	731
Red Medina	773
Grey shale	830
White Medina	840
Red shale	843

Show of gas at 709 and 729 feet.
Fresh water at 56 and 96 feet; sulphur water at 184 feet.

DOMINION NATURAL GAS CO., LTD.

I. Smith No. 1, lot 14, con. II, Oneida tp.

Completed May 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	46
Lime and shale	345
Niagara	561
Shale	622
Clinton	651
Red Medina	685
Grey shale	739
White Medina	751
Red shale	754

Fresh water at 64 and 108 feet; sulphur water at 205 feet.

Dominion Natural Gas Co., Ltd.
A. and A. Webb No. 1, lot 28, con. I, E.P.R., Oneida tp.

Completed August 28, 1945.
Producing gas well.
Rock pressure: 310 lbs.

Formation	Depth, ft.
Surface	10
Lime and shale	410
Niagara	620
Shale	691
Clinton	731
Red Medina	758
Grey shale	807
White Medina	817
Red shale	820

Gas at 707 and 730 feet.
Fresh water at 40 and 79 feet.

Dominion Natural Gas Co., Ltd.
A. and A. Webb No. 2, lot 28, con. I, E.P.R., Oneida tp.

Completed October 9, 1945.
Dry hole.

Formation	Depth, ft.
Surface	2
Lime and shale	402
Niagara	611
Shale	690
Clinton	715
Red Medina	750
Grey shale	805
White Medina	815
Red shale	819

Fresh water at 45, 78, and 245 feet.

Big Seven Gas Syndicate
G. Ullman No. 1, lot 19, con. I, Rainham tp.

Completed February 22, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	15
Flint	55
Lime and shale	421
Niagara	652
Shale	705
Clinton	733
Red Medina	776
Shale	836
White Medina	848
Red shale	850

Gas at 709, 743, 749, and 756 feet.
Fresh water at 53 and 120 feet.

Big Seven Gas Syndicate
G. Ullman No. 2, lot, 19 con. I, Rainham tp.

Completed March 31, 1945.
Dry hole.

Formation	Depth, ft.
Surface	11
Flint	55
Lime and shale	425
Niagara	650
Shale	709
Clinton	737
Red Medina	780
Shale	842
White Medina	852
Red shale	855

Fresh water at 38 and 90 feet.

Big Seven Gas Syndicate
R. Ullman No. 1, lot 20, con. I, Rainham tp.

Completed May 19, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	5
Flint	40
Lime and shale	415
Niagara	640
Shale	693
Clinton	725
Red Medina	764
Shale	824
White Medina	834
Red shale	836

Gas at 696 and 725 feet.
Fresh water at 12 and 68 feet.

W. C. Patterson Gas Co., Ltd.
G. Winger No. 2, lot 8, con. VI, Rainham tp.

Completed September 24, 1945.
Producing gas well.
Rock pressure: 360 lbs.

Formation	Depth, ft.
Surface	11
Flint	76
Lime and shale	440
Niagara	679
Shale	724
Clinton	752
Red Medina	797
Grey shale	852
White shale	884
Red shale	929

Gas at 768 and 872 feet.
Fresh water at 26 feet; sulphur water at 146 feet.

W. C. Patterson Gas Co., Ltd.
G. Winger No. 3, lot 8, con. VII, Rainham tp.

Completed November 10, 1945.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Depth, ft.
Surface	10
Flint	80
Shale	445
Niagara	668
Shale	728
Clinton	758
Red Medina	800
Shale	850

Gas at 736 to 756 feet.
Fresh water at 45 feet; sulphur water at 400 feet.

Ryrsie Oil and Gas Syndicate
W. Messner No.1, lot 19, con. II, Rainham tp.

Completed September 25, 1945.
Producing gas well.
Rock pressure: 285 lbs.

Formation	Depth, ft.
Surface	11
Flint	81
Lime and shale	411
Niagara	652
Shale	717
Clinton	747
Red Medina	787
Grey shale	847
White Medina	859
Red shale	871

Gas at 730 and 740 feet.
Fresh water at 72 feet.

RYRSIE OIL AND GAS SYNDICATE

Mrs. R. Sherk No. 3, lot 19, con. II, Rainham tp.

Completed May 14, 1945.
Producing gas well.
Rock pressure: 265 lbs.

Formation	Depth, ft.
Surface	16
Flint	79
Lime and shale	404
Niagara	644
Shale	704
Clinton	734
Red Medina	774
Grey shale	834
White Medina	844
Red shale	862

Gas at 714, 730, 754, and 840 feet.
Fresh water at 80 feet.

PORT COLBORNE-WELLAND GAS AND OIL CO., LTD.

J. H. Cummings No. 1, lot 4, Fish Carrier tract, Seneca tp.

Completed November 6, 1945.
Producing gas well.
Rock pressure: 180 lbs.

Formation	Depth, ft.
Surface	74
Lime and shale	200
Niagara	430
Shale	482
Clinton	512
Red Medina	547
Grey shale	597
White Medina	602
Red shale	652

Gas at 497 and 600 feet.
Fresh water at 50 and 72 feet.

PORT COLBORNE-WELLAND GAS AND OIL CO., LTD.

J. Martindale No. 1, lot 12, con. III, Seneca tp.

Completed September 11, 1945.
Dry hole.

Formation	Depth, ft.
Surface	60
Lime and shale	200
Niagara	440
Shale	490
Clinton	513
Red Medina	548
Grey shale	608
White Medina	612
Red shale	614

Fresh water at 60 feet; black water at 400 feet; salt water at 410 feet.

PORT COLBORNE-WELLAND GAS AND OIL CO., LTD.

W. Nelles No. 2, Davis block, Seneca tp.

Completed June 6, 1945.
Producing gas well.
Rock pressure: 225 lbs.

Formation	Depth, ft.
Surface	30
Lime and shale	190
Niagara	415
Shale	474
Clinton	501
Red Medina	531
Grey shale	599
White Medina	604
Red shale	605

Gas at 476 and 505 feet.
Fresh water at 31 feet; black water at 52 feet.

PORT COLBORNE-WELLAND GAS AND OIL CO., LTD.

J. Shannon No. 1, Nelles tract, Seneca tp.

Completed July 23, 1945.
Dry hole.

Formation	Depth, ft.
Surface	60
Lime and shale	210
Niagara	440
Shale	495
Clinton	515
Red Medina	550
Grey shale	610
White Medina	618
Red shale	620

PORT COLBORNE-WELLAND GAS AND OIL CO., LTD.

Col. Thompson Estate No. 4, ot 25, con. I, Seneca tp.

Completed January 22, 1945.
Dry hole.

Formation	Depth, ft.
Surface	40
Lime and shale	250
Niagara	470
Shale	530
Clinton	552
Red Medina	587
Grey shale	642
White Medina	654
Red shale	655

Show of gas at 547 feet.
Fresh water at 70 and 90 feet; black water at 125 feet.

WALPOLE GAS SYNDICATE NO. 1

A. Thompson Estate No. 1, lot 1, Front range, Seneca tp.

Completed July 27, 1945.
Dry hole.

Formation	Depth, ft.
Surface	54
Lime and shale	275
Niagara	506
Shale	552
Clinton	582
Red Medina	627
Grey shale	684
White Medina	696
Red shale	698

WALPOLE GAS SYNDICATE NO. 1

A. Thompson Estate No. 2, lot 3, Front range, Seneca tp.

Completed September 15, 1945.
Producing gas well.
Rock pressure: 210 lbs.

Formation	Depth, ft.
Surface	65
Lime and shale	275
Niagara	500
Shale	550
Clinton	580
Red Medina	625
Grey shale	682
White Medina	694
Red shale	697

Gas at 565 feet.

WALPOLE GAS SYNDICATE NO. 1

A. Thompson Estate No. 3, lot 5, Front range, Seneca tp.

Completed November 30, 1945.
Producing gas well.
Rock pressure: 200 lbs.

Formation	Depth, ft.
Surface	75
Lime and shale	275
Niagara	505
Shale	551
Clinton	581
Red Medina	625
Grey shale	684
White Medina	696
Red shale	698

Gas at 591 feet.
Black water at 125 feet.

DOMINION NATURAL GAS CO., LTD.

E. High No. 1, lot 23, con. V, South Cayuga tp.

Completed March 22, 1945.
Dry hole.

Formation	Depth, ft.
Surface	12
Flint	40
Lime	78
Lime and shale	415
Niagara	640
Shale	695
Clinton	723
Red Medina	763
Grey shale	818
White Medina	833
Red shale	837

Show of gas at 733 and 828 feet.
Fresh water at 38 and 65 feet; black water at 95 feet

DOMINION NATURAL GAS CO., LTD.

E. High No. 2, lot 23, con. V, South Cayuga tp.

Completed April 25, 1945.
Dry hole.

Formation	Depth, ft.
Surface	12
Flint	40
Lime	75
Lime and shale	417
Niagara	642
Shale	700
Clinton	728
Red Medina	768
Grey shale	824
White Medina	840
Red shale	843

Show of gas at 730 feet.
Fresh water at 35, 55, and 95 feet.

DOMINION NATURAL GAS CO., LTD.

G. Hoffman No. 2, lot 24, con. V, South Cayuga tp.

Completed February 10, 1945.
Producing gas well.
Rock pressure: 220 lbs.

Formation	Depth, ft.
Surface	18
Flint	44
Lime	84
Lime and shale	415
Niagara	645
Shale	699
Clinton	727
Red Medina	767
Grey shale	821
White Medina	837
Red shale	839

Gas at 703, 722, 729, 735, and 741 feet.
Fresh water at 54 and 65 feet.

DOMINION NATURAL GAS CO., LTD.

W. Kreiter No. 2, lot 14, con. VII, South Cayuga tp.

Completed September 21, 1945.
Dry hole.

Formation	Depth, ft.
Surface	15
Flint	25
Lime and shale	455
Niagara	680
Shale	736
Clinton	770
Red Medina	814
Grey shale	870
White Medina	885
Red shale	889

Fresh water at 28 feet; black water at 125 feet.

DOMINION NATURAL GAS CO., LTD.

W. Link No. 2, lot 13, con. VII, South Cayuga tp.

Completed June 25, 1945.
Producing gas well.
Rock pressure: 165 lbs.

Formation	Depth, ft.
Surface	22
Flint	37
Lime and shale	426
Niagara	653
Shale	705
Clinton	739
Red Medina	780
Grey shale	835
White Medina	850
Red shale	851

Gas at 752 and 759 to 761 feet.
Fresh water at 38 and 220 feet.

DOMINION NATURAL GAS CO., LTD.

W. Link No. 3, lot 13, con. VII, South Cayuga tp.

Completed August 2, 1945.
Dry hole.

Formation	Depth, ft.
Surface	21
Flint	51
Lime and shale	426
Niagara	654
Shale	708
Clinton	743
Red Medina	785
Grey shale	842
White Medina	857
Red shale	861

Show of gas at 747 and 853 feet.
Fresh water at 36 and 41 feet; black water at 280 feet.

BROADWAY GAS SYNDICATE

H. and E. Catherwood No. 1, lot 10, con. XIII, Walpole tp.

Completed September 1, 1945.
Dry hole.

Formation	Depth, ft.
Surface	34
Flint	54
Lime and shale	432
Niagara	645
Shale	744
Clinton	774
Red Medina	815
Grey shale	855
White Medina	868
Red shale	870

BROADWAY GAS SYNDICATE
Mrs. N. Slack No. 1, lot 8, con. XII, Walpole tp.

Completed June 28, 1945.
Producing gas well.
Rock pressure: 230 lbs.

Formation	Depth, ft.
Surface	36
Flint	56
Lime and shale	430
Niagara	645
Shale	739
Clinton	770
Red Medina	810
Shale	855
White Medina	864
Shale	866

Gas at 709 feet.

BROADWAY GAS SYNDICATE
Mrs. N. Slack No. 2, lot 8, con. XII, Walpole tp.

Completed July 28, 1945.
Dry hole.

Formation	Depth, ft.
Surface	34
Flint	54
Lime and shale	436
Niagara	640
Shale	752
Clinton	792
Red Medina	827
Grey shale	869
White Medina	879
Red shale	881

BROADWAY GAS SYNDICATE
G. H. Swing No. 1, lot 17, con. X, Walpole tp.

Completed December 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	16
Flint	54
Lime and shale	426
Niagara	640
Shale and lime	751
Clinton	778
Red Medina	818
Shale	863
White Medina	881
Red shale	883

Show of gas at 771 to 776 feet.
Fresh water at 37 feet.

BROADWAY GAS SYNDICATE
Wm. Williamson No. 1, lot 17, con. IX, Walpole tp.

Completed October 13, 1945.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Depth, ft.
Surface	27
Flint	65
Lime and shale	433
Niagara	670
Shale	743
Clinton	776
Red Medina	809
Shale	852
White Medina	860
Shale	862

Gas at 745 and 755 feet.

BROADWAY GAS SYNDICATE
Wm. Williamson No. 2, lot 17, con. IX, Walpole tp.

Completed November 10, 1945.
Producing gas well.
Rock pressure: 385 lbs.

Formation	Depth, ft.
Surface	16
Flint	58
Lime and shale	437
Niagara	645
Shale	747
Clinton	777
Red Medina	807
Shale	861
White Medina	875
Shale	905

Gas at 749, 779, and 867 feet.

DOMINION NATURAL GAS CO., LTD.
I. Bilton No. 1, lot 12, con. XII, Walpole tp.

Completed August 10, 1945.
Producing gas well.
Rock pressure: 449 lbs.

Formation	Depth, ft.
Surface	14
Flint	49
Lime and shale	434
Niagara	694
Shale	737
Clinton	765
Red Medina	800
Shale	856
White Medina	869
Red shale	871

Gas at 753 feet.
Fresh water at 30 and 140 feet; sulphur water at 270 feet.

DOMINION NATURAL GAS CO., LTD.
L. H. Bilton No. 1, lot 12, con. XII, Walpole tp.

Completed August 27, 1945.
Producing gas well.
Rock pressure: 263 lbs.

Formation	Depth, ft.
Surface	8
Flint	59
Lime and shale	431
Niagara	690
Shale	740
Clinton	771
Red Medina	808
Shale	856
White Medina	865
Red shale	886

Gas at 743, 752 to 756, and 871 feet.
Fresh water at 32 and 108 feet; black water at 509 feet.

DOMINION NATURAL GAS CO., LTD.
L. H. Bilton No. 2, lot 12, con. XII, Walpole tp.

Completed September 12, 1945.
Producing gas well.
Rock pressure: 403 lbs.

Formation	Depth, ft.
Surface	7
Flint	61
Lime and shale	437
Niagara	694
Shale	746
Clinton	783
Red Medina	813
Shale	863
White Medina	871
Red shale	873

Gas at 749 and 769 to 783 feet.
Fresh water at 35 feet; sulphur water at 197 feet.

DOMINION NATURAL GAS CO., LTD.
T. H. Bilton No. 1, lot 12, con. XII, Walpole tp.
Completed September 10, 1945.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Depth, ft.
Surface	21
Flint	48
Lime and shale	432
Niagara	686
Shale	737
Clinton	772
Red Medina	807
Shale	863
White Medina	873
Red shale	877

Gas at 749 and 764 feet.
Fresh water at 110 feet; sulphur water at 295 feet.

DOMINION NATURAL GAS CO., LTD.
E. Catherwood No. 1, lot 11, con. XII, Walpole tp.
Completed October 8, 1945.
Dry hole.

Formation	Depth, ft.
Surface	7
Flint	59
Lime and shale	433
Niagara	701
Shale	753
Clinton	784
Red Medina	820
Shale	867
White Medina	877
Red shale	882

Show of gas at 757 feet.
Fresh water at 87 feet; black water at 472 feet.

DOMINION NATURAL GAS CO., LTD.
E. Catherwood No. 2, lot 11, con. XII, Walpole tp.
Completed December 14, 1945.
Dry hole.

Formation	Depth, ft.
Surface	9
Flint	58
Lime and shale	431
Niagara	699
Shale	748
Clinton	778
Red Medina	810
Shale	861
White Medina	870
Red shale	874

Show of gas at 750 and 869 feet.
Fresh water at 18 and 182 feet; black water at 475 feet.

DOMINION NATURAL GAS CO., LTD.
C. Cox No. 5, lot 17, con. I, Walpole tp.
Completed May 24, 1945.
Producing gas well.
Rock pressure: 330 lbs.

Formation	Depth, ft.
Surface	50
Flint	165
Lime and shale	555
Niagara	806
Shale	863
Clinton	885
Red Medina	927
Shale	977
White Medina	1,004
Red shale	1,007

Gas at 902 to 905 and 912 feet.
Fresh water at 65 feet; sulphur water at 119 feet.

DOMINION NATURAL GAS CO., LTD.
G. and O. Dilello No. 1, lot 11, con. XII, Walpole tp.
Completed October 17, 1945.
Dry hole.

Formation	Depth, ft.
Surface	13
Flint	60
Lime and shale	439
Niagara	705
Shale	753
Clinton	788
Red Medina	820
Shale	869
White Medina	879
Red Medina	882

Show of gas at 757 feet.
Fresh water at 85 feet; black water at 190 feet.

DOMINION NATURAL GAS CO., LTD.
G. and O. Dilello No. 2, lot 11, con. XI, Walpole tp.
Completed November 9, 1945.
Dry hole.

Formation	Depth, ft.
Surface	16
Flint	56
Lime and shale	444
Niagara	699
Shale	750
Clinton	780
Red Medina	814
Shale	864
White Medina	872
Red shale	876

Show of gas at 757 feet.
Fresh water at 48 and 278 feet.

DOMINION NATURAL GAS CO., LTD.
H. and M. Harrop No. 2, lot 11, con. XI, Walpole tp.
Completed November 8, 1945.
Producing gas well.
Rock pressure: 386 lbs.

Formation	Depth, ft.
Surface	11
Flint	76
Lime and shale	448
Niagara	698
Shale	755
Clinton	792
Red Medina	820
Shale	870
White Medina	882
Shale	885

Gas at 765, 774, 783, and 792 feet.
Fresh water at 36 feet; sulphur water at 185 feet.

DOMINION NATURAL GAS CO., LTD.
E. Helka No. 1, lot 14, con. XII, Walpole tp.
Completed September 10, 1945.
Producing gas well.
Rock pressure: 318 lbs.

Formation	Depth, ft.
Surface	16
Flint	34
Lime and shale	427
Niagara	671
Shale	719
Clinton	754
Red Medina	784
Shale	834
White Medina	843
Red shale	863

Gas at 731, 747 to 752, and 839 feet.
Fresh water at 58 and 128 feet; sulphur water at 245 feet.

DOMINION NATURAL GAS CO., LTD.
F. Helka No. 2, lot 14, con. XII, Walpole tp.

Completed March 14, 1945.
Producing gas well.
Rock pressure: 382 lbs.

Formation	Depth, ft.
Surface	13
Flint	58
Lime and shale	426
Niagara	674
Shale	733
Clinton	770
Red Medina	807
Shale	852
White Medina	857
Red shale	860

Gas at 735 to 752 feet.
Fresh water at 35 feet; black water at 120 feet.

DOMINION NATURAL GAS CO., LTD.
F. Helka No. 3, lot 14, con. XII, Walpole tp.

Completed April 9, 1945.
Producing gas well.
Rock pressure: 348 lbs.

Formation	Depth, ft.
Surface	13
Flint	43
Lime and shale	449
Niagara	689
Shale	724
Clinton	764
Red Medina	799
Shale	858
White Medina	865
Red shale	870

Gas at 736 to 741 feet.
Fresh water at 73 feet.

DOMINION NATURAL GAS CO., LTD.
I. Hewitt No. 4, lot 18, con. XII, Walpole tp.

Completed October 30, 1945.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Depth, ft.
Surface	8
Flint	40
Lime and shale	421
Niagara	665
Shale	717
Clinton	754
Red Medina	794
Shale	834
White Medina	847
Red shale	849

Gas at 720 and 749 feet.
Fresh water at 62 feet.

DOMINION NATURAL GAS CO., LTD.
H. E. Hind No. 4, lot 17, con. XII, Walpole tp.

Completed July 17, 1945.
Dry hole.

Formation	Depth, ft.
Surface	8
Flint	40
Lime and shale	424
Niagara	659
Shale	707
Clinton	743
Red Medina	778
Shale	833
White Medina	845
Red shale	848

Show of gas at 719 feet.
Fresh water at 60 feet; black water at 190 feet.

DOMINION NATURAL GAS CO., LTD.
H. E. Hind No. 5, lot 16, con. XII, Walpole tp.

Completed September 21, 1945.
Producing gas well.
Rock pressure: 378 lbs.

Formation	Depth, ft.
Surface	11
Flint	51
Lime and shale	420
Niagara	664
Shale	716
Clinton	746
Red Medina	777
Shale	830
White Medina	841
Red shale	843

Gas at 720, 730, 735, and 746 feet.
Fresh water at 65 and 90 feet; sulphur water at 125 feet.

DOMINION NATURAL GAS CO., LTD.
A. Hunter No. 1, lot 16, con. XII, Walpole tp.

Completed June 6, 1945.
Dry hole.

Formation	Depth, ft.
Surface	10
Flint	35
Lime and shale	425
Niagara	659
Shale	711
Clinton	746
Red Medina	786
Shale	836
White Medina	846
Red shale	849

Show of gas at 743 feet.
Fresh water at 75 feet; sulphur water at 255 feet.

DOMINION NATURAL GAS CO., LTD.
A. Hunter No. 2, lot 16, con. XII, Walpole tp.

Completed June 16, 1945.
Dry hole.

Formation	Depth, ft.
Surface	9
Flint	45
Lime and shale	420
Niagara	672
Shale	711
Clinton	744
Red Medina	776
Shale	828
White Medina	838
Red shale	840

Show of gas at 721 feet.
Fresh water at 14 and 90 feet; sulphur water at 215 feet.

DOMINION NATURAL GAS CO., LTD.
J. Jepson No. 2, lot 16, con. V, Walpole tp.

Completed July 27, 1945.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Depth, ft.
Surface	33
Flint	133
Lime and shale	487
Niagara	767
Shale	817
Clinton	845
Red Medina	888
Shale	938
White Medina	950
Red shale	955

Gas at 842 feet.
Fresh water at 56 feet.

DOMINION NATURAL GAS CO., LTD.
R. and U. Jepson No. 1, lot 15, con. XI, Walpole tp.
Completed May 5, 1945.
Producing gas well.
Rock pressure: 393 lbs.

Formation	Depth, ft.
Surface	18
Flint	59
Lime and shale	431
Niagara	692
Shale	741
Clinton	766
Red Medina	802
Shale	857
White Medina	866
Red shale	868

Gas at 758 and 780 feet.
Fresh water at 37 feet; black water at 478 feet.

DOMINION NATURAL GAS CO., LTD.
W. D. Lindsay No. 2, lot 14, con. XI, Walpole tp.
Completed March 8, 1945.
Producing gas well.
Rock pressure: 368 lbs.

Formation	Depth, ft.
Surface	17
Flint	62
Lime and shale	428
Niagara	680
Shale	740
Clinton	770
Red Medina	805
Shale	855
White Medina	865
Red shale	869

Gas at 756 feet.
Fresh water at 45 feet; black water at 154 feet.

DOMINION NATURAL GAS CO., LTD.
W. D. Lindsay No. 3, lot 14, con. XI, Walpole tp.
Completed April 21, 1945.
Dry hole.

Formation	Depth, ft.
Surface	7
Flint	62
Lime and shale	430
Niagara	670
Shale	738
Clinton	768
Red Medina	805
Shale	855
White Medina	863
Red shale	866

Show of gas at 740 and 768 feet.
Fresh water at 45 feet..

DOMINION NATURAL GAS CO., LTD.
W. D. Lindsay No. 4, lot 14, con. XII, Walpole tp.
Completed May 26, 1945,
Producing gas well.
Rock pressure: 355 lbs.

Formation	Depth, ft.
Surface	13
Flint	47
Lime and shale	432
Niagara	677
Shale	727
Clinton	763
Red Medina	793
Shale	841
White Medina	851
Red shale	854

Gas at 740 to 749 feet.
Fresh water at 33 feet; sulphur water at 150 feet.

DOMINION NATURAL GAS CO., LTD.
C. Lofthouse No. 2, lot 17, con. IV, Walpole tp.
Completed October 26, 1945.
Dry hole.

Formation	Depth, ft.
Surface	23
Flint	123
Lime and shale	480
Niagara	760
Shale	814
Clinton	841
Red Medina	883
Shale	933
White Medina	949
Red shale	951

Show of gas at 817 feet.
Fresh water at 53 feet; black water at 65 feet.

DOMINION NATURAL GAS CO., LTD.
W. Nichol No. 2, lot 16, con. XI, Walpole tp.
Completed June 12, 1945.
Dry hole.

Formation	Depth, ft.
Surface	2
Flint	56
Lime and shale	434
Niagara	700
Shale	746
Clinton	780
Red Medina	814
Shale	866
White Medina	879
Red shale	900

Show of gas at 750, 786, and 875 feet.
Fresh water at 48 feet.

DOMINION NATURAL GAS CO., LTD.
W. C. O'Hara No. 2, lot 24, con. IX, Walpole tp.
Completed September 5, 1945.
Dry hole.

Formation	Depth, ft.
Surface	6
Flint	40
Lime and shale	428
Niagara	670
Shale	725
Clinton	759
Red Medina	781
Grey shale	849
White Medina	861
Red shale	864

Fresh water at 60 and 80 feet.

DOMINION NATURAL GAS CO., LTD.
W. C. O'Hara No. 3, lot 24, con. IX, Walpole tp.
Completed October 9, 1945.
Producing gas well.
Rock pressure: 425 lbs.

Formation	Depth, ft.
Surface	10
Flint	40
Lime and shale	440
Niagara	675
Shale	730
Clinton	760
Red Medina	782
Shale	850
White Medina	864
Red shale	867

Gas at 735, 752, and 770 feet.
Fresh water at 45 feet; sulphur water at 120 feet.

DOMINION NATURAL GAS CO., LTD.

G. F. and J. E. Richardson No. 1, lot 13, con. XII, Walpole tp.

Completed May 15, 1945.
Producing gas well.
Rock pressure: 403 lbs.

Formation	Depth, ft.
Surface	16
Flint	55
Lime and shale	435
Niagara	685
Shale	735
Clinton	757

Gas at 737 and 747 feet.
Fresh water at 35 and 80 feet; sulphur water at 135 feet.

DOMINION NATURAL GAS CO., LTD.

G. F. and J. E. Richardson No. 2, lot 13, con. XII, Walpole tp.

Completed June 4, 1945.
Producing gas well.
Rock pressure: 400 lbs.

Formation	Depth, ft.
Surface	12
Flint	42
Lime and shale	452
Niagara	692
Shale	727
Clinton	767
Red Medina	797
Shale	848
White Medina	856
Red shale	886

Gas at 762 and 854 feet.
Fresh water at 37 feet.

DOMINION NATURAL GAS CO., LTD.

G. F. and J. E. Richardson No. 3, lot 13, con. XII, Walpole tp.

Completed July 20, 1945.
Producing gas well.
Rock pressure: 359 lbs.

Formation	Depth, ft.
Surface	7
Flint	58
Lime and shale	439
Niagara	697
Shale	745
Clinton	773
Red Medina	806
Shale	857
White Medina	868
Red shale	871

Gas at 747 and 757 feet.
Fresh water at 47 feet; black water at 502 feet.

DOMINION NATURAL GAS CO., LTD.

G. F. and J. E. Richardson No. 4, lot 13, con. XII, Walpole tp.

Completed August 14, 1945.
Producing gas well.
Rock pressure: 388 lbs.

Formation	Depth, ft.
Surface	5
Flint	55
Lime and shale	431
Niagara	677
Shale	728
Clinton	768
Red Medina	798
Shale	847
White Medina	854
Red shale	884

Gas at 745 and 852 to 854 feet.
Fresh water at 26 feet; sulphur water at 185 feet.

DOMINION NATURAL GAS CO., LTD.

J. W. Roulston No. 1, lot 10, con. XII, Walpole tp.

Completed November 23, 1945.
Producing gas well.
Rock pressure: 404 lbs.

Formation	Depth, ft.
Surface	19
Flint	69
Lime and shale	452
Niagara	704
Shale	755
Clinton	795
Red Medina	828
Shale	875
White Medina	880
Red shale	883

Gas at 791 feet.
Fresh water at 35 feet; sulphur water at 160 feet.

DOMINION NATURAL GAS CO., LTD.

H. and V. M. Smith No. 2, lot 17, con. XII, Walpole tp.

Completed May 24, 1945.
Producing gas well.
Rock pressure: 372 lbs.

Formation	Depth, ft.
Surface	7
Flint	25
Lime and shale	415
Niagara	665
Shale	707
Clinton	735
Red Medina	775
Shale	824
White Medina	839
Red shale	844

Gas at 709 and 719 feet.
Fresh water at 40 and 90 feet; sulphur water at 215 feet.

DOMINION NATURAL GAS CO., LTD.

C. Stark No. 3, lot 23, con. IX, Walpole tp.

Completed November 13, 1945.
Producing gas well.
Rock pressure: 390 lbs.

Formation	Depth, ft.
Surface	33
Flint	58
Lime and shale	442
Niagara	677
Shale	732
Clinton	765
Red Medina	787
Shale	850
White Medina	864
Red shale	867

Gas at 751 and 759 feet.
Fresh water at 40 feet.

DOMINION NATURAL GAS CO., LTD.

A. W. Stewart No. 1, lot 23, con. IX, Walpole tp.

Completed June 3, 1945.
Producing gas well.
Rock pressure: 435 lbs.

Formation	Depth, ft.
Surface	9
Flint	45
Lime and shale	435
Niagara	670
Shale	725
Clinton	750
Red Medina	768
Shale	840
White Medina	859
Red shale	862

Gas at 762 to 765 feet.
Fresh water at 35 feet.

Dominion Natural Gas Co., Ltd.
A. W. Stewart No. 2, lot 23, con. IX, Walpole tp.

Completed August 3, 1945.
Producing gas well.
Rock pressure: 422 lbs.

Formation	Depth, ft.
Surface	8
Flint	45
Lime and shale	435
Niagara	670
Shale	722
Clinton	749
Red Medina	772
Shale	842
White Medina	857
Red shale	859

Gas at 736 feet.
Fresh water at 50 feet.

Dominion Natural Gas Co., Ltd.
W. and H. R. Thomas No. 2, lot 15, con. XII, Walpole tp.

Completed April 13, 1945.
Producing gas well.
Rock pressure: 237 lbs.

Formation	Depth, ft.
Surface	15
Flint	45
Lime and shale	428
Niagara	669
Shale	719
Clinton	756
Red Medina	796
Shale	836
White Medina	846
Red shale	849

Gas at 733 to 740 feet.
Fresh water at 70 feet; black water at 250 feet.

Dominion Natural Gas Co., Ltd.
W. and H. R. Thomas No. 3, lot 15, con. XII, Walpole tp.

Completed April 19, 1945.
Producing gas well.
Rock pressure: 372 lbs.

Formation	Depth, ft.
Surface	14
Flint	38
Lime and shale	420
Niagara	668
Shale	721
Clinton	761
Red Medina	792
Shale	840
White Medina	847
Red shale	850

Gas at 723 and 742 feet.
Fresh water at 32 feet.

Dominion Natural Gas Co., Ltd.
W. and H. R. Thomas No. 4, lot 15, con. XII, Walpole tp.

Completed June 30, 1945.
Producing gas well.
Rock pressure: 300 lbs.

Formation	Depth, ft.
Surface	13
Flint	44
Lime and shale	416
Niagara	665
Shale	717
Clinton	757
Red Medina	788
Shale	836
White Medina	843
Red shale	873

Gas at 741 to 747 and 839 feet.
Fresh water at 23 feet; sulphur water at 305 feet.

Dominion Natural Gas Co., Ltd.
W. and H. R. Thomas No. 5, lot 15, con. XII, Walpole tp.

Completed July 31, 1945.
Producing gas well.
Rock pressure: 320 lbs.

Formation	Depth, ft.
Surface	13
Flint	45
Lime and shale	420
Niagara	680
Shale	716
Clinton	751
Red Medina	785
Shale	837
White Medina	847
Red shale	877

Gas at 729 and 842 to 846 feet.
Fresh water at 50 and 170 feet.

Hagersville Quarry
Hagersville Quarry No. 1, lot 13, con. XIII, Walpole tp.

Completed June 22, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	2
Lime	13
Flint	45
Lime and shale	430
Niagara	640
Shale	655
Guelph	670
Shale	730
Clinton	769
Red Medina	801
Grey shale	841
White Medina	848
Red shale	851

Gas at 740 feet.
Fresh water at 90 feet; sulphur water at 240 feet.

Hagersville Quarry
Hagersville Quarry No. 2, lot 13, con. XIII, Walpole tp.

Completed August 15, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	7
Flint	45
Lime and shale	422
Niagara	672
Shale	719
Clinton	739
Red Medina	780
Grey shale	829
White Medina	841
Red shale	856

Gas at 722, 730, and 835 feet.
Fresh water at 47 feet; sulphur water at 165 feet.

W. C. Patterson Gas Co., Ltd.
G. Perrett No. 3, lot 13, con. VII, Walpole tp.

Completed October 27, 1945.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Depth, ft.
Surface	19
Flint	120
Lime and shale	460
Niagara	730
Shale	785
Clinton	815
Red Medina	855
Grey shale	906
White Medina	920
Red shale	924

Gas at 797 feet.
Fresh water at 38 feet; black water at 194 feet.

W. C. Patterson Gas Co., Ltd.
E. Person No. 1, lot 14, con. VII, Walpole tp.

Completed December 10, 1945.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Depth, ft.
Surface	12
Flint	116
Lime and shale	460
Niagara	735
Shale	785
Clinton	815
Red Medina	851
Grey shale	905
White Medina	916
Red shale	950

Gas at 788 and 907 feet.
Fresh water at 34 feet; black water at 165 feet.

F. W. Reicheld
W. R. Hodges No. 2, lot 6, con. III, Walpole tp.

Completed July 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	26
Flint	156
Lime and shale	528
Niagara	788
Shale	843
Clinton	863
Red Medina	903
Shale	966
White Medina	978
Red shale	981

Fresh water at 45 feet; black water at 85 and 580 feet.

F. W. Reicheld
F. W. Reicheld No. 2, lot 7, con. VI, Walpole tp.

Completed December 7, 1945.
Dry hole.

Formation	Depth, ft.
Surface	30
Flint	115
Lime and shale	505
Niagara	770
Shale	815
Clinton	840
Red Medina	880
Shale	936
White Medina	945
Red shale	950

Sulphur water at 55 feet; black water at 110 feet.

F. W. Reicheld
Wm. Robinson No. 1, lot 4, con. IV, Walpole tp.

Completed May 14, 1945.
Producing gas well.
Rock pressure: 420 lbs.

Formation	Depth, ft.
Surface	19
Flint	155
Lime and shale	527
Niagara	769
Shale	830
Clinton	858
Red Medina	898
Grey shale	951
White Medina	959
Red shale	999

Gas at 848, 870, and 958 feet.
Fresh water at 57 feet; sulphur water at 114 feet.

F. W. Reicheld
K. Saunders No. 1, lot 3, con. IV, Walpole tp.

Completed February 5, 1945.
Producing gas well.
Rock pressure: 115 lbs.

Formation	Depth, ft.
Surface	15
Flint	155
Lime and shale	530
Niagara	770
Shale	837
Clinton	866
Red Medina	906
Grey shale	975
White Medina	985
Red shale	990

Gas at 850 to 855 and 872 to 876 feet.
Fresh water at 40 feet; sulphur water at 60 and 105 feet.

Walpole Gas Syndicate No. 2
Mrs. H. Nichol No. 1, lot 15, con. XI, Walpole tp.

Completed May 27, 1945.
Producing gas well.
Rock pressure: 365 lbs.

Formation	Depth, ft.
Surface	11
Flint	58
Lime and shale	433
Niagara	630
Shale	737
Clinton	764
Red Medina	804
Grey shale	847
White Medina	865
Red shale	868

Gas at 740 feet.
Fresh water at 55 feet.

Walpole Gas Syndicate No. 2
J. Nichol No. 1, lot 16, con. XI, Walpole tp.

Completed March 7, 1945.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Depth, ft.
Surface	21
Flint	63
Lime and shale	433
Niagara	650
Shale	731
Clinton	773
Red Medina	803
Grey shale	843
White Medina	854
Red shale	858

Gas at 734, 755, and 771 feet.
Fresh water at 40 feet.

Walpole Gas Syndicate No. 2
J. Nichol No. 2, lot 16, con. XI, Walpole tp.

Completed April 3, 1945.
Producing gas well.
Rock pressure: 360 lbs.

Formation	Depth, ft.
Surface	11
Flint	52
Lime and shale	433
Niagara	637
Shale	730
Clinton	766
Red Medina	801
Grey shale	846
White Medina	858
Red shale	860

Gas at 755 feet.
Fresh water at 35 feet.

WALPOLE GAS SYNDICATE NO. 2

E. Walbrook No. 5, lot 17, con. XI, Walpole tp.

Completed February 12, 1945.
Producing gas well.
Rock pressure: 380 lbs.

Formation	Depth, ft.
Surface	10
Flint	69
Lime and shale	435
Niagara	687
Shale	739
Clinton	774
Red Medina	807
Grey shale	851
White Medina	858
Red shale	878

Gas at 746, 774, and 855 feet.
Fresh water at 59 feet.

WALPOLE GAS SYNDICATE NO. 2

E. Walbrook No. 6, lot 17, con. XI, Walpole tp.

Completed April 5, 1945.
Dry hole.

Formation	Depth ft.
Surface	8
Flint	71
Lime and shale	434
Niagara	690
Shale	740
Clinton	781
Red Medina	805
Grey shale	850
White Medina	864
Red shale	869

Fresh water at 58 feet.

Kent County

UNION GAS CO. OF CANADA, LTD.

A. A. and C. F. Deline No. 1, lot 8, con. II, Camden tp.

Completed April 3, 1945.
Dry hole.

Formation	Depth, ft.
Surface	65
Soap and lime shell	85
Black shale	95
Soap	255
Middle lime	266
Soap	294
Brown lime	480
Brown and grey lime	585
Brown lime	645
Sharp sand	850
Brown and grey lime	980
Brown lime	1,040
Lime and gypsum	1,050
Brown lime	1,080
Blue lime and gypsum	1,190
Brown lime	1,242
Blue lime	1,276
Brown lime	1,323
Brown and blue lime	1,428
Brown lime and salt	1,608
Brown lime	1,660
Grey lime	1,668
Blue lime	1,751
Brown lime	1,854
Brown and grey lime	1,937

Fresh water at 49 feet; sulphur water at 416 feet.

UNION GAS CO. OF CANADA, LTD.

G. Patterson No. 1, lot 3, con. I, Camden tp.

Completed August 8, 1945.
Dry hole.

Formation	Depth, ft.
Surface	63
Black shale	104
Soap and lime shell	165
Soap	335
Middle lime	347
Soap	376
Grey lime	516
Brown lime	750
Sharp sand	985
Light-brown lime	1,020
Dark-brown lime	1,070
Brown and grey lime	1,162
Brown and blue lime	1,192
Blue lime	1,267
Brown and blue lime	1,287
Brown lime	1,327
Blue lime	1,344
Brown lime	1,398
Brown and blue lime	1,520
Brown lime	1,526
Brown lime and salt	1,531
Brown lime	1,577
Grey lime	1,650
Brown lime	1,710
Grey lime	1,762

Show of gas at 1,558 to 1,560 feet.
Fresh water at 40 feet; sulphur water at 522 feet; salt water at 1,734 feet.

UNION GAS CO. OF CANADA, LTD.

W. S. Bodkin No. 1, lot 11, con. XIV, Camden gore, Camden tp.

Completed February 6, 1945.
Dry hole.

Formation	Depth, ft.
Surface	29
Top rock	55
Black shale	82
Top rock and shale	148
Soap and lime shell	320
Grey lime	462
Brown lime	540
Grey and brown lime	632
Brown lime	692
Sharp grey lime	914
Brown lime	1,051
Blue and grey lime	1,077
Brown and grey lime	1,107
Brown and blue lime	1,125
Blue and grey lime	1,199
Brown and grey lime	1,290
Brown lime	1,320
Brown and blue lime	1,424
Brown lime	1,481
Brown and grey lime	1,499
Grey lime	1,543
Brown and grey lime	1,558
Brown lime	1,615
Grey lime	1,638
Brown and grey lime	1,683

Fresh water at 26 feet; salt water at 1,677 to 1,683 feet.

UNION GAS CO. OF CANADA, LTD.
R. E. Snary No. 1, lot 7, con. XI, Camden gore, Camden tp.

Completed September 29, 1945.
Dry hole.

Formation	Depth, ft.
Surface	10
Shale	38
Soap and lime shell	56
Black shale	115
Soap	310
Grey lime	340
Brown lime	430
Water sand	442
Brown lime	650
Sharp sand	776
Water sand	834
Grey and brown lime	885
Brown lime	950
Brown and grey lime	1,012
Water sand	1,038
Blue lime	1,068
Brown and blue lime	1,295
Blue lime	1,348
Blue and grey lime	1,402
Brown lime	1,456
Grey lime	1,528
Brown lime	1,601
Grey lime	1,680
Brown and grey lime	1,738
Grey lime	1,760

Show of gas at 1,534 to 1,545 feet.
Fresh water at 36 and 75 feet; sulphur water at 350, 430, 456, and 1,012 feet.

IMPERIAL OIL, LTD.
R. Lozon No. 1, lot 4, con. VIII, Dover tp.

Completed September 5, 1945.
Dry hole.

Formation	Depth, ft.
Surface	68
Black shale	70
Black shale and top rock	74
Soap	86
Lime shell	90
Soap	105
Lime shell	115
Soap	230
Middle lime	250
Soap	282
Brown lime	400
Water sand	410
Brown lime	438
Water sand	443
Brown lime	480
Grey lime	484
Brown lime	539

Show of oil at 465 to 470 feet.
Fresh water at 4, 64, and 326 feet; sulphur water at 400 feet; black sulphur water at 438 to 443 feet.

UNION GAS CO. OF CANADA, LTD.
A. E. and F. Carroll No. 1, lot 1, con. XIV, Chatham tp.

Completed December 6, 1945.
Dry hole.

Formation	Depth, ft.
Surface	75
Black shale	105
Brown shale	165
Lime shell	227
Soap and lime shell	345
Middle lime	359
Soap	392
Brown lime	763
Sharp brown and grey lime	990
Brown and grey lime	1,070
Brown lime	1,202
Lime and gypsum	1,250
Blue and grey lime	1,344
Brown and blue lime	1,368
Brown and grey lime	1,457
Brown, blue, and grey lime	1,853
Grey shale	1,872
Clinton	1,880
Grey shale	1,894
Red shale	1,912
Grey shale	2,004
White Medina	2,022
Grey shale	2,043
Red shale	2,148
Red and grey shale	2,241
Pink shale	2,304
Blue shale	2,491
Grey shale	2,644
Brown shale	2,727
Trenton	3,666
Potsdam	3,682
Granite	3,685

Show of oil at 1,720 feet.
Show of gas at 3,198 to 3,204 feet.
Fresh water at 65 feet; sulphur water at 493 feet.

IMPERIAL OIL, LTD.
M. Bokar No. 1, lot 16, con. II, L.E.S., Harwich tp.

Completed August 4, 1945.
Dry hole.

Formation	Depth, ft.
Surface	137
Black shale	190
Soap	217
Lime shell	222
Soap	321
Lime shell	331
Soap	362
Middle lime	382
Soap	410
Brown lime	565
Brown and grey lime	590
Brown lime	660
Lime shell	713
Grey and brown lime	723
Flint	746

Show of gas at 80 feet.
Show of oil at 567 and 660 to 677 feet.
Fresh water at 25, 90, and 126 feet; black sulphur water at 567 feet; salt water at 735 feet.

IMPERIAL OIL, LTD.

D. Ferguson No. 1, lot 12, con. IV, R.T.S., Harwich tp.

Completed November 6, 1945.
Dry hole.

Formation	Depth, ft.
Surface	63
Black shale	105
Soap	125
Black shale	170
Soap	315
Black shale	333
Soap	338
Black shale	348
Soap	369
Brown lime	379
Grey lime	437
Brown lime	578
Grey lime and gypsum	584
Brown lime	735
Flint	883
Grey and brown lime	890
Brown lime and gypsum	1,048
Blue and brown lime and gypsum	1,079
Grey lime, shale, and gypsum	1,117
Grey and brown lime and gypsum	1,146
Blue and brown lime	1,152
Brown lime	1,252
Brown and blue lime	1,277
Brown and grey lime	1,300
Brown and blue lime	1,370
Salt	1,395
Brown and grey lime	1,401
Salt	1,513
Brown lime	1,530
Brown and grey lime	1,590
Blue lime	1,618
Brown lime	1,694
Sand	1,707
Brown lime	1,738

Show of oil at 650 to 660 feet.
Fresh water at 60 and 78 feet; salt water at 505, 550, and 1,694 to 1,707 feet; black water at 902 feet.

IMPERIAL OIL, LTD.

N. Haggart No. 1, lot 19, con. III, L.E.S., Harwich tp.

Completed November 21, 1945.
Dry hole.

Formation	Depth, ft.
Surface	144
Black shale	191
Soap	192
Soap and black shale	197
Black shale	209
Soap	222
Black shale	240
Soap	298
Grey shale	304
Soap	343
Grey shale	354
Soap	363
Grey shale	423
Grey lime	510
Lime	600
Lime and shale	625

Show of gas at 125, 156 to 159, and 170 feet.
Show of oil at 485 and 605 feet.
Fresh water at 125 and 144 feet; salt water at 156 and 170 feet; sulphur water at 559 feet.

IMPERIAL OIL, LTD.

W. C. Cowan No. 1, lot 8, con. XII, Orford tp.

Completed September 7, 1945.
Dry hole.

Formation	Depth, ft.
Surface	111
Shale	157
Soap	190
Soap and shale	229
Soap	287
Soap and shale	350
Shale	394
Lime	513
Sharp lime	530
Lime and sharp sand	551

Fresh water at 88 to 111 feet; black water at 548 feet.

IMPERIAL OIL, LTD.

A. Prokopchuck No. 1, lot 19, con. X, Orford tp.

Completed December 15, 1945.
Dry hole.

Formation	Depth, ft.
Surface	181
Brown lime	183
Soap	188
Sand	190
Lime	192
Soap	205
Brown lime	207
Soap	390
Grey and buff lime	512
Buff lime and chert	564
Sharp sand	594

Salt water at 188 feet; black sulphur water at 574 and 585 feet.

DOMINION NATURAL GAS CO., LTD.

Crown lease, lake well No. 21, opposite lot 191, Romney tp.

Completed August 7, 1945.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Depth, ft.
Surface	112
Brown lime	350
Sharp sand	515
Grey lime	535
Brown lime	615
Grey lime	655
Brown and blue lime	675
Blue lime and gypsum	795
Brown lime	835
Grey lime	855
Brown lime	915
Blue lime	1,090
Brown lime	1,135
Grey lime	1,155
Grey and brown lime	1,215
Grey lime	1,248

Show of gas at 1,110 feet; gas at 1,115, 1,170, 1,185, 1,190, and 1,212 feet.
Fresh water at 115 feet; black water at 515 feet; salt water at 1,206, 1,230, and 1,247 feet.

DOMINION NATURAL GAS CO., LTD.

Crown lease, lake well No. 22, opposite lot 192, Romney tp.

Completed October 9, 1945.
Producing gas well.
Rock pressure: 190 lbs.

Formation	Depth, ft.
Surface	126
Brown lime	375
Sharp sand	565
Grey lime	580
Brown lime	655
Grey lime	690
Brown lime	705
Brown and blue lime	715
Brown and blue lime	740
Lime and gypsum	835
Brown lime	945
Blue lime	1,085
Brown lime	1,225
Grey lime	1,245
Brown and grey lime	1,301

Gas at 1,230, 1,240, 1,250, 1,260, 1,275, 1,290, and 1,301 feet.
Fresh water at 85 and 132 feet; black water at 475 and 565 feet.

WEST PETROLEUM, LTD.

Crown lease, in Lake Erie, opposite lot 181, Romney tp.

Completed November 30, 1945.
Producing gas well.
Rock pressure: 335 lbs.

Formation	Depth, ft.
Water	35
Clay	151
Light-grey lime	216
Buff and grey lime and chert	306
Light-grey lime	382
Brown lime and chert	427
Buff cherty lime	531
Buff sand	543
Brown and grey lime	647
Grey and buff lime	701
Lime, gypsum, and anhydrite	722
Grey shale, lime, and gypsum	808
Grey and brown lime and gypsum	858
Grey shale and gypsum	864
Lime and shale	924
Grey shale, gypsum, and anhydrite	1,035
Lime, shale, gypsum, and anhydrite	1,071
Grey lime	1,126

Gas at 1,070, 1,098, and 1,126 feet.

WEST PETROLEUM, LTD.

Crown lease, in Lake Erie, opposite lot line between lots 184 and 185, Romney tp.

Completed August 22, 1945.
Producing gas well.
Rock pressure: 315 lbs.

Formation	Depth, ft.
Water	35
Clay	150
Grey lime	218
Light-brown lime	236
Buff and grey lime and chert	343
Grey lime and chert	466
Grey and brown lime and chert	588
Arenaceous brown lime	600
Brown lime	619
Grey and brown lime	700
Grey lime and gypsum	740
Grey lime	754
Grey lime, shale, and gypsum	786
Grey shale and gypsum	862
Lime, shale, and gypsum	926
Grey lime	944
Grey and brown lime and anhydrite	956
Grey lime	984
Lime, shale, gypsum, and anhydrite	1,102
Lime, gypsum, and anhydrite	1,124
Grey and brown lime	1,174
Gypsum, anhydrite, and lime	1,207
Buff lime	1,217
Light-grey lime	1,248
Grey and brown lime	1,267

Show of gas at 1,123 feet; gas at 1,140, 1,168, 1,248, and 1,254 feet.
Black water at 593 and 615 feet.

IMPERIAL OIL, LTD.

H. Renwick No. 1, lot 15, con. X, Tilbury East tp.

Completed November 16, 1945.
Dry hole.

Formation	Depth, ft.
Surface	145
Soap	158
Lime	164
Soap	176
Lime	200
Soap	210
Lime shell	222
Lime	228
Middle lime	232
Soap and lime shell	262
Brown lime	409
Grey lime	416
Blue lime	423
Grey lime	435
Brown lime	516

Show of oil at 222 to 228 feet.
Sulphur water at 397 feet.

UNION GAS CO. OF CANADA, LTD.

J. and N. Beecroft No. 1, lot 10, con. VII, Zone tp.

Completed March 20, 1945.
Producing gas well.
Rock pressure: 694 lbs.

Formation	Depth, ft.
Surface	85
Top rock	125
Soap	255
Middle lime	271
Soap	300
Grey lime	312
Brown lime	435
Sharp brown and grey lime	465
Brown lime	620
Sharp brown and grey lime	870
Brown lime	987
Brown and blue lime	999
Lime and gypsum	1,011
Brown and grey lime	1,036
Brown and blue lime	1,070
Blue lime	1,105
Brown and blue lime	1,170
Brown lime	1,187
Brown and blue lime	1,367
Brown and grey lime	1,437
Grey lime	1,509
Brown lime	1,578

Gas at 1,391 to 1,403 and 1,409 to 1,421 feet.
Sulphur water at 435 feet.

UNION GAS CO. OF CANADA, LTD.

J. and N. Beecroft No. 2, lot 9, con. VII, Zone tp.

Completed May 1, 1945.
Producing gas well.
Rock pressure: 701 lbs.

Formation	Depth, ft.
Surface	93
Top rock	130
Soap and lime shell	252
Middle lime	270
Soap	305
Brown lime	439
Sharp grey lime	451
Brown lime	613
Sharp brown and grey lime	854
Brown lime	1,028
Brown and blue lime	1,070
Blue and grey lime	1,122
Brown and blue lime	1,389
Brown and grey lime	1,497
Lime and gypsum	1,506
Brown lime	1,562

Gas at 1,393 to 1,401 and 1,417 to 1,423 feet.

UNION GAS CO. OF CANADA, LTD.
S. and C. Bodkin No. 1, lot 8, con. VII, Zone tp.

Completed December 6, 1945.
Producing gas well.
Rock pressure: 715 lbs.

Formation	Depth, ft.
Surface	105
Soap	245
Middle lime	257
Soap	286
Brown and grey lime	346
Brown lime	615
Sharp brown and grey lime	900
Brown lime	1,046
Grey lime	1,058
Brown lime	1,078
Brown and grey lime	1,130
Blue and grey lime	1,184
Brown lime	1,196
Brown and grey lime	1,246
Brown lime	1,294
Brown and grey lime	1,324
Blue and grey lime	1,402
Brown lime	1,464
Brown and grey lime	1,509
Brown lime	1,555

Show of gas at 1,410 to 1,416, and 1,532 to 1,538 feet.
Gas at 1,416 to 1,422 and 1,428 to 1,434 feet.
Fresh water at 80 feet; sulphur water at 480 feet.

UNION GAS CO. OF CANADA, LTD.
J. Ciglar No. 1, lot 10, con. VII, Zone tp.

Completed June 4, 1945.
Producing gas well.
Rock pressure: 698 lbs.

Formation	Depth, ft.
Surface	90
Brown shale	100
Top rock	149
Soap and lime shell	280
Middle lime	294
Soap	321
Grey lime	516
Brown and grey lime	715
Sharp brown and grey lime	892
Brown lime	928
Brown and grey lime	976
Brown lime	1,018
Blue lime and gypsum	1,028
Brown lime	1,086
Blue lime	1,136
Blue and brown lime	1,176
Brown lime	1,308
Brown and blue lime	1,402
Brown lime	1,455

Show of oil at 79 feet.
Show of gas at 1,412 feet.
Gas at 1,412 to 1,436 feet.
Fresh water at 79 and 90 feet.

UNION GAS CO. OF CANADA, LTD.
J. H. Buchanan No. 1, lot 8, con. I, Zone tp.

Completed March 23, 1945.
Dry hole.

Formation	Depth, ft.
Surface	48
Black shale	83
Top rock	130
Soap	191
Soap and lime shell	304
Grey lime	440
Grey and brown lime	542
Brown lime	630
Sharp grey lime	857
Grey and brown lime	1,029
Brown lime	1,047
Lime and gypsum	1,070
Brown lime	1,180
Grey lime	1,280
Brown lime	1,349
Grey lime	1,408
Grey and brown lime	1,478
Dark-grey lime	1,545
Grey and brown lime	1,590
Grey lime	1,656
Brown lime	1,685

Show of gas at 1,545 to 1,550 feet.
Fresh water at 37 feet; sulphur water at 430 feet; and salt water at 1,635 to 1,640 feet.

UNION GAS CO. OF CANADA, LTD.
J. M. Coutts No. 1, lot 9, con. VI, Zone tp.

Completed September 10, 1945.
Producing gas well.
Rock pressure: 710 lbs.

Formation	Depth, ft.
Surface	85
Top rock	110
Soap and lime shell	250
Middle lime	265
Soap and lime shell	295
Brown lime	428
Sharp brown lime	446
Brown lime	640
Sharp brown and grey lime	852
Brown lime	997
Lime and gypsum	1,003
Brown, blue, and grey lime	1,027
Lime and gypsum	1,045
Brown and grey lime	1,057
Blue and grey lime	1,120
Blue, grey, and brown lime	1,172
Brown and blue lime	1,321
Blue and grey lime	1,375
Brown lime	1,417
Brown and grey lime	1,435

Show of oil at 330 and 385 feet.
Gas at 1,381 to 1,393 and 1,399 to 1,417 feet.
Fresh water at 112 feet; sulphur water at 470 feet.

Union Gas Co. of Canada, Ltd.
R. Cutler No. 1, lot 10, con. VII, Zone tp.
Completed April 27, 1945.
Producing gas well.
Rock pressure: 696 lbs.

Formation	Depth, ft.
Surface	90
Top rock	132
Soap and lime shell	263
Middle lime	283
Soap	306
Grey lime	450
Sharp grey lime	469
Grey lime	590
Grey and brown lime	660
Sharp grey lime	880
Brown lime	1,002
Blue lime	1,008
Brown lime	1,042
Blue and brown lime	1,169
Brown lime	1,213
Brown and blue lime	1,237
Brown lime	1,315
Blue lime	1,363
Brown and grey lime	1,406
Brown and blue lime	1,412
Brown lime	1,440

Show of oil at 335 feet.
Gas at 1,400 to 1,406 and 1,418 to 1,424 feet.
Sulphur water at 450 and 525 feet.

Union Gas Co. of Canada, Ltd.
W. A. Elgie No. 1, lot 11, con. VIII, Zone tp.
Completed August 17, 1945.
Producing gas well.
Rock pressure: 712 lbs.

Formation	Depth, ft.
Surface	106
Brown shale and sand	120
Top rock	150
Soap	300
Middle lime	314
Soap and lime shell	345
Grey lime	608
Brown lime	660
Sharp brown and grey lime	891
Brown and grey lime	921
Brown lime	1,021
Lime and gypsum	1,027
Brown and blue lime	1,093
Blue lime	1,147
Brown and blue lime	1,165
Brown lime	1,318
Brown and blue lime	1,395
Brown lime	1,467

Gas at 1,411 to 1,423, 1,429 to 1,435, and 1,450 to 1,455 feet.
Fresh water at 105 feet.

Union Gas Co. of Canada, Ltd.
Mrs. A. Eacott No. 1, town of Bothwell, Zone tp.
Completed February 23, 1945.
Producing gas well.
Rock pressure: 761 lbs.

Formation	Depth, ft.
Surface	103
Black shale	130
Top rock	175
Soap	270
Lime shell and soap	320
Middle lime	332
Soap and lime shell	355
Brown lime	665
Sharp brown and grey lime	937
Brown lime	1,041
Lime and gypsum	1,059
Brown and grey lime	1,090
Lime and gypsum	1,095
Brown and blue lime	1,110
Blue and grey lime	1,198
Brown and blue lime	1,216
Brown lime	1,252
Brown and grey lime	1,270
Brown and blue lime	1,297
Brown lime	1,315
Brown and blue lime	1,333
Blue and grey lime	1,370
Brown and grey lime	1,434
Brown lime	1,481
Brown and grey lime	1,558

Gas at 1,438 to 1,446, 1,458 to 1,464, and 1,540 to 1,552 feet.
Sulphur water at 500 and 600 feet; salt water at 1,552 to 1,558 feet.

Union Gas Co. of Canada, Ltd.
M. Grainger No. 1, lot 9, con. VII, Zone tp.
Completed June 27, 1945.
Producing gas well.
Rock pressure: 702 lbs.

Formation	Depth, ft.
Surface	136
Soap	285
Middle lime	295
Soap	310
Brown lime	452
Sharp brown lime	476
Brown lime	622
Sharp brown and grey lime	895
Brown and grey lime	1,015
Brown and blue lime	1,027
Lime and gypsum	1,039
Brown lime	1,055
Blue and grey lime	1,135
Blue lime	1,171
Brown and blue lime	1,215
Brown and grey lime	1,293
Blue and grey lime	1,352
Brown and grey lime	1,364
Blue and grey lime	1,400
Brown and grey lime	1,472
Blue and grey lime	1,514
Brown lime	1,575

Gas at 1,412 to 1,424, 1,430 to 1,442, and 1,526 to 1,532 feet.
Fresh water at 85 feet.

UNION GAS CO. OF CANADA, LTD.
A. Humphrey No. 1, lot 9, con. VI, Zone tp.

Completed October 12, 1945.
Producing gas well.
Rock pressure: 665 lbs.

Formation	Depth, ft.
Surface	75
Blue shale	82
Top rock	120
Soap	260
Middle lime	278
Soap	305
Grey lime	430
Brown lime	442
Sharp grey lime	460
Brown and grey lime	538
Brown lime	644
Sharp grey lime	856
Brown lime	891
Brown and grey lime	980
Brown lime	1,003
Lime and gypsum	1,015
Brown lime	1,041
Grey and blue lime	1,153
Brown and blue lime	1,201
Brown lime	1,292
Brown and grey lime	1,393
Brown lime	1,557

Gas at 1,399 to 1,405 and 1,417 to 1,423 feet.
Fresh water at 70 feet; sulphur water at 442 feet.

UNION GAS CO. OF CANADA, LTD.
A. King and B. McClung No. 1, lot 13, con. VI, Zone tp.

Completed September 5, 1945.
Producing gas well.
Rock pressure: 815 lbs.

Formation	Depth, ft.
Surface	75
Black and grey shale	140
Top rock	180
Soap	335
Middle lime	359
Soap	373
Brown lime	496
Sharp grey lime	520
Brown and grey lime	680
Sharp brown and grey lime	895
Brown lime	1,009
Lime and gypsum	1,021
Brown lime	1,052
Brown and grey lime	1,166
Brown lime	1,286
Brown and grey lime	1,380
Brown and blue lime	1,392
Brown lime	1,466
Grey lime	1,516
Brown lime	1,560
Brown and grey lime	1,616

Gas at 1,514 to 1,531, 1,554 to 1,560, and 1,577 to 1,583 feet.
Fresh water at 75 feet; sulphur water at 496 feet.

UNION GAS CO. OF CANADA, LTD.
F. and M. Humphrey No. 1, lot 8, con. V, Zone tp.

Completed May 9, 1945.
Dry hole.

Formation	Depth, ft.
Surface	83
Black shale	132
Top rock	175
Soap	308
Middle lime	320
Soap	355
Grey lime	472
Grey and brown lime	578
Brown lime	674
Sharp grey lime	856
Grey and brown lime	1,030
Brown lime	1,058
Brown and grey lime	1,115
Blue lime	1,202
Brown and grey lime	1,274
Brown lime	1,325
Blue lime	1,355
Grey and blue lime	1,385
Dark-grey lime	1,421
Brown lime	1,465
Grey lime	1,586
Brown and grey lime	1,640
Grey lime	1,693

Show of gas at 1,430 to 1,436 feet.
Fresh water at 85 feet; sulphur water at 390 feet; salt water at 1,681 to 1,687 feet.

UNION GAS CO. OF CANADA, LTD.
L., A., and F. Kneebone No. 1, lot 11, con. VII, Zone tp.

Completed March 26, 1945.
Producing gas well.
Rock pressure: 690 lbs.

Formation	Depth, ft.
Surface	80
Brown shale	95
Top rock	145
Soap	274
Middle lime	289
Soap	307
Grey lime	548
Brown and grey lime	700
Sharp grey lime	900
Brown lime	1,007
Brown and blue lime	1,019
Lime and gypsum	1,025
Brown and blue lime	1,055
Brown lime	1,084
Brown and blue lime	1,310
Blue lime	1,346
Brown and blue lime	1,415
Brown lime	1,437

Gas at 1,400 to 1,409 and 1,423 to 1,430 feet.
Fresh water at 75 and 86 feet.

UNION GAS CO. OF CANADA, LTD.

L. and M. Leverton No. 1, lot 9, con. III, Zone tp.

Completed June 23, 1945.
Dry hole.

Formation	Depth, ft.
Surface	75
Brown shale	150
Top rock	200
Soap and lime shell	333
Middle lime	349
Soap	365
Grey lime	421
Grey and brown lime	481
Sharp grey lime	493
Brown and grey lime	620
Brown lime	686
Sharp grey lime	905
Brown and grey lime	1,017
Brown and blue lime	1,070
Brown lime	1,094
Brown and grey lime	1,144
Grey and blue lime	1,200
Brown lime	1,324
Brown and blue lime	1,370
Brown and grey lime	1,440
Brown lime	1,488
Brown and grey lime	1,558
Brown lime	1,612
Grey and brown lime	1,634
Lime and gypsum	1,640
Grey lime	1,668

Show of gas at 1,446 to 1,452 feet.
Show of oil at 1,658 feet.
Fresh water at 65 feet; sulphur water at 481 feet; salt water at 1,552 to 1,558 and 1,658 feet.

UNION GAS CO. OF CANADA, LTD.

G. Linley No. 1, lot 12, con. IX, Zone tp.

Completed March 30, 1945.
Dry hole.

Formation	Depth, ft.
Surface	100
Black shale	128
Top rock	174
Soap	260
Soap and lime shell	320
Middle lime	332
Soap and lime shell	365
Brown lime	665
Sharp brown and grey lime	935
Brown lime	1,052
Brown and blue lime	1,058
Lime and gypsum	1,070
Brown and blue lime	1,220
Brown lime	1,256
Blue and brown lime	1,424
Brown and grey lime	1,532
Blue and grey lime	1,538
Brown lime	1,594
Blue and grey lime	1,651
Grey lime	1,675

Fresh water at 85 feet; sulphur water at 498 feet; salt water at 1,663 and 1,669 feet.

UNION GAS CO. OF CANADA, LTD.

P. Lidster No. 3, lot 10, con. VI, Zone tp.

Completed February 7, 1945.
Producing gas well.
Rock pressure: 687 lbs.

Formation	Depth, ft.
Surface	80
Top rock	120
Soap and lime shell	249
Middle lime	261
Soap	294
Brown lime	433
Sharp brown and grey lime	463
Brown lime	616
Sharp brown and grey lime	870
Brown lime	984
Lime and gypsum	1,009
Brown lime	1,048
Brown and grey lime	1,066
Blue and grey lime	1,115
Brown and grey lime	1,151
Brown lime	1,271
Brown and grey lime	1,375
Brown lime	1,402
Dark-grey lime	1,410
Brown and grey lime	1,435

Show of oil at 310 to 316 feet.
Gas at 1,391 to 1,401 and 1,411 to 1,416 feet.
Fresh water at 75 feet; sulphur water at 433 to 439 feet.

UNION GAS CO. OF CANADA, LTD.

M. M. McBrayne No. 1, lot 12, con. VII, Zone tp.

Completed May 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	85
Brown shale	125
Top rock	196
Soap and lime shell	350
Middle lime	365
Soap and lime shell	390
Brown lime	520
Sharp brown lime	532
Brown lime	725
Sharp brown and grey lime	944
Brown lime	1,035
Lime and gypsum	1,047
Brown lime	1,059
Lime and gypsum	1,065
Brown and blue lime	1,120
Blue and grey lime	1,174
Blue, grey, and brown lime	1,330
Blue lime	1,366
Brown and blue lime	1,390
Brown lime	1,402
Grey and blue lime	1,416
Grey and brown lime	1,499
Blue and brown lime	1,538
Brown lime	1,578

Show of gas at 1,447 to 1,452 feet.
Shows of gas and oil at 1,538 to 1,544 feet.
Sulphur water at 532 feet.

UNION GAS CO. OF CANADA, LTD.

F. and J. Maynard No. 1, lot 12, con. VI, Zone tp.

Completed July 24, 1945.
Producing gas well.
Rock pressure: 568 lbs.

Formation	Depth, ft.
Surface	60
Black shale and sand	73
Black shale	149
Top rock	200
Soap	328
Middle lime	352
Soap	376
Grey lime	445
Brown lime	506
Sharp grey lime	524
Brown lime	718
Sharp brown and grey lime	904
Brown lime	1,011
Blue lime	1,017
Lime and gypsum	1,029
Brown and grey lime	1,097
Blue lime	1,158
Brown and blue lime	1,176
Brown lime	1,301
Blue and brown lime	1,343
Brown and grey lime	1,395
Brown lime	1,430

Surface gas at 60 feet; gas at 1,399 to 1,407 feet.
Fresh water at 62 feet; sulphur water at 506 feet.

UNION GAS CO. OF CANADA, LTD.

E. Miller No. 1, lot 12, con. X, Zone tp.

Completed January 5, 1945.
Dry hole.

Formation	Depth, ft.
Surface	94
Brown shale	142
Top rock	180
Soap and lime shell	320
Middle lime	345
Soap	370
Brown lime	670
Sharp brown and grey lime	944
Brown lime	1,046
Lime and gypsum	1,064
Brown, blue, and grey lime	1,120
Blue and grey lime	1,209
Brown and blue lime	1,225
Brown lime	1,243
Brown and blue lime	1,295
Brown lime	1,325
Brown and grey lime	1,397
Brown, blue, and grey lime	1,427
Brown lime	1,509
Brown and grey lime	1,556
Brown lime	1,649
Brown and grey lime	1,706

Sulphur water at 510 feet.

UNION GAS CO. OF CANADA, LTD.

W. Nash No. 1, lot 10, con. VIII, Zone tp.

Completed September 22, 1945.
Producing gas well.
Rock pressure: 792 lbs.

Formation	Depth, ft.
Surface	105
Brown shale	115
Top rock	155
Soap	308
Middle lime	320
Soap	348
Grey lime	660
Sharp brown and grey lime	925
Grey lime	939
Brown lime	1,042
Lime and gypsum	1,048
Brown lime	1,078
Blue lime	1,172
Blue and brown lime	1,190
Brown lime	1,242
Brown and blue lime	1,254
Brown lime	1,314
Brown and blue lime	1,338
Blue lime	1,380
Brown and blue lime	1,409
Brown lime	1,560

Gas at 1,425 to 1,431 and 1,533 to 1,542 feet.
Fresh water at 90 feet; sulphur water at 480 and 580 feet.

UNION GAS CO. OF CANADA, LTD.

W. J. Willer No. 1, lot 11, con. VII, Zone tp.

Completed July 7, 1945.
Producing gas well.
Rock pressure: 696 lbs.

Formation	Depth, ft.
Surface	91
Brown shale	103
Top rock	142
Soap and lime shell	321
Grey lime	578
Grey and brown lime	650
Sharp brown and grey lime	895
Grey lime	906
Brown lime	965
Brown and grey lime	1,006
Lime and gypsum	1,012
Brown lime	1,052
Blue lime	1,162
Brown lime	1,297
Brown and blue lime	1,309
Blue lime	1,349
Brown and blue lime	1,377
Brown lime	1,441

Show of oil at 600 feet.
Show of gas at 1,405 feet; gas at 1,405 to 1,417 and 1,422 to 1,432 feet.
Fresh water at 77 feet; sulphur water at 465 feet.

Lambton County

A. E. LILEY

C. Short No. 1, lot 10, con. I, Brooke tp.

Completed May 25, 1945.
Dry hole.

Formation	Depth, ft.
Surface	64
Top rock	130
Upper soap	267
Middle lime	279
Lower soap	316
Big lime	425

Show of oil at 330 to 335 feet.
Sulphur water at 35 feet; black water at 425 feet.

A. E. Liley

C. Short No. 2, lot 10, con. I, Brooke tp.

Completed October 30, 1945.
Dry hole.

Formation	Depth, ft.
Surface	55
Shale	84
Top rock	150
Soap	287
Middle lime	299
Lower soap	329
Black streak	333
Soap	336
Big lime	400

Fresh water at 84 feet.

Union Gas Co. of Canada, Ltd.

G. Stuart Estate No. 1, lot 16, con. VIII, Euphemia tp.

Completed November 12, 1945.
Dry hole.

Formation	Depth, ft.
Surface	85
Soap and lime shell	110
Top rock	128
Soap and lime shell	270
Middle lime	280
Soap	295
Grey lime	415
Brown and grey lime	650
Sharp brown and grey lime	800
Grey and brown lime	815
Brown lime	857
Brown and grey lime	900
Brown lime	944
Blue lime	1,000
Blue and brown lime	1,020
Brown lime	1,188
Grey lime	1,212
Brown lime	1,242
Salt	1,405
Salt and lime	1,435
Brown lime	1,541
Grey lime	1,577
Brown lime	1,613
Grey lime	1,665

Show of sulphur gas at 240 feet.
Show of oil at 530, 640, 1,550, and 1,626 to 1,633 feet.
Fresh water at 100 and 305 feet; salt water at 1,626 to 1,633 feet.

Imperial Oil, Ltd.

L. Smith No. 1, lot 18, con. VIII, Moore tp.

Completed December 27, 1945.
Dry hole.

Formation	Depth, ft.
Surface	153
Black shale	245
Soap	265
Grey lime	320
Soap	450
Middle lime	458
Soap	509
Brown lime	850

Show of oil at 675 to 682 feet.
Fresh water at 150 feet; salt water at 632 to 636 and 848 feet.

Francis Shaw

F. Shaw No. 1, lot A, Indian reserve, Sarnia tp.

Completed March 24, 1945.
Dry hole.

Formation	Depth, ft.
Surface	115
Black shale	155
Grey shale	163
Lime and shale	280
Shale	400
Middle lime	404
Shale	469
Grey lime	586

Show of gas at 246 and 275 feet.
Show of oil at 475 feet.
Salt water at 586 feet.

Imperial Oil, Ltd.

C. Van Damme No. 1, lot 14, con. XIII, Sombra tp.

Completed November 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	110
Black shale	165
Grey shale	171
Soap	200
Black shale	328
Grey shale and soap	348
Brown lime	349
Brown and grey lime	365
Grey shale	375
Grey shale and brown lime	385
Soap	395
Grey and brown lime	400
Grey lime and soap	410
Soap	510
Middle lime	522
Soap	562
Brown lime	783
Grey lime	793
Brown and grey lime	815
Grey lime	820

Fresh water at 107 and 135 feet; salt water at 665 to 671 feet.

Wilson Sullivan Development Co.

E. Davidson No. 3, lot 26, con. VI, S.E.R., Warwick tp.

Completed December 22, 1945.
Producing oil well.

Formation	Depth, ft.
Surface	125
Top rock	186
Top soap	325
Middle lime	343
Lower soap	375
Dark lime	382
Grey lime	408

Oil at 382 feet.
Fresh water at 124 feet.

Wilson Sullivan Development Co.

L. Eastabrook No. 8, lot 26, con. V, S.E.R., Warwick tp.

Completed November 9, 1945.
Dry hole.

Formation	Depth, ft.
Surface	121
Top rock	182
Top soap	320
Middle lime	350
Lower soap	371
Dark lime	378
Grey lime	490

Show of oil at 378 and 440 to 445 feet.
Fresh water at 43 and 121 feet.

Lincoln County

John M. Goit

J. M. Goit No. 1, lot 17, con. II, Caistor tp.

Completed November 30, 1945.
Producing gas well.
Rock pressure: 145 lbs.

Formation	Depth, ft.
Surface	56
Shale	81
Niagara	281
Shale	321
Clinton	346
Red Medina	387
Grey shale	442
White Medina	453

Gas at 360 feet.
Fresh water at 80 feet; black water at 100 feet.

GRIMSBY NATURAL GAS CO., LTD.
J. Olascki No. 1, lot 10, con. IV, Caistor tp.

Completed June 29, 1945.
Producing gas well.
Rock pressure: 178 lbs.

Formation	Depth, ft.
Surface	61
Shale	84
Niagara	275
Shale	325
Clinton	355
Red Medina	390
Grey shale	450
White Medina	460

Gas at 350, 360, and 380 feet.
Fresh water at 72 feet; salt water at 460 feet.

GRIMSBY NATURAL GAS CO., LTD.
J. Olascki No. 2, lot 10, con. IV, Caistor tp.

Completed August 28, 1945.
Producing gas well.
Rock pressure: 147 lbs.

Formation	Depth, ft.
Surface	53
Lime and shale	93
Niagara	323
Clinton	353
Red Medina	388
Grey shale	448
White Medina	460

Gas at 373 and 380 feet.
Fresh water at 64 feet; salt water at 455 feet.

GRIMSBY NATURAL GAS CO., LTD
J. Olascki No. 3, lot 10, con. IV, Caistor tp.

Completed October 10, 1945.
Producing gas well.
Rock pressure: 182 lbs.

Formation	Depth, ft.
Surface	51
Shale	83
Niagara	248
Shale	321
Clinton	356
Red Medina	391
Grey shale	461
White Medina	473
Red shale	475

Gas at 370 feet.
Fresh water at 49 feet; black water at 120 feet; salt water at 469 feet.

GRIMSBY NATURAL GAS CO., LTD.
J. Olascki No. 4, lot 10, con. IV, Caistor tp.

Completed December 5, 1945.
Producing gas well.
Rock pressure: 176 lbs.

Formation	Depth, ft.
Surface	67
Shale	107
Niagara	230
Shale	325
Clinton	360
Red Medina	395
Grey shale	450
White Medina	455

Gas at 335, 358, and 387 feet.
Fresh water at 68 feet; black water at 130 feet; salt water at 455 feet.

Middlesex County

WILSON SULLIVAN DEVELOPMENT CO.
J. Galbraith No. 1, lot 6, con. IV, S.E.R., Adelaide tp.

Completed June 15, 1945.
Producing oil well.

Formation	Depth, ft.
Surface	130
Top rock	135
Top soap	266
Middle lime	287
Lower soap	325
Grey lime	388

Oil at 325 and 385 feet.
Fresh water at 30 feet.

WILSON SULLIVAN DEVELOPMENT CO.
J. Galbraith No. 2, lot 6, con. IV, S.E.R., Adelaide tp.

Completed August 4, 1945.
Dry hole.

Formation	Depth, ft.
Surface	128
Top rock	130
Top soap	265
Middle lime	285
Lower soap	315
Dark lime	320
Grey lime	415

Fresh water at 125 feet.

WILSON SULLIVAN DEVELOPMENT CO.
T. C. Galbraith No. 1, lot 5, con. IV, S.E.R.
Adelaide tp.

Completed May 24, 1945.
Dry hole.

Formation	Depth, ft.
Surface	108
Top rock	134
Top soap	268
Middle lime	288
Lower soap	318
Dark lime	324
Grey lime	429

Fresh water at 108 feet; black water at 424 feet.

C. J. BESSEY
C. W. Patterson No. 1, lot 1, con. I, Metcalfe tp.

Completed July 18, 1945.
Small producing oil well.

Formation	Depth, ft.
Surface	90
Top rock	129
Upper soap	262
Middle lime	286
Lower soap	309
Black streak	311
Soap	313
Big lime	418

Oil at 370 and 408 feet.
Fresh water at 93 feet.

DOLPHIN BROS.
W. J. Diamond No. 1, lot 8, con. I, Metcalfe tp.

Completed April 27, 1945.
Dry hole.

Formation	Depth, ft.
Surface	115
Top rock	118
Upper soap	256
Middle lime	278
Lower soap	295
Black streak	301
Lower soap	304
Big lime	370

Fresh water at 118 feet; salt water at 370 feet.

DOMINION PETROLEUM CO., LTD.
D. Secord No. 17, lot 6, con. VI, Mosa tp.

Completed August 18, 1945.
Producing oil well.

Formation	Depth, ft.
Surface	86
Upper soap	217
Middle lime	233
Lower soap	253
Dark streak	258
Soap	262
Lower lime	394

Oil at 245 and 360 feet.

DOMINION PETROLEUM CO., LTD.
D. Secord No. 18, lot 6, con. VI, Mosa tp.

Producing oil well.
No driller's log available.

UNION GAS CO. OF CANADA, LTD.
G. and M. Hewitt No. 2, lot 26, con. I, Mosa tp.

Completed January 13, 1945.
Dry hole.

Formation	Depth, ft.
Surface	100
Brown shale	150
Top rock	209
Soap and lime shell	353
Middle lime	365
Soap	391
Brown and grey lime	695
Sharp brown and grey lime	910
Grey and brown lime	1,003
Brown lime	1,140
Brown and blue lime	1,276
Brown lime	1,354
Blue lime	1,384
Brown and blue lime	1,435
Brown lime	1,543
Grey and brown lime	1,555
Brown lime	1,632
Brown and grey lime	1,683

Show of gas at 1,470 feet.
Sulphur water at 545 and 590 feet; salt water at 1,680 feet.

UNION GAS CO. OF CANADA, LTD.
J. F. and M. Morrison No. 1, lot 21, con. II, Mosa tp.

Completed June 27, 1945.
Dry hole.

Formation	Depth, ft.
Surface	130
Soap and lime shell	295
Middle lime	307
Soap	333
Brown lime	635
Sharp brown and grey lime	817
Brown lime	871
Brown and blue lime	895
Lime and gypsum	919
Brown lime	937
Lime and gypsum	967
Blue and grey lime	1,034
Brown and blue lime	1,070
Brown lime	1,088
Brown and grey lime	1,157
Brown lime	1,175
Brown and blue lime	1,260
Brown lime and salt	1,290
Salt and lime shell	1,400
Brown lime and salt	1,424
Brown lime	1,477
Grey lime	1,533
Brown and grey lime	1,545
Brown lime	1,569
Brown and grey lime	1,642

Show of oil at 1,618 to 1,624 feet.
Fresh water at 110 feet; sulphur water at 455 feet; salt water at 1,618 to 1,624 and 1,636 to 1,639 feet.

UNION GAS CO. OF CANADA, LTD.
W. H. Parnall No. 1, lot 21, con. I, Mosa tp.

Completed August 21, 1945.
Dry hole.

Formation	Depth, ft.
Surface	127
Brown shale	147
Top rock	198
Soap and lime shell	387
Brown lime	700
Sharp brown and grey lime	968
Brown lime	1,055
Brown and blue lime	1,061
Lime and gypsum	1,073
Brown and grey lime	1,091
Lime and gypsum	1,121
Brown and blue lime	1,223
Brown lime	1,241
Brown and blue lime	1,418
Brown and grey lime	1,430
Brown lime	1,494
Brown and grey lime	1,540
Brown lime	1,574
Brown and grey lime	1,633

Sulphur water at 520 and 575 feet; salt water at 1,621 to 1,627 feet.

UNION GAS CO. OF CANADA, LTD.
J. Winger No. 1, lot 13, range II N., Mosa tp.

Completed November 20, 1945.
Dry hole.

Formation	Depth, ft.
Surface	175
Soap and lime shell	307
Middle lime	325
Soap	345
Brown lime	469
Sharp grey lime	493
Brown lime	684
Sharp brown and grey lime	819
Brown lime	882
Brown and blue lime	894
Lime and gypsum	900
Brown lime	923
Lime and gypsum	941
Brown and grey lime	967
Grey lime	1,023
Brown and grey lime	1,241
Brown lime and salt	1,307
Brown lime	1,319
Salt and lime shell	1,407
Brown lime	1,490
Brown and grey lime	1,531
Brown lime	1,597
Grey lime	1,624
Brown lime	1,655

Fresh water at 90 and 175 feet; sulphur water at 470 feet; salt water at 1,636 to 1,642 feet.

Norfolk County

DOMINION NATURAL GAS CO., LTD.
H. Gerhing No. 1, lot 43, con. II, S.T.R., Middleton tp.

Completed June 20, 1945.
Dry hole.

Formation	Depth, ft.
Surface	208
Grey lime	340
Flint	460
Brown lime	480
Lime and shale	845
Niagara	1,083
Shale	1,135
Clinton	1,150
Red Medina	1,175
Shale	1,249
White Medina	1,259
Red shale	1,265

Fresh water at 210 feet; black water at 300 feet; salt water at 860 feet.

DOMINION NATURAL GAS CO., LTD.
R. Sage No. 1, lot 31, con. III, Middleton tp.

Completed September 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	236
Grey lime	296
Brown lime	405
Flint	490
Brown lime	545
Lime and shale	890
Niagara	1,135
Shale	1,192
Clinton	1,218
Red Medina	1,223

Fresh water at 237 feet; sulphur water at 265 feet; salt water at 940 feet.

DOMINION NATURAL GAS CO., LTD.
S. Santo No. 2, lot 35, con. II, S.T.R., Middleton tp.

Completed March 28, 1945.
Producing gas well.
Rock pressure: 50 lbs.

Formation	Depth, ft.
Surface	193
Lime	204

Gas at 204 feet.

DOMINION NATURAL GAS CO., LTD.
L. C. Dement No. 1, lot 14, con. XIV, North Walsingham tp.

Completed December 15, 1945.
Dry hole.

Formation	Depth, ft.
Surface	236
Lime	250
Grey and brown lime	415
Flint	555
Lime	605
Shale	665
Lime and shale	935
Niagara	1,195
Shale	1,252
Clinton	1,275
Red Medina	1,315
Shale	1,379
Red shale	1,384

Sulphur water at 240 feet; black water at 510 feet.

DOMINION NATURAL GAS CO., LTD.
R. and B. Bowyer No. 3, lot 15, con. XII, Townsend tp.

Completed January 27, 1945.
Producing gas well.
Rock pressure: 440 lbs.

Formation	Depth, ft.
Surface	53
Flint	131
Brown lime	188
Shale and gypsum	264
Lime and shale	497
Niagara	798
Shale	844
Clinton	885
Red Medina	922
Shale	925

Gas at 862 and 890 feet.
Fresh water at 55 and 62 feet; sulphur water at 129 and 148 feet.

DOMINION NATURAL GAS CO., LTD.
R. and B. Bowyer No. 4, lot 15, con. XII, Townsend tp.

Completed September 13, 1945.
Dry hole.

Formation	Depth, ft.
Surface	61
Flint	140
Lime	193
Shale	277
Lime and shale	510
Niagara	808
Shale	855
Clinton	893
Red Medina	895

Show of gas at 893 feet.
Fresh water at 84 feet; sulphur water at 137 feet; black water at 589 feet.

DOMINION NATURAL GAS CO., LTD.
B. and E. Brath No. 1, lot 5, con. IX, Townsend tp.

Completed November 17, 1945.
Producing gas well.
Rock pressure: 427 lbs.

Formation	Depth, ft.
Surface	124
Flint	189
Lime	245
Shale and gypsum	320
Lime and shale	562
Niagara	864
Shale	907
Clinton	929
Red Medina	970

Gas at 912 to 922 feet.
Fresh water at 125 feet; sulphur water at 164 feet.

DOMINION NATURAL GAS CO., LTD.
S. J. Buckborough No. 1, lot 18, con. XIII, Townsend tp.

Completed March 29, 1945.
Dry hole.

Formation	Depth, ft.
Surface	14
Flint	92
Lime and shale	446
Niagara	700
Lime and shale	725
Guelph	751
Shale	792
Clinton	824
Red Medina	850
Grey shale	904
White Medina	913
Red shale	916

Fresh water at 80 and 90 feet; black water at 195 feet.

DOMINION NATURAL GAS CO., LTD.
S. J. Buckborough No. 2, lot 18, con. XII, Townsend tp.

Completed May 23, 1945.
Dry hole.

Formation	Depth, ft.
Surface	43
Flint and sharp sand	93
Lime and shale	470
Niagara	715
Lime and shale	745
Guelph	775
Shale	820
Clinton	855
Red Medina	875
Grey shale	932
White Medina	941
Red shale	945

Fresh water at 80 feet; black water at 110 and 260 feet.

DOMINION NATURAL GAS CO., LTD.

J. and G. Cloet No. 1, lot 5, con. X, Townsend tp.

Completed May 1, 1945.
Producing gas well.
Rock pressure: 420 lbs.

Formation	Depth, ft.
Surface	149
Flint	219
Lime, shale, and gypsum	588
Niagara	884
Shale	925
Clinton	955
Red Medina	975
Shale	995

Gas at 995 feet.
Fresh water at 154 and 180 feet; sulphur water at 240 feet.

DOMINION NATURAL GAS CO., LTD.

J. and G. Cloet No. 2, lot 5, con. X, Townsend tp.

Completed June 6, 1945.
Dry hole.

Formation	Depth, ft.
Surface	143
Flint	210
Lime, shale, and gypsum	585
Niagara	884
Shale	928
Clinton	954
Red Medina	974
Shale	1,048
White Medina	1,052
Red shale	1,056

Fresh water at 144, 155 and 170 feet; black water at 335 feet.

DOMINION NATURAL GAS CO., LTD.

B. G. Collver No. 1, lot 10, con. XI, Townsend tp.

Completed June 25, 1945.
Producing gas well.
Rock pressure: 417 lbs.

Formation	Depth, ft.
Surface	90
Flint	170
Lime and shale	545
Niagara	837
Shale	882
Clinton	919
Red Medina	956

Gas at 885 feet.
Fresh water at 91 feet; sulphur water at 120 and 230 feet.

DOMINION NATURAL GAS CO., LTD.

H. Collver No. 2, lot 9, con. XI, Townsend tp.

Completed August 14, 1945.
Dry hole.

Formation	Depth, ft.
Surface	114
Flint	200
Lime and shale	572
Niagara	872
Shale	918
Clinton	953
Red Medina	957

Fresh water at 116 feet; sulphur water at 148 feet.

DOMINION NATURAL GAS CO., LTD.

J. Cooper No. 1, lot 6, con. XI, Townsend tp.

Completed December 3, 1945.
Producing gas well.
Rock pressure: 460 lbs.

Formation	Depth, ft.
Surface	156
Flint	238
Lime and shale	606
Niagara	906
Shale	949
Clinton	979
Red Medina	1,016

Gas at 972 feet.
Fresh water at 161 feet; sulphur water at 220 feet.

DOMINION NATURAL GAS CO., LTD.

J. W. Duckworth No. 1, lot 4, con. IX, Townsend tp.

Completed September 26, 1945.
Producing gas well.
Rock pressure: 310 lbs.

Formation	Depth, ft.
Surface	124
Flint	185
Lime	240
Shale and gypsum	324
Lime and shale	565
Niagara	860
Shale	904
Clinton	929
Red Medina	970

Gas at 907 feet.
Fresh water at 124 and 150 feet; black water at 200 feet.

DOMINION NATURAL GAS CO., LTD.

E. Farr No. 2, lot 8, con. XII, Townsend tp.

Completed July 9, 1945.
Producing gas well.
Rock pressure: 475 lbs.

Formation	Depth, ft.
Surface	125
Flint	231
Lime	297
Shale	375
Lime and shale	609
Niagara	916
Shale	960
Clinton	990
Red Medina	1,030

Gas at 976 to 981 feet.
Fresh water at 134 feet; sulphur water at 181 feet; black water at 640 feet.

DOMINION NATURAL GAS CO., LTD.

E. Farr No. 3, lot 8, con. XII, Townsend tp.

Completed August 16, 1945.
Producing gas well.
Rock pressure: 370 lbs.

Formation	Depth, ft.
Surface	150
Flint	226
Brown lime	285
Shale	341
Lime and shale	592
Niagara	900
Shale	948
Clinton	982
Red Medina	1,012

Gas at 974 to 979 feet.
Fresh water at 152 feet; sulphur water at 185 feet; black water at 610 feet.

DOMINION NATURAL GAS CO., LTD.

J. Gallea No. 2, lot 7, con. XII, Townsend tp.

Completed May 22, 1945.
Producing gas well.
Rock pressure: 500 lbs.

Formation	Depth, ft.
Surface	127
Flint	230
Lime and shale	600
Niagara	918
Shale	956
Clinton	988
Red Medina	1,026

Gas at 966 to 988 feet.
Fresh water at 130 and 185 feet; black water at 740 feet.

DOMINION NATURAL GAS CO., LTD.
W. A. Jacques No. 1, lot 6, con. IX, Townsend tp.

Completed July 23, 1945.
Dry hole.

Formation	Depth, ft.
Surface	167
Flint	230
Brown lime	285
Shale and gypsum	350
Lime and shale	600
Niagara	902
Shale	943
Clinton	968
Red Medina	970

Fresh water at 167, 169, and 190 feet.

DOMINION NATURAL GAS CO., LTD.
J. D. Kitchen No. 1, lot 9, con. X, Townsend tp.

Completed March 6, 1945.
Dry hole.

Formation	Depth, ft.
Surface	101
Flint	191
Lime and shale	255
Shale and gypsum	573
Niagara	853
Shale	894
Clinton	931
Red Medina	961
Shale	1,014
White Medina	1,022
Red shale	1,026

Fresh water at 104 and 124 feet; black water at 200 feet.

DOMINION NATURAL GAS CO., LTD.
F. R. Lingwood No. 1, lot 13, con. XII, Townsend tp

Completed May 24, 1945.
Producing gas well.
Rock pressure: 450 lbs.

Formation	Depth, ft.
Surface	59
Flint	144
Brown lime	212
Shale and gypsum	276
Lime and shale	516
Niagara	814
Shale	863
Clinton	900
Red Medina	929
Grey shale	940

Gas at 899 to 900 feet.
Fresh water at 61 feet; sulphur water at 77 and 102 feet.

DOMINION NATURAL GAS CO., LTD.
F. R. Lingwood No. 2, lot 13, con. XII, Townsend tp.

Completed June 26, 1945.
Dry hole.

Formation	Depth, ft.
Surface	58
Flint	142
Brown lime	210
Shale and gypsum	276
Lime and shale	517
Niagara	814
Shale	858
Clinton	895
Red Medina	923
Shale	967
White Medina	979
Red shale	983

Fresh water at 60 feet; sulphur water at 132 feet.

DOMINION NATURAL GAS CO., LTD.
G. and K. Maksymoviz No. 1, lot 10, con. X, Townsend tp.

Completed January 8, 1945.
Producing gas well.
Rock pressure: 362 lbs.

Formation	Depth, ft.
Surface	98
Flint	180
Lime and shale	550
Niagara	830
Shale	878
Clinton	914
Red Medina	954

Gas at 896 feet.
Fresh water at 100 feet; sulphur water at 145 feet.

DOMINION NATURAL GAS CO., LTD.
G. and K. Maksymoviz No. 2, lot 10, con. X, Townsend tp.

Completed September 8, 1945.
Dry hole.

Formation	Depth, ft.
Surface	126
Flint	205
Lime and shale	560
Niagara	790
Guelph	815
Shale	870
Clinton	911
Red Medina	918

Fresh water at 120 and 130 feet; sulphur water at 175 feet.

DOMINION NATURAL GAS CO., LTD.
A. Malo No. 2, lot 7, con. XIII, Townsend tp.

Completed May 19, 1945.
Producing gas well.
Rock pressure: 490 lbs.

Formation	Depth, ft.
Surface	142
Flint	222
Lime and shale	620
Niagara	953
Shale	983
Clinton	1,013
Red Medina	1,028

Gas at 1,009 feet.
Fresh water at 147 and 215 feet; black water at 350 feet.

DOMINION NATURAL GAS CO., LTD.
S. R. Misner No. 2, lot 11, con. XII, Townsend tp.

Completed November 21, 1945.
Producing gas well.
Rock pressure: 481 lbs.

Formation	Depth, ft.
Surface	49
Flint	128
Brown lime	184
Shale	265
Lime and shale	495
Niagara	802
Shale	847
Clinton	881
Red Medina	921

Gas at 862 to 864 feet.
Fresh water at 48, 53, and 57 feet; sulphur water at 89 feet; black water at 130 feet.

Dominion Natural Gas Co., Ltd.
L. Nicks No. 1, lot 5, con. XII, Townsend tp.
Completed December 20, 1945.
Producing gas well.
Rock pressure: 463 lbs.

Formation	Depth, ft.
Surface	135
Flint	255
Lime and shale	608
Niagara	908
Shale and lime	918
Shale	958
Clinton	990
Red Medina	1,018
Grey shale	1,028

Gas at 960, 971, 982, and 987 feet.
Fresh water at 138 feet; black water at 225 feet.

Dominion Natural Gas Co., Ltd.
S. Nytray No. 1, lot 15, con. XII, Townsend tp.
Completed August 4, 1945.
Dry hole.

Formation	Depth, ft.
Surface	61
Flint	134
Brown lime	192
Shale and gypsum	264
Lime and shale	497
Niagara	793
Shale	845
Clinton	880
Red Medina	915
Shale	959
White Medina	968
Red shale	971

Fresh water at 62 feet; sulphur water at 72 feet; black water at 122 feet.

Dominion Natural Gas Co., Ltd.
F. Smith No. 3, lot 6, con. XIII, Townsend tp.
Completed April 13, 1945.
Producing gas well.
Rock pressure: 419 lbs.

Formation	Depth, ft.
Surface	143
Flint	233
Lime and shale	590
Niagara	900
Shale	951
Clinton	983
Red Medina	1,023

Gas at 951 to 983 feet.
Black water at 215 feet.

Dominion Natural Gas Co., Ltd.
R. Smith No. 1, lot 12, con. IX, Townsend tp
Completed October 17, 1945.
Dry hole.

Formation	Depth, ft.
Surface	74
Flint	112
Brown lime	183
Shale	268
Lime and shale	492
Niagara	766
Shale	816
Clinton	842
Red Medina	863
Grey shale	930
White Medina	935
Red shale	940

Fresh water at 76 and 98 feet; sulphur water at 137 feet.

Dominion Natural Gas Co., Ltd.
H. E. Stewart No. 1, lot 11, con. XIII, Townsend tp.
Completed September 7, 1945.
Dry hole.

Formation	Depth, ft.
Surface	102
Flint	169
Grey lime	218
Lime and gypsum	312
Lime and shale	541
Niagara	844
Shale	895
Clinton	929
Red Medina	937

Fresh water at 104 feet; sulphur water at 167, 540, and 728 feet.

Dominion Natural Gas Co., Ltd.
H. E. Stewart No. 2, lot 11, con. XIII, Townsend tp
Completed October 12, 1945.
Dry hole.

Formation	Depth, ft.
Surface	78
Flint	166
Grey lime	232
Lime and gypsum	311
Lime and shale	545
Niagara	849
Shale	893
Clinton	918
Red Medina	925

Fresh water at 78, 82, and 109 feet.
Sulphur water at 228 feet.
Black water at 567 feet.

Dominion Natural Gas Co., Ltd.
M. and M. Weiss No. 1, lot 7, con. XIII, Townsend tp.
Completed January 20, 1945.
Producing gas well.
Rock pressure: 458 lbs.

Formation	Depth, ft.
Surface	134
Flint	227
Lime and shale	600
Niagara	908
Shale	954
Clinton	986
Red Medina	1,026

Gas at 968 feet.
Fresh water at 136 feet; black water at 227 feet.

Dominion Natural Gas Co., Ltd.
G. B. York No. 1, lot 10, con. XI, Townsend tp.
Completed October 6, 1945.
Producing gas well.
Rock pressure: 415 lbs.

Formation	Depth, ft.
Surface	80
Flint	160
Lime and shale	533
Niagara	818
Shale	863
Clinton	898
Red Medina	933

Gas at 866 feet.
Fresh water at 82 feet; sulphur water at 120 feet.

DOMINION NATURAL GAS CO., LTD.
H. Zaveruka No. 1, lot 11, con. X, Townsend tp.

Completed April 24, 1945.
Producing gas well.
Rock pressure: 475 lbs.

Formation	Depth, ft.
Surface	90
Flint	171
Lime and shale	540
Niagara	825
Shale	871
Clinton	906
Red Medina	941

Gas at 894 to 899 feet.
Fresh water at 94 and 120 feet; sulphur water a 200 feet.

DOMINION NATURAL GAS CO., LTD.
H. Zaveruka No. 2, lot 11, con. X, Townsend tp.

Completed July 25, 1945.
Producing gas well.
Rock pressure: 445 lbs.

Formation	Depth, ft.
Surface	101
Flint	185
Lime and shale	551
Niagara	785
Guelph	817
Shale	862
Clinton	900
Red Medina	932
Grey shale	942

Gas at 875 to 885 feet.
Fresh water at 95, 104, and 185 feet.

DOMINION NATURAL GAS CO., LTD.
H. Zaveruka No. 3, lot 11, con. X, Townsend tp.

Completed October 25, 1945.
Dry hole.

Formation	Depth, ft.
Surface	68
Flint and sharp sand	152
Lime and shale	531
Niagara	759
Guelph	815
Shale	852
Clinton	879
Red Medina	910

Show of gas at 852 feet.
Fresh water at 73 and 132 feet; black water at 200 feet.

WALTER GAS SYNDICATE, LTD.
G. R. McEown No. 3, lot 11, con. XIV, Townsend tp.

Completed March 15, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	105
Brown lime	120
Flint	190
Lime and shale	565
Niagara	880
Shale	914
Clinton	949
Red Medina	964
Blue shale	1,034
Grey sand	1,042

Gas at 928, 934, and 949 feet.
Fresh water at 107 and 133 feet.

WALTER GAS SYNDICATE, LTD.
G. R. McEown No. 4, lot 11, con. XIV, Townsend tp.

Completed June 25, 1945.
Dry hole.

Formation	Depth, ft.
Surface	114
Brown lime	129
Flint	194
Lime and shale	560
Niagara	865
Shale	871
Grey shale	899
Clinton	934
Red Medina	949
Blue shale	1,024
White Medina	1,030
Red shale	1,036

Fresh water at 117 and 148 feet.

WALTER GAS SYNDICATE, LTD.
G. R. McEown No. 5, lot 10, con. XIV, Townsend tp.

Completed August 25, 1945.
Producing gas well.
Rock pressure: 395 lbs.

Formation	Depth, ft.
Surface	103
Lime and shale	249
Brown lime	269
Flint	329
Lime and shale	555
Niagara	860
Grey shale	870
Shale	893
Clinton	933
Red Medina	943
Blue shale	986

Gas at 907, 931, and 937 feet.
Fresh water at 110 and 135 feet; black water at 181 feet.

RAY WOOD
C. R. Bollert No. 2, lot 11, con. XIV, Townsend tp.

Completed February 2, 1945.
Dry hole.

Formation	Depth, ft.
Surface	88
Flint	172
Lime and shale	550
Niagara	854
Shale	897
Clinton	933
Red Medina	941

Fresh water at 87 and 124 feet; sulphur water at 140 and 210 feet.

RAY WOOD
C. R. Bollert No. 3, lot 10, con. XIV, Townsend tp.

Completed June 8, 1945.
Producing gas well.
Rock pressure: 475 lbs.

Formation	Depth, ft.
Surface	95
Flint	178
Lime and shale	550
Niagara	860
Shale	900
Clinton	938
Red Medina	966

Gas at 914, 928, and 936 feet.
Fresh water at 94 and 115 feet; sulphur water at 140 and 210 feet.

RAY WOOD

C. R. Bollert No. 4, lot 11, con. XIV, Townsend tp.

Completed August 22, 1945.
Producing gas well.
Rock pressure: 425 lbs.

Formation	Depth, ft.
Surface	82
Lime and shale	92
Flint	180
Lime and shale	550
Niagara	860
Shale	903
Clinton	938
Red Medina	941

Gas at 907 and 918 feet.
Fresh water at 82 feet; black water at 150 feet.

RAY WOOD

C. R. Bollert No. 5, lot 11, con. XIV, Townsend tp

Completed October 25, 1945.
Dry hole.

Formation	Depth, ft.
Surface	52
Flint	145
Lime and shale	515
Niagara	795
Shale	870
Clinton	905
Red Medina	910

Fresh water at 55, 75, and 95 feet.

DOMINION NATURAL GAS CO., LTD.

A. Pow No. 2, lot 7, con. III, Woodhouse tp.

Completed June 26, 1945.
Producing gas well.
Rock pressure: 229 lbs.

Formation	Depth, ft.
Surface	32
Flint	197
Lime and shale	622
Niagara	923
Shale	931
Clinton	961
Red Medina	1,001
Grey shale	1,056
White Medina	1,066
Red shale	1,071

Gas at 966 feet.
Fresh water at 45 feet; black water at 90 feet.

DOMINION NATURAL GAS CO., LTD.

R. A. Whiteside No. 2, lot 7, con. I, Woodhouse tp.

Completed October 3, 1945.
Dry hole.

Formation	Depth, ft.
Surface	100
Flint	295
Lime and shale	695
Niagara	935
Shale	980
Clinton	1,008
Red Medina	1,048
Grey shale	1,104
White Medina	1,114
Red shale	1,117

Fresh water at 99 feet; black water at 251 feet.

WALTER GAS SYNDICATE, LTD.

C. Chambers No. 1, lot 11, con. VI, Woodhouse tp.

Completed March 20, 1945.
Producing gas well.
Rock pressure: 455 lbs.

Formation	Depth, ft.
Surface	81
Lime	103
Flint	180
Shale	550
Niagara	855
Shale	912
Clinton	950
Red Medina	985
Grey shale	1,035
White Medina	1,045
Red shale	1,046

Gas at 923, 927, and 935 feet.
Fresh water at 104 feet; black water at 205 feet.

WALTER GAS SYNDICATE, LTD.

J. Christison No. 1, lot 8, con. VI, Woodhouse tp.

Completed December 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	108
Brown lime	123
Flint	213
Lime and shale	580
Niagara	875
Grey shale	938
Clinton	968
Red Medina	988
Blue shale	1,056
White Medina	1,062
Red shale	1,072

Fresh water at 111 feet.

WALTER GAS SYNDICATE, LTD.

H. Matthews No. 1, lot 10, con. VI, Woodhouse tp.

Completed May 28, 1945.
Dry hole.

Formation	Depth, ft.
Surface	91
Brown lime	116
Flint	190
Lime	240
Shale and gypsum	325
Brown lime	550
Niagara	845
Shale	919
Clinton	954
Red Medina	990
Blue shale	1,046
White Medina	1,050
Red shale	1,051

Show of gas at 933 feet.
Fresh water at 82 and 115 feet; sulphur water at 215 feet.

WALTER GAS SYNDICATE, LTD.

H. Matthews No. 2, lot 10, con. VI, Woodhouse tp.

Completed October 12, 1945.
Producing gas well.
Rock pressure: 425 lbs.

Formation	Depth, ft.
Surface	114
Brown lime	124
Flint	197
Lime and shale	570
Niagara	887
Grey shale	930
Clinton	970
Red Medina	990
Blue shale	1,047
White Medina	1,055
Red shale	1,061

Gas at 931 and 942 feet.
Fresh water at 139 feet; sulphur water at 193 feet.

WALTER GAS SYNDICATE, LTD.

J. Trescak No. 2, lot 10, con. VI, Woodhouse tp.

Completed August 23, 1945.
Producing gas well.
Rock pressure: 395 lbs.

Formation	Depth, ft.
Surface	85
Brown lime	100
Flint	195
Grey lime	225
Dark-brown lime	260
Shale and gypsum	325
Brown lime and gypsum	555
Niagara	830
Brown lime and shale	917
Clinton	953
Red Medina	988
Grey shale	1,042
White Medina	1,052
Red shale	1,054

Gas at 968 feet.
Fresh water at 117 feet; black water at 144 and 215 feet.

Oxford County

IMPERIAL OIL, LTD.

P. O'Brien No. 1, lot 5, con. XI, South Norwich tp.

Completed December 24, 1945.
Dry hole.

Formation	Depth, ft.
Surface	117
Brown lime	145
Grey lime	166
Brown lime	205
Flint	280
Brown lime	330
Brown lime and shale	465
Brown and grey lime	500
Brown lime and shale	662
Brown lime	690
Lime and shale	728
Guelph	735
Brown lime	974
Brown lime and shale	986
Blue shale	998
Shale	1,024
Clinton	1,045
Shale	1,055
Red Medina	1,068
Shale	1,119
White Medina	1,136
Red shale	1,140

Show of oil at 166 to 172 feet.
Fresh water at 110 and 120 feet; black water at 190, 280, 740, and 818 feet.

Simcoe County

M. STOBIE

J. F. Hambly No. 1, lot 21, con. X, West Gwillimbury tp.

Completed December 20, 1945.
Dry hole.

Formation	Depth, ft.
Surface	180
Trenton	779
Granite	780

Small show of gas at 312 feet.
Small show of oil at 550 feet.
Fresh water at 40, 90, and 178 feet.

MALCOLM STOBIE

B. Roberts No. 1, lot 18, con. XI, West Gwillimbury tp.

Completed July 26, 1945.
Dry hole.

Formation	Depth, ft.
Surface	247
Trenton	920

Show of gas at 860 feet.
Fresh water at 40, 100, and 237 feet.

Welland County

LOUIS BAKER

L. Baker No. 2, Stevensville, Bertie tp.

Completed June 12, 1945.
Producing gas well.
Rock pressure: 120 lbs.

Formation	Depth, ft.
Surface	50
Lime and shale	260
Niagara	460
Grey shale	545
Clinton	577
Red Medina	647
White Medina	697
Red shale	732

Gas at 657 feet.
Sulphur water at 50 feet.

FRETZ AND RUEGG

S. House No. 1, lot 29, con. III, Bertie tp.

Completed July 10, 1945.
Producing gas well.
Rock pressure: 180 lbs.

Formation	Depth, ft.
Surface	18
Flint	33
Brown lime and shale	410
Niagara	600
Shale	705
Clinton	732
Red Medina	807
Shale	842
White Medina	854
Red shale	884

Gas at 440, 709, 754, 772, and 854 feet.
Fresh water at 27 feet; sulphur water at 132 feet.

STANLEY S. JENKINS

S. Batusic No. 1, lot 2, con. XV, Bertie tp.

Completed August 24, 1945.
Producing gas well.
Rock pressure: 350 lbs.

Formation	Depth, ft.
Surface	14
Lime and shale	407
Niagara	642
Shale	689
Clinton	718
Red Medina	780
Shale	813
White Medina	828
Red shale	831

Gas at 758 and 818 feet.
Fresh water at 40 feet; sulphur water at 180 feet.

STANLEY S. JENKINS

L. Fretz No. 1, lot 3, con. XV, Bertie tp.

Completed June 9, 1945.
Producing gas well.
Rock pressure: 250 lbs.

Formation	Depth, ft.
Surface	17
Lime and shale	399
Niagara	629
Shale	671
Clinton	702
Red Medina	768
Shale	798
White Medina	813
Red shale	817

Gas at 739 and 745 feet.
Fresh water at 40 feet; sulphur water at 175 feet.

STANLEY S. JENKINS
L. Fretz No. 2, lot 3, con. XV, Bertie tp.
Completed July 11, 1945.
Dry hole.

Formation	Depth, ft.
Surface	17
Lime and shale	380
Niagara	610
Shale	664
Clinton	696
Red Medina	761
Grey shale	791
White Medina	803
Red shale	806

Fresh water at 31 feet; sulphur water at 175 feet.

STANLEY S. JENKINS
Mrs. S. Fretz No. 1, lot 2, con. XVI, Bertie tp.
Completed November 17, 1945.
Producing gas well.
Rock pressure: 70 lbs.

Formation	Depth, ft.
Surface	3
Lime and shale	400
Niagara	625
Shale	676
Clinton	708
Red Medina	770
Grey shale	805
White Medina	820
Red shale	882

Gas at 751 and 815 feet.
Fresh water at 26 feet; sulphur water at 200 feet.

STANLEY S. JENKINS
F. House No. 1, lot 2, con. XIV, Bertie tp.
Completed October 4, 1945.
Dry hole.

Formation	Depth, ft.
Surface	21
Lime and shale	415
Niagara	645
Shale	681
Clinton	713
Red Medina	774
Grey shale	809
White Medina	824
Red shale	827

Fresh water at 45 feet; sulphur water at 150 feet.

STANLEY S. JENKINS
J. Stauth No. 3, lot 2, con. XV, Bertie tp.
Completed March 13, 1945.
Producing gas well.
Rock pressure: 160 lbs.

Formation	Depth, ft.
Surface	9
Lime and shale	405
Niagara	640
Shale	690
Clinton	720
Red Medina	788
Shale	818
White Medina	833
Red shale	838

Gas at 750, 755, and 760 feet.
Fresh water at 40 feet; black water at 210 feet.

STANLEY S. JENKINS
J. Stauth No. 4, lot 2, con. XV, Bertie tp.
Completed May 2, 1945.
Producing gas well.
Rock pressure: 60 lbs.

Formation	Depth, ft.
Surface	14
Lime and shale	410
Niagara	641
Shale	680
Clinton	710
Red Medina	773
Grey shale	808
White Medina	823
Red shale	873

Gas at 753, 813, and 818 feet.
Fresh water at 40 feet; sulphur water at 200 feet.

LAKE SHORE GAS AND OIL SYNDICATE
H. E. Empey No. 1, lot 3, con. XIV, Bertie tp.
Completed August 7, 1945.
Dry hole.

Formation	Depth, ft.
Surface	9
Lime and shale	385
Niagara	585
Shale	672
Clinton	703
Red Medina	773
White shale	795
White Medina	814
Red shale	820

Fresh water at 47 feet; black water at 435 feet.

LAKE SHORE GAS AND OIL SYNDICATE
G. Sider No. 1, lot 14, con. IX, Bertie tp.
Completed September 12, 1945.
Producing gas well.
Rock pressure: 75 lbs.

Formation	Depth, ft.
Surface	61
Lime and shale	285
Niagara	485
Shale	559
Clinton	588
Red Medina	667
White shale	675
White Medina	698
Red shale	750

Gas at 568 and 662 feet.
Fresh water at 62 feet; black water at 340 feet.

LAKE SHORE GAS AND OIL SYNDICATE
M. Winger No. 1, lot 13, con. IX, Bertie tp.
Completed October 24, 1945.
Producing gas well.
Rock pressure: 155 lbs.

Formation	Depth, ft.
Surface	62
Lime and shale	290
Niagara	493
Shale	567
Clinton	599
Red Medina	679
White shale	687
White Medina	711
Red shale	725

Gas at 622 feet.
Sulphur water at 62 and 342 feet.

MAPLE LEAF GAS SYNDICATE

V. Sider No. 1, lot 2, con. XIII, Bertie tp.

Completed June 16, 1945.
Producing gas well.
Rock pressure: 410 lbs.

Formation	Depth, ft.
Surface	20
Lime and shale	411
Niagara	611
Grey shale	681
Clinton	711
Red Medina	782
Shale	803
White Medina	822
Red shale	860

Gas at 743, 750, and 776 feet.
Fresh water at 46 feet; black water at 455 feet.

CHARLES T. MOEBIUS

C. T. Moebius No. 1, lot 15, con. V, N.R.S., Bertie tp.

Completed August 3, 1945.
Dry hole.

Formation	Depth, ft.
Surface	18
Salina	298
Guelph and Niagara	465
Rochester	555
Clinton	599
Red Medina	661
Manitoulin	683
White Medina	701
Queenston	710

Show of gas at 566 and 634 feet.
Fresh water at 18 and 48 feet.

CHARLES T. MOEBIUS

C. T. Moebius No. 2, lot 15, con. VI, N.R.S., Bertie tp.

Completed August 28, 1945.
Producing gas well.
Rock pressure: 160 lbs.

Formation	Depth, ft.
Surface	18
Salina	301
Guelph and Niagara	463
Rochester	561
Clinton	604
Red Medina	674
Manitoulin	690
White Medina	708
Queenston	770

Gas at 580, 669, and 707 feet.
Fresh water at 18 and 42 feet.

ELMER NAGEL

E. Nagel No. 1, Stevensville, Bertie tp.

Completed November 3, 1945.
Producing gas well.
Rock pressure: 75 lbs.

Formation	Depth, ft.
Surface	50
Lime and shale	250
Niagara	460
Grey shale	545
Clinton	577
Red Medina	647
Grey shale	677
White Medina	697
Red shale	745

Gas at 553, 612, and 692 feet.
Sulphur water at 50 feet.

NIAGARA GAS SYNDICATE

H. A. Empey No. 1, lot 7, con. II, N.R.S., Bertie tp.

Completed November 30, 1945.
Producing gas well.
Rock pressure: 85 lbs.

Formation	Depth, ft.
Surface	70
Salina	310
Guelph and Niagara	540
Rochester	605
Clinton	633
Red Medina	703
Manitoulin	721
White Medina	739
Queenston	811

Gas at 734 feet.
Fresh water at 88 feet.

NIAGARA GAS SYNDICATE

J. F. Robb No. 3, lot 8, con. II, N.R.S., Bertie tp.

Completed October 16, 1945.
Producing gas well.
Rock pressure: 80 lbs.

Formation	Depth, ft.
Surface	78
Salina	316
Guelph and Niagara	550
Rochester	615
Clinton	649
Red Medina	725
Manitoulin	739
White Medina	761
Queenston	815

Gas at 656 and 755 feet.
Fresh water at 75 feet and 85 feet.

STAR GAS SYNDICATE

R. Miller No. 1, lot 16, con. V, Bertie tp.

Completed December 31, 1945.
Dry hole.

Formation	Depth, ft.
Surface	61
Lime and shale	235
Niagara	445
Shale	543
Clinton	574
Red Medina	658
White shale	671
White Medina	694
Red shale	700

Show of gas at 676 feet.
Sulphur water at 61 and 330 feet.

JOSEPH F. WALSH

S. Lunenfeld No. 1, town of Fort Erie, Bertie tp.

Completed April 26, 1945.
Producing gas well.
Rock pressure: 230 lbs.

Formation	Depth, ft.
Surface	12
Flint	82
Shale and brown lime	450
Niagara	670
Guelph	690
Shale	772
Clinton	807
Red Medina	883
Shale	898
White Medina	913
Red shale	916

Gas at 559 feet; show of gas at 776, 872, and 912 feet.
Fresh water at 37 feet; sulphur water at 92 and 569 feet.

Joseph F. Walsh

P. H. Wetzel No. 1, town of Fort Erie, Bertie tp.

Completed September 10, 1945.
Dry hole.

Formation	Depth, ft.
Surface	18
Flint	83
Shale and brown lime	451
Niagara	630

Show of sulphur gas at 565, 575, and 592 feet.
Fresh water at 32, 40, and 60 feet; sulphur water at 112 and 611 feet.

Crowland Gas Syndicate

N. Alward No. 1, lot 14, con. VII, Crowland tp.

Completed December 31, 1945.
Producing gas well.
Rock pressure: 35 lbs.

Formation	Depth, ft.
Surface	97
Shale and lime	235
Niagara	435
Grey shale	522
Clinton	554
Red Medina	613
Grey shale	642
White Medina	660
Red shale	710

Gas at 532, 560, 570, 652, and 659 feet.
Fresh water at 99 and 255 feet; black water at 395 feet.

Crowland Gas Syndicate

W. L. Pearson No. 1, lot 12, con. VI, Crowland tp.

Completed July 12, 1945.
Producing gas well.
Rock pressure: 35 lbs.

Formation	Depth, ft.
Surface	119
Lime and shale	235
Niagara	464
Grey shale	526
Clinton	565
Red Medina	630
Grey shale	648
White Medina	669
Red shale	720

Gas at 533, 567, 595, and 666 feet.
Fresh water at 123 and 290 feet; sulphur water at 355 feet.

Crowland Gas Syndicate

W. L. Pearson No. 2, lot 12, con. VI, Crowland tp.

Completed August 15, 1945.
Producing gas well.
Rock pressure: 35 lbs.

Formation	Depth, ft.
Surface	108
Lime and shale	257
Niagara	457
Grey shale	522
Clinton	560
Red Medina	625
Grey shale	650
White Medina	667
Red shale	717

Gas at 530 and 660 to 662 feet.
Fresh water at 111 feet; sulphur water at 285 and 410 feet.

W. L. Pearson and Sons

W. L. Pearson and Sons No. 1, lot 11, con. VI, Crowland tp.

Completed March 14, 1945.
Producing gas well.
Rock pressure: 205 lbs.

Formation	Depth, ft.
Surface	111
Salina	263
Guelph and Niagara	430
Rochester	496
Clinton	527
Red Medina	588
Manitoulin	613
White Medina	635
Queenston	712

Gas at 520 and 625 feet.
Fresh water at 27 feet; sulphur water at 275 feet.

W. L. Pearson and Sons

W. L. Pearson and Sons No. 2, lot 11, con. VI, Crowland tp.

Completed April 14, 1945.
Producing gas well.
Rock pressure: 30 lbs.

Formation	Depth, ft.
Surface	112
Lime and shale	230
Niagara	420
Grey shale	514
Clinton	545
Red Medina	615
Grey shale	637
White Medina	654
Red shale	720

Gas at 520, 580 and 663 to 670 feet.
Fresh water at 114 feet; sulphur water at 235 feet.

Perry Sherk

E. White No. 2, lot 14, con. III, Humberstone tp.

Completed April 7, 1945.
Producing gas well.
Rock pressure: 35 lbs.

Formation	Depth, ft.
Surface	54
Lime and shale	341
Niagara	593
Shale	631
Clinton	663
Red Medina	722
Shale	760
White Medina	774
Red shale	854

Gas at 665 feet.

W. C. Patterson Gas Co., Ltd.

A. Davis No. 1, lot 16, con. I, Wainfleet tp.

Completed July 9, 1945.
Producing gas well.
Rock pressure: 110 lbs.

Formation	Depth, ft.
Surface	80
Shale	380
Niagara	634
Shale	694
Clinton	736
Red Medina	786
Shale	826
White Medina	844
Red shale	874

Gas at 704 and 840 feet.
Fresh water at 78 feet; sulphur water at 115 feet.

W. C. PATTERSON GAS CO., LTD.
L. Green No. 2, lot 5, con. VI, Wainfleet tp.
Completed June 5, 1945.
Dry hole.

Formation	Depth, ft.
Surface	117
Shale	230
Niagara	451
Shale	511
Clinton	549
Red Medina	599
Shale	637
White Medina	654
Shale	656

Show of gas at 650 feet.
Fresh water at 116 feet; sulphur water at 170 feet.

W. C. PATTERSON GAS CO., LTD.
F. M. McCollum No. 1, lot 4, con. V, Wainfleet tp.
Completed May 2, 1945.
Dry hole.

Formation	Depth, ft.
Surface	107
Shale	233
Niagara	448
Shale	508
Clinton	550
Red Medina	595
Shale	635
White Medina	652
Red shale	656

Fresh water at 106 feet; sulphur water at 165 feet.

W. C. PATTERSON GAS CO., LTD.
Provincial Gas Co. No. 8, lot 13, con. II, Wainfleet tp.
Completed August 13, 1945.
Dry hole.

Formation	Depth, ft.
Surface	94
Lime and shale	364
Niagara	568
Shale	628
Clinton	663
Red Medina	713
Shale	753
White Medina	770
Red shale	773

Show of gas at 650 and 760 feet.
Fresh water at 90 feet; sulphur water at 130 feet.

H. STAYZER
H. Stayzer No. 1, lot 25, con. VI, Wainfleet tp.
Completed December 21, 1945.
Producing gas well.
Rock pressure: 120 lbs.

Formation	Depth, ft.
Surface	123
Shale	223
Niagara	418
Shale	463
Clinton	506
Red Medina	551
Shale	611
White Medina	623
Shale	653

Gas at 610 feet.
Black water at 120 feet.

WAINFLEET GAS CO., LTD.
E. Marr No. 3, lot 24, con. III, Wainfleet tp.
Completed January 10, 1945.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Depth, ft.
Surface	159
Shale	313
Niagara	547
Shale	607
Clinton	642
Red Medina	687
Shale	725
White Medina	742
Red shale	777

Gas at 733 feet.
Fresh water at 156 feet; sulphur water at 194 feet.

WAINFLEET GAS CO., LTD.
E. Marr No. 4, lot 24, con. III, Wainfleet tp.
Completed February 20, 1945.
Producing gas well.
Rock pressure: 260 lbs.

Formation	Depth, ft.
Surface	141
Lime and shale	302
Niagara	538
Shale	596
Clinton	628
Red Medina	678
Shale	718
White Medna	735
Red shale	770

Gas at 721 feet.
Fresh water at 150 feet; sulphur water at 192 feet.

Wentworth County

CANADIAN PENN-GRADE PRODUCERS, LTD.
W. Patterson No. 1, lot 14, con. IV, Beverly tp.
Completed January 20, 1945.
Dry hole.

Formation	Depth, ft.
Surface	16
Guelph-Lockport	285
Rochester	300
Clinton	312
Grimsby	374
Manitoulin	399
Whirlpool	408
Queenston	414

G. L. MOTT AND ASSOCIATES
E. Patton No. 3, lot 30, con. IV, Beverly tp.
Completed July 16, 1945.
Dry hole.

Formation	Depth, ft.
Surface	12
Brown lime	140
White lime	200
Grey lime	219
Sand and lime	228
Clinton	237
Red Medina	257
Shale and lime	318
White Medina	329
Red shale	332

Show of gas at 322 feet.
Fresh water at 35 feet; sulphur water at 92 feet; salt water at 326 feet.

ROY BARTLETT

R. Bartlett No. 1, lot 6, con. II, Binbrook tp.

Completed May 25, 1945.
Producing gas well.
Rock pressure: 90 lbs.

Formation	Depth, ft.
Surface	76
Shale and lime	106
Niagara	256
Shale	303
Clinton	327
Red Medina	355
Shale	425
White Medina	433
Red shale	483

Gas at 342 and 429 feet.
Fresh water at 79 feet; black water at 190 feet.

ROY LAIDMAN

R. Laidman No. 1, lot 27, con. VII, Binbrook tp.

Completed August 8, 1945.
Producing gas well.
Rock pressure: 100 lbs.

Formation	Depth, ft.
Surface	60
Lime and shale	98
Niagara	268
Shale	305
Clinton	325
Red Medina	350
Grey shale	420
White Medina	431
Red shale	481

Gas at 325 and 431 feet.
Fresh water at 60 feet; black water at 190 feet.

ALVIN LAIDMAN

A. Laidman No. 3, lot 9, con. VII, Glanford tp.

Completed October 1, 1945.
Producing gas well.
Rock pressure: 145 lbs.

Formation	Depth, ft.
Surface	54
Lime and shale	72
Niagara	284
Shale	334
Clinton	350
Red Medina	380
Shale	435
White Medina	446
Red shale	471

Gas a 1440 feet.
Fresh water at 60 feet; black water at 75 feet.

York County

MALCOLM STOBIE

G. Dean No. 1, lot 113, con. I E.,
East Gwillimbury tp.

Completed January 5, 1945.
Dry hole.

Formation	Depth, ft.
Surface	202
Trenton	830
Granite	835

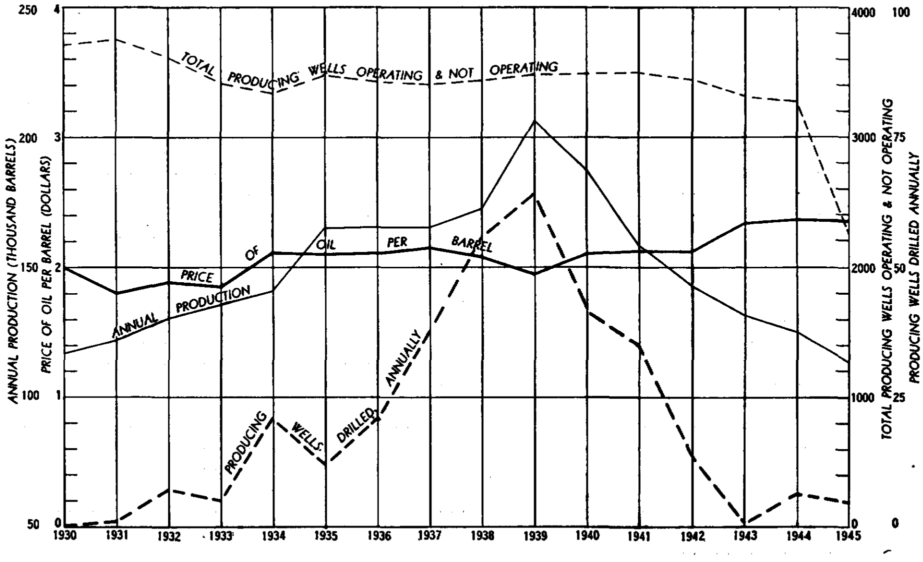
Show of gas at 645 feet.
Show of oil at 830 feet.
Fresh water at 40, 66, and 100 feet.

PETROLEUM IN 1945

By R. B. Harkness

General

The production of petroleum in Ontario in 1945 shows a serious decline when compared with that of 1944, the net loss being 11,743 barrels and the production being the all-time low in eighty years. The loss is general; the few gains are mainly due to carry-overs in storage rather than to any increase of supply or greater efforts to produce. The decline in production is attributed by the producers to three main causes: (1) deep snow in January, 1945, when many operators shut down; (2) the lack of labour in the oil fields due to the increase of wages in other industries; and (3) the scarcity and high price of materials for



Graph of the petroleum industry in Ontario for the years 1930 to 1945.

essential repairs. It should be remembered that Ontario crude oils have a high-sulphur base, which causes rapid corrosion in equipment, making necessary frequent renewals of pumps, sucker rods, and tubing below ground and cable, jerker rods, and pump jacks above ground. These replacements are all second-hand and obsolete equipment; it is most unusual to find any new equipment on any of the old oil fields of Ontario. As a consequence the time lost from shut-downs increases annually, which is another cause of the decline in oil production. It is most regrettable that the young men of Ontario born in the oil industry and given that broad training that few industries can offer cannot find opportunity for advancement in the industry. They readily find employment and advancement in other fields of endeavour. The graph above shows the trends in the industry. It is clear that the production is declining faster than the price of oil is advancing and that only a price adjustment that will allow the producers to re-equip their wells can revive the industry.

The number of men employed in producing oil in 1945 was 120, and the wages paid amounted to $108,324. To this may be added those employed in drilling, 14, to whom $6,857 was paid in wages. Many of these men were employed only part of the time and at higher rates than the figures would indicate. The footage drilled in 1945 was 13,454 feet, 11,440 in dry holes and 2,014 in producing wells. Table I shows the number of wells drilled—5 producing and 19 dry. The price of oil in 1945 was $2.37 per barrel, the same as in 1944.

Oil Wells and Their Production

Table I shows the detail of wells operated and idle in each oil field, and Table II gives a comparison of production in these fields for the past eight years. The total value and price per barrel will be found at the bottom of Table II.

TABLE I—OIL FIELDS AND THEIR PRODUCTION, 1945

Field	No. of wells				No. of wells drilled		Production[1]
	Operating	Idle	Abandoned	Reopened	Producing	Dry	
							bbls.
Petrolia and Enniskillen	474	241	488	....	....	....	39,350
Oil Springs	710	110	185	....	....	....	25,657
Moore tp.	6	38	39	....	....	1	247
Sarnia tp.	6	5	75	....	....	1	190
Plympton tp.	1	2	25	....	....	....	9
Bothwell and Thamesville	186	114	45	....	....	3	22,791
Dover, Raleigh, and Romney tps.	15	2	....	1	....	1	5,935
Onondaga tp.	3	5	39	....	....	1	24
Mosa tp.	137	38	2	1	2	....	14,344
Euphemia and Dawn tps.	2	15	114	....	....	....	362
Dunwich tp.	21	69	....	....	....	1	1,677
Brooke tp.	....	4	1	....	....	2	....
Chatham tp.	....	1	....	....	....	....	....
Warwick tp.	7	30	2	....	....	1	2,739 (Warwick, Metcalfe, Adelaide)
Metcalfe tp.	6	11	6	....	....	1	
Adelaide tp.	5	2	1	....	....	2	
Other fields	....	[2]8	....	....	....	[3]5	....
Total	1,579	695	1,022	2	5	19	113,325

[1]Information from Imperial Oil Refineries, Limited.
[2]5 in Manitoulin Island and 1 in each of Bosanquet, Hullett, and Sarawak townships.
[3]3 in Harwich township, 1 in Tilbury East, and 1 in Sombra.

It will be noted in Table I that there is a great increase in the number of wells abandoned, 975 more than in 1944. These 975 wells have not been abandoned and plugged, they are wells that have been idle for probably fifteen or twenty years; some have pumps, etc., and some none, but in every case they are wells that could not now be put into operation without major repairs, too costly to make a profitable venture. As these wells are not injuring adjacent operating wells, none of the operators want to disturb them; the Inspector in the field is aware of this condition and should any trouble arise will take remedial action. It is felt that these wells should be removed from the report of idle wells in order to give a truer picture of the number of wells in the field that might be put into operation.

Although the number of wells drilled in 1945 just equals that of 1944, there is encouragement in the fact that five of these penetrated the oil horizon of the Salina and Guelph formations. This horizon has been found productive in Essex, Kent, and Lambton counties. One million barrels were pumped from these formations in the Tilbury oil field from twenty to thirty-five years ago.

Table I shows the production in each field. A comparison of the figures for 1945 with those of the previous year will show that a loss is quite general. Small gains are in equally small fields and are usually due to annual carry-overs in field storage.

TABLE II—OIL PRODUCTION BY FIELDS, 1938–1945

Field	1938	1939	1940	1941	1942	1943	1944	1945
	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.	bbls.
Petrolia and Enniskillen	58,270	56,951	55,589	54,583	51,917	45,308	41,433	39,350
Oil Springs	32,299	32,422	31,392	29,783	27,369	27,270	28,537	25,657
Moore tp.	1,398	1,527	1,307	1,333	806	332	133	247
Sarnia tp.	595	397	370	213	237	305	268	190
Plympton tp.	191	156	89	93	24	26	27	9
Bothwell	40,430	39,616	36,685	33,053	28,033	25,908	24,966	22,791
Tilbury East tp.	206	....	....	....	....	....	....	....
Dover tp.	8,801	15,037	11,856	9,574	8,575	9,177	7,642	5,935
Raleigh and Romney tps.	....	27	76	245	(1)	(1)	(1)	(1)
Onondaga tp.	886	219	957	300	120	11	7	24
Mosa tp.	13,527	12,857	17,288	19,075	19,209	16,327	15,585	14,344
Thamesville	1,990	1,293	(2)	(2)	(2)	(2)	(2)	(2)
Euphemia tp.	406	385	(3)	(3)	(3)	114	58	77
Dunwich tp.	195	210	337	420	358	1,422	1,728	1,676
Brooke tp.	101	52	51	113	77	....	....	....
Dawn tp.	5,010	3,573	2,294	834	596	325	199	285
Warwick, Metcalfe, and Adelaide tps.	8,310	41,478	29,353	9,748	6,524	5,967	4,484	2,739
Chatham tp.	27	159	....	27	....	....	....	....
Other fields	....	....	....	[4]44	....	....	....	....
Total	172,642	206,379	187,644	159,438	143,845	132,492	125,067	113,324
Value	$359,268	$401,429	$397,078	$337,760	$306,242	$311,356	$296,420	$268,478
Average price	$2.08	$1.95	$2.11	$2.12	$2.13	$2.35	$2.37	$2.37

[1]Included in Dover township.
[2]Included in the Bothwell field.
[3]Included in Dawn township.
[4]In Assiginack township, district of Manitoulin.

Petroleum Refining Operations

There are six petroleum refineries operating in Ontario. They are listed below, and the capacity is 76,450 barrels of petroleum per day.

Company	Location of refinery	Head office address
British American Oil Co., Ltd.	Foot of Cherry St., Toronto	Royal Bank Bldg., Toronto.
British American Oil Co., Ltd.	Clarkson	Royal Bank Bldg., Toronto.
Canadian Oil Companies, Ltd.	Petrolia	Terminal Bldg., Toronto.
Goodrich Refining Co., Ltd.	Port Credit	Port Credit.
Imperial Oil Refineries, Ltd.	Sarnia	56 Church St., Toronto.
McColl-Frontenac Oil Co., Ltd.	Foot of Cherry St., Toronto	360 St. James St. W., Montreal.

The year 1945 shows a decline in the total value of products of Ontario refineries; the number of products that show a decrease, however, is equalled by the number that show an increase. The decrease is $3,298,344, or 4 per cent. less than in 1944.

The total amount of crude oil distilled is 36,209,209 gallons more than in 1944. The price per gallon has decreased by nearly 0.13 cents.

The production of straight-run gasoline has increased by 18,681,572 gallons, but aviation grade shows a decline of 18,421,842 gallons. Cracked gasoline shows a decline of 16,183,035 gallons, making a net decrease in gasoline production of 15,923,305 gallons.

The increase in kerosene production is mainly in the stove oils and not in illuminating oils. Lubricating oil also shows a slight increase.

In the case of the fuel oils and distillates of various kinds it is most difficult to draw useful comparisons because these have trade names and their uses vary greatly from those indicated by the trade name.

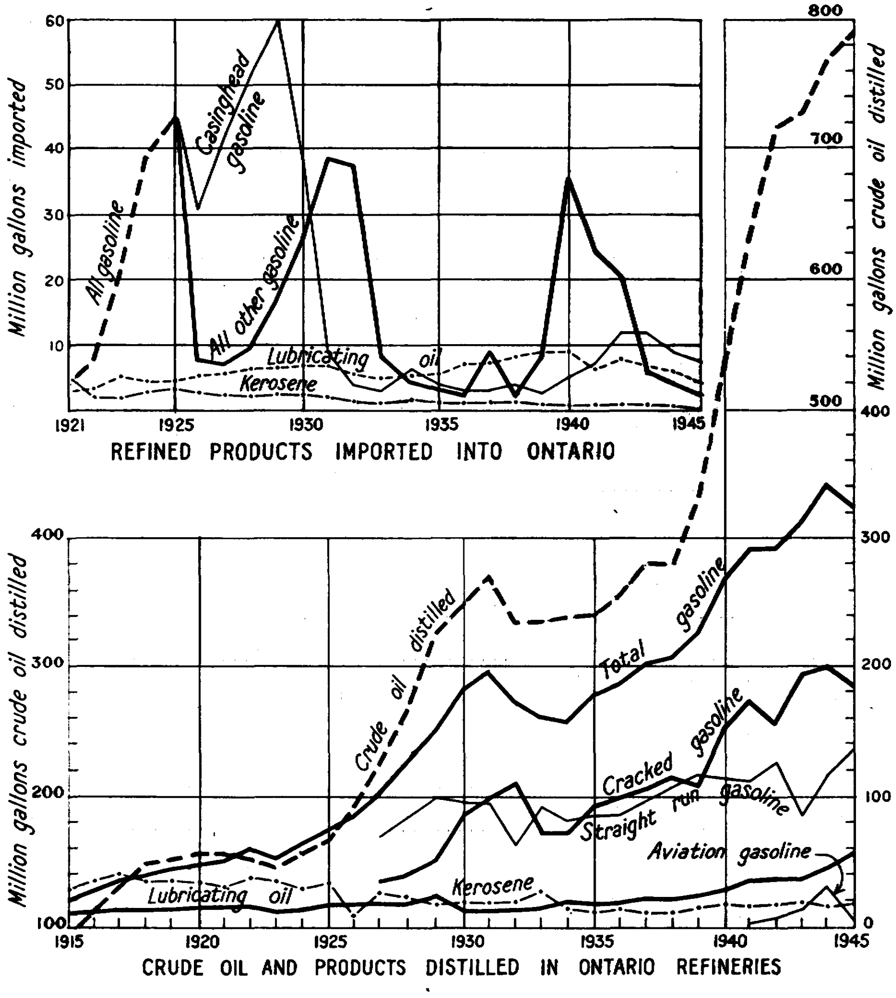
TABLE III—PETROLEUM REFINING OPERATIONS, 1940–1945[1]

Schedule	Unit of measure	1940	1941	1942	1943	1944	1945
Imported crude distilled.	Gallons[2]....	530,689,694	625,139,679	709,696,414	722,694,659	762,620,029	789,829,238
	Value......	$25,947,253	$36,283,935	$42,489,364	$43,949,034	$46,644,200	$47,803,156
Canadian crude distilled.	Gallons....	6,147,532	5,409,555	5,540,214	4,196,249	4,825,919	3,933,357
	Value......	$388,284	$345,008	$354,662	$295,948	$344,067	$280,092
Percentage of total...	....	1.15	0.86	0.77	0.58	0.63	0.51
Total value of crude	....	$26,335,537	$36,628,943	$42,844,026	$44,244,982	$46,988,267	$48,083,248
PRODUCTS							
Gasoline:							
Aviation grade.....	Gallons....	2,804,578	7,156,388	12,628,412	30,191,674	22,510,723	4,088,881
	Selling value	$412,553	$1,011,198	$2,266,158	$5,731,539	$4,083,471	$752,903
Straight run.......	Gallons....	112,957,625	112,227,465	124,104,737	84,678,920	116,624,179	135,305,751
	Selling value	$9,435,705	$11,009,503	$13,652,049	$9,786,920	$13,579,236	$14,064,872
By cracking process.	Gallons....	152,833,301	172,127,202	153,415,156	194,852,097	200,079,398	183,896,363
	Selling value	$12,404,718	$16,628,002	$17,100,527	$21,726,517	$23,642,700	$20,322,467
Kerosene...........	Gallons....	17,616,688	15,797,650	15,667,767	17,736,883	16,506,157	17,779,449
	Selling value	$1,490,140	$1,431,278	$1,663,152	$1,799,542	$1,821,081	$1,997,765
Lubricating oil.......	Gallons....	27,005,059	35,111,329	36,771,635	36,533,042	45,000,007	48,269,274
	Selling value	$5,288,559	$6,848,637	$7,171,038	$7,753,833	$10,488,812	$11,489,745
Engine distillate.....	Gallons....	1,920,608	1,970,619	2,443,455	5,335,353	5,630,061	26,922,704
	Selling value	$161,348	$165,567	$242,109	$523,295	$568,569	$1,590,545
Solvent naphtha.....	Gallons....	5,061,421	6,673,599	10,005,177	9,720,856	12,800,154	12,540,574
	Selling value	$444,565	$632,305	$1,117,596	$1,086,770	$1,493,992	$1,435,258
Light fuel oils.......	Gallons....	76,410,367	84,999,312	110,178,828	101,343,584	77,984,929	65,443,947
	Selling value	$3,834,082	$4,677,398	$6,541,085	$5,839,394	$4,555,842	$4,039,985
Residual fuel oils.....	Gallons....	85,908,699	132,882,829	192,937,096	158,421,953	162,103,161	174,757,336
	Selling value	$3,444,962	$6,312,172	$9,970,457	$7,975,690	$8,032,245	$8,560,940
Tar...............	Gallons....	....	655,515	2,947,525	3,350,305	2,863,350	2,336,670
	Selling value	....	$20,977	$94,321	$107,290	$91,627	$74,743
Grease.............	Pounds.....	9,451,282	15,576,181	20,862,365	21,404,757	19,839,358	19,011,347
	Selling value	$550,009	$862,318	$1,169,088	$1,216,160	$868,763	$849,243
Paraffin wax and candles.	Pounds.....	6,449,816	5,356,240	14,686,238	15,704,971	16,941,572	17,500,730
	Selling value	$346,799	$282,282	$800,374	$836,027	$1,218,161	$1,363,358
Petroleum coke......	Short tons..	61,935	65,208	71,486	82,411	67,364	62,837
	Value......	$414,671	$464,682	$517,386	$598,726	$485,400	$490,049
Still gas............	M cu. ft....	3,611,386	4,223,521	3,847,644	4,455,518	5,647,642	6,012,167
	Value......	$830,500	$1,355,995	$1,622,870	$1,630,370	$2,267,723	$2,243,119
Asphalt............	Gallons....	13,629,274	15,822,927	15,031,311	9,324,170	18,187,096	21,800,029
	Selling value	$1,253,893	$1,465,203	$1,412,943	$848,499	$1,641,836	$1,996,984
Miscellaneous.......	Value......	$199,390	$212,597	$170,915	$174,324	$4,242,401	$3,911,135
Total value of refined products..	....	$40,511,894	$53,380,114	$65,512,068	$67,634,896	$79,081,860	$75,783,516
Employees..........	Average No.	2,193	2,287	2,536	2,718	3,115	3,097
	Wages paid.	$3,781,440	$4,432,949	$4,977,800	$5,828,163	$6,666,917	$6,437,620
Capital invested.....	....	$24,781,081	$28,814,379	$27,228,930	$37,594,239	....	....

[1]Information furnished by the Dominion Bureau of Statistics, Ottawa.
[2]Gallons refer to Imperial gallons.

Refined Products Imported into Ontario

The graph below shows the refined products imported into Ontario since the year 1920. In Table IV it will be seen that the imports show a decline in 1945 of $613,844 without correction for freight and duty paid. The greatest decline is in gasoline, both casing head used in blending with lower grades of gasoline and regular gasoline for motor fuel. The next greatest reduction in imports is in lubricating oils of all grades. This reduction is probably due to the



reduction of demands for war purposes. One increase is notable, in the oils for manufacturing cumene.

Refined products show little variation from the year 1944.

In the last twenty years, Ontario refineries have made great advances in every phase of the industry and produce products that can compete with any. This is apparent from the following statistical comparison: Twenty years ago, 30.7 per cent. of all gasoline was imported, now only 3 per cent. of gasoline of all grades is imported; 22 per cent. of all kerosene used was imported, now approximately 12 per cent. is imported; 20 per cent. of all lubricating oil was imported, now approximately 4 per cent. is imported. It is difficult to compare other commodities because trade names for these vary so greatly that there is no good basis for a comparison.

TABLE IV—PETROLEUM AND REFINED PRODUCTS IMPORTED IN 1944 AND 1945[1]

Import	1944		1945	
	Imperial gallons	Value	Imperial gallons	Value
CRUDE PETROLEUM FOR REFINING:				
Petroleum, 0.8155 (A.P.I.) specific gravity or heavier, for refining....	774,217,000	$32,416,982	793,105,022	$33,271,997
REFINED PETROLEUM:				
For use in concentrating ores.......	40,459	$30,554	108,613	73,184
Gasoline lighter than 0.6852 specific gravity (casing-head)...........	9,428,598	718,053	7,883,663	579,740
Gasoline lighter than 0.8236 specific gravity........................	3,491,421	689,686	2,449,649	438,690
Crude petroleum, n.o.p............	....	....	....	....
Kerosene and illuminating oils......	35,633	4,257	83,898	3,445
Products of petroleum, n.o.p., 0.8236 specific gravity and heavier.......	843,622	177,590	641,079	153,129
Engine distillate heavier than 0.8017 specific gravity.................	1,201	403	229	91
Lubricating oils, consisting wholly or in part of petroleum, costing less than 25 cents a gallon...........	2,240,105	371,810	1,486,921	242,603
Lubricating oils, all other...........	3,451,293	2,039,197	2,646,113	1,542,111
Oils, cumene bottoms for the manufacture of cumene	775,829	584,818	2,148,901	1,037,704
Total........................	20,308,161	$4,616,368	17,340,493	$4,002,524
PETROLEUM PRODUCTS:				
Petroleum grease and lubricating grease, n.o.p.................lbs.	4,322,304	$286,306	4,669,392	$260,364
Vaseline, toilet and medicinal petroleum..........................	....	320,339	....	338,003
Paraffin wax..................lbs.	9,059,849	615,676	9,505,142	617,053
Paraffin wax candles............lbs.	92,754	21,640	99,772	24,457
Other petroleum products lighter than 0.8236 specific gravity........ gals.	659,108	72,283	743,425	92,335
Total........................	....	$1,316,243	....	$1,332,212
Total value..................	....	$38,349,593	....	$38,606,733
Total net value of petroleum and refined products imported[1]...........	$38,349,593		$38,606,733	
Duty paid on the above, calculated on the existing tariff schedule..........	781,988		696,475	
Sales tax at 8 per cent................	3,130,526		3,008,538	
Total value delivered in Ontario[2] ..	$42,262,107		$42,311,746	

[1]These statistics are compiled from information furnished through the courtesy of the Department of Customs and Excise.

[2]Freight charges are not included.

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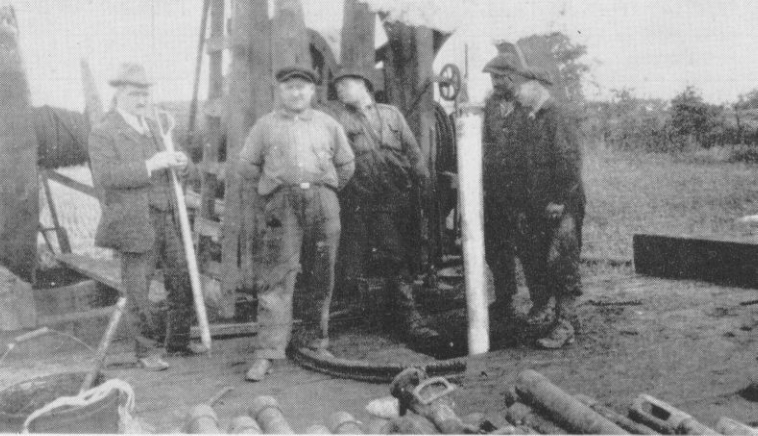

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. LESLIE M. FROST, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FIFTY-FIFTH ANNUAL REPORT

OF THE

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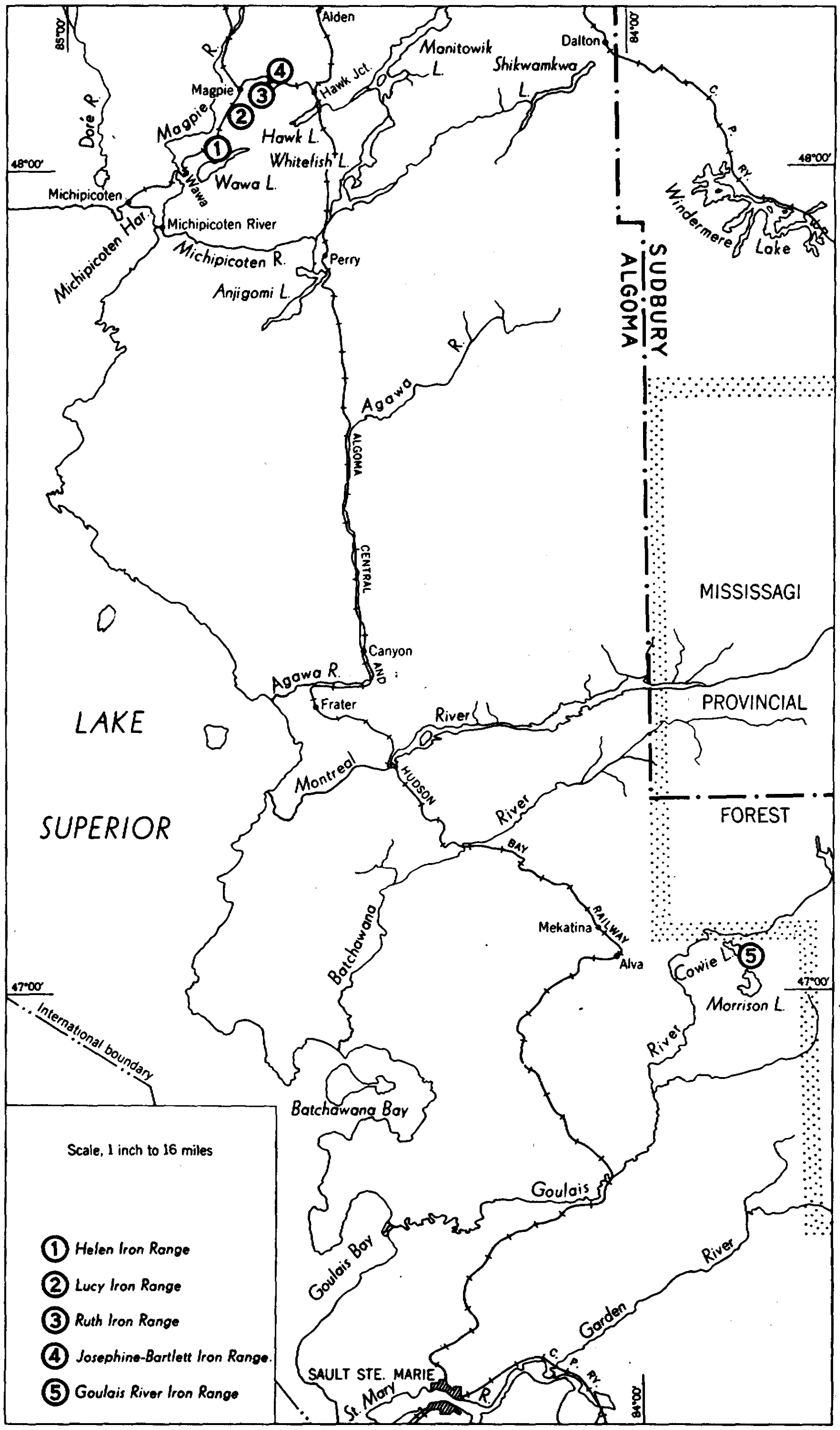


Fig. 1—Key map showing the location of the iron ranges described in the report.

Iron Deposits in the District of Algoma

By E. S. Moore and H. S. Armstrong

CHAPTER I

INTRODUCTION

A large number of iron ranges have long been known to exist in the district of Algoma, but this report deals with only a few of them. Those described are either productive or known to contain important reserves of iron ore. They include the Helen, which has been actively producing since 1939; the Josephine-Bartlett, with the Josephine mine[1]; and the Ruth, Lucy, Eleanor, and Goulais River ranges (see Fig. 1).

These ranges were all studied and mapped by the writers during the field seasons of 1943 and 1944, and a short visit was made in 1945 to the Helen and Josephine mines by the senior author. It has seemed wise to combine the work of the two years into one comprehensive report covering all these ranges.

In this report, the senior author naturally assumes most of the responsibility for the opinions expressed on geological problems, especially those involving theories or controversial matters. The junior author did much of the work on the maps.

Many persons connected with the properties investigated extended hospitality to the writers and gave valuable assistance during the field work and the preparation of the report. Information of all kinds has been furnished without reserve by the companies concerned, and to their officials and employees the writers are deeply grateful. Special acknowledgments will be made to those connected with the different properties when the several ranges are discussed in detail. George W. MacLeod, formerly manager of the Mining Department of the Algoma Central and Hudson Bay Railway, later consulting engineer and now general manager of Algoma Ore Properties, Limited, a wholly-owned subsidiary of the Algoma Steel Corporation, Limited, controlling its mining properties, should, however, be mentioned here. He was extremely helpful and gave every assistance in the prosecution of the work. George S. Cowie, purchasing agent of the Algoma Steel Corporation, also aided the writers on many occasions.

V. J. Okulitch, of the Department of Geology, University of Toronto, very kindly assisted in the preparation of the photomicrographs included in this report, and the authors are very grateful to him.

History of Discoveries and Previous Geological Work

The discovery of the Helen iron range, first commercially important one in Algoma, was made in 1898 and aroused great interest in this region. Within two years most of the other ranges in the Michipicoten area were located. The Helen range was outstanding because of the large body of oxide ore it contained. Mining operations were started in 1900, and continued until 1918, on the brown oxide resulting from the weathering of the great body of siderite, and some pyrite, in Helen hill. The presence of the siderite deposit was later recognized, but it was not until 1939 that production of carbonate ore began from this range. Between 1911 and 1921, the Magpie mine was operated on siderite. About 1,500,000 tons of this ore was mined and roasted in rotary kilns.

[1]The Josephine mine started production in October, 1945, and closed down because of caving in October, 1946.

The Josephine-Bartlett range was discovered in 1899. Brown ore was found on the surface in the Josephine section around Parks lake and carbonate ore in the Bartlett section at about the same time. Much drilling was done on the Josephine between 1900 and 1906 and again in 1913 and 1914, and some on the Bartlett section in 1912. A spur was constructed from Josephine Junction on the Michipicoten branch of the Algoma Central and Hudson Bay Railway to the Josephine property, and two shallow shafts were sunk at the time of the drilling, between 1900 and 1906. The steel in this spur was later removed.

Much surface work was done in the early days on the Ruth and Lucy ranges by Alois Goetz. In 1930, the Bethlehem Steel Corporation drilled eight holes on the Ruth property under option from Goetz and then dropped the option. In 1941, the Frobisher Exploration Company, Limited, secured a lease on the Josephine, Ruth, and Lucy properties from Goetz and his associates, and a drilling campaign was started. The following year a shaft was sunk on the Josephine, drilling was continued underground from the shaft, and a large amount of drilling was done on the Ruth range.

Iron was found on the upper waters of the Goulais river as early as 1909, and claims were surveyed in 1914. In 1922, drilling was done on the Sligh property, or Hillier claims, on the northern part of the Goulais River range, and in 1924 the senior author reported on this and neighbouring ranges.

Nothing more was done on the Goulais River range until January, 1941, when Algoma Ore Properties, Limited, started drilling east of Cowie lake. In August of that year, search for iron began in the Morrison Lake area, where some iron formation had previously been known to exist. A very extensive drilling campaign, which was carried on almost throughout the length of the Goulais River range, was completed in the spring of 1944.

A considerable body of literature has grown up on the iron deposits of Algoma, especially on those in the Michipicoten area. The most comprehensive work on this region is that by Collins and Quirke, "Michipicoten Iron Ranges," and the writers found this of much service in their recent work.

Bibliography

A. B. Willmott, "Michipicoten Mining Division," Ont. Bur. Mines, Vol. VII, 1898, pt. 2, pp. 184-206.

A. P. Coleman and A. B. Willmott, "Michipicoten Iron Range," Ont. Bur. Mines, Vol. VIII, 1899, pt. 2, pp. 254-258.

A. P. Coleman, "Copper and Iron Regions of Ontario," Ont. Bur. Mines, Vol. IX, 1900, pp. 143-191.

A. P. Coleman, "Iron Ranges of the Lower Huronian," Ont. Bur. Mines, Vol. X, 1901, pp. 181-212.

A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines, Vol. XI, 1902, pp. 152-185.

W. G. Miller, "Iron Ranges of Northern Ontario," Ont. Bur. Mines, Vol. XII, 1903, pp. 304-317.

A. B. Willmott, "Exploration of the Ontario Iron Ranges," Jour. Can. Min. Inst., Vol. VII, 1904, pp. 257-265.

J. M. Bell, "Iron Ranges of Michipicoten West," Ont. Bur. Mines, Vol. XIV, 1905, pp. 278-355.

A. P. Coleman, "Iron Ranges of Eastern Michipicoten," Ont. Bur. Mines, Vol. XV, 1906, pp. 173-206.

A. P. Coleman, "The Helen Mine, Michipicoten, "Econ. Geol., Vol. I, 1905-1906, pp. 521-529.

G. C. MacKenzie, "The Iron and Steel Industry of Ontario," Ont. Bur. Mines, Vol. XVII, 1908, pp. 190-342.

C. K. Leith, "The Iron Ores of Canada," Jour. Can. Min. Inst., Vol. XI, 1908, pp. 91-105.

A. B. Willmott, "The Iron Ores of Ontario," Jour. Can. Min. Inst., Vol. XI, 1908, pp. 106-123.

R. W. Seelye, "The Helen Mine, Michipicoten, Ont.," Jour. Can. Min. Inst., Vol. XIII, 1910, pp. 121-133.

A. B. Willmott, "The Undeveloped Iron Resources of Canada," Jour. Can. Min. Inst., Vol. XIV, 1911, pp. 236-258.

A. W. G. Wilson, "Pyrites in Canada," Can. Dept. Mines, Mines Branch, Pub. No. 167, 1912, pp. 72-81.

A. L. Parsons, "The Productive Area of the Michipicoten Iron Ranges," Ont. Bur. Mines, Vol. XXIV, 1915, pt. 1, pp. 185-215.

E. LINDEMAN, L. L. BOLTON, and A. H. A. ROBINSON, "Iron Ore Occurrences in Canada," Can. Dept. Mines, Mines Branch, Pub. No. 217, 1917, Vol. I, pp. 35-37; Vol. II, pp. 72-84.
E. S. MOORE, "Mississagi Reserve and Goulais River Iron Ranges," Ont. Dept. Mines, Vol. XXXIV, 1925, pt. 4, pp. 1-33.
E. S. MOORE, "Goudreau and Michipicoten Gold Areas, District of Algoma," Ont. Dept. Mines, Vol. XL, 1931, pt. 4, pp. 42-50 (Iron Ore).
W. H. COLLINS and T. T. QUIRKE, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, pt. 1, 1926, pp. 1-141.
FRANK F. GROUT, "Michipicoten Iron Ranges" (a review), Econ. Geol., Vol. XXI, 1926, p. 813.
T. L. GLEDHILL, "Michipicoten Gold Area," Ont. Dept. Mines, Vol. XXXVI, 1927, pt. 2, pp. 1-49.
L. J. WEEKS, "Michipicoten River Map-Area, Algoma District, Ontario," Geol. Surv. Can., Sum. Rept. 1928, pt. C, pp. 1-11.
E. S. MOORE, "Goudreau and Michipicoten Gold Areas, District of Algoma," Ont. Dept. Mines, Vol. XL, 1931, pt. 4, pp. 47-51 (Iron deposits).
J. E. HAWLEY, "Origin of Some Siderite, Pyrite, Chert Deposits, Michipicoten District, Ontario," Trans. Roy. Soc. Can., Sect. IV, Vol. XXXVI, 1942, pp. 79-87.
S. J. KIDDER, and G. C. MCCARTNEY, "Mining and Geology at the Helen Mine," Amer. Inst. Min. and Met., Eng. Tech. Pub. No. 1971, 1946.

Geological Features Common to the Ranges

There are certain geological features common to all the ranges discussed in this report. They are treated here to avoid repetition for each range, in the description of which only the variations from the common type need be mentioned.

One of the common features is the occurrence of the ore deposits in Keewatin formations. Another is the presence of a banded silica member in almost all the iron formations in Algoma whether they contain siderite, hematite, or magnetite, the only exception being the Magpie deposit in the Michipicoten area.

The Iron Formation

The term "iron formation" is commonly applied to a rock composed of banded silica and its associated iron deposits. The iron formation consists of one or more members: the banded silica member, with or without iron oxides; sediments, pyroclastics, and lavas interbedded with beds of banded silica; and the iron deposits associated with the banded silica but not originally a part of it. A band of iron formation of considerable but not of any definite size is known as an "iron range." A range very frequently, but not necessarily, constitutes a prominent topographical feature. Some ranges occur, in part at least, in low land.

The iron formation in which the banded silica member is the characteristic rock is a peculiar formation. The typical banded silica is restricted to the Precambrian; and although it has been found on almost all the continents and is very similar in character in different countries, nothing just like it has been discovered in systems younger than the Precambrian. This may be partly explained as due to the intense metamorphism undergone by most Precambrian rocks and the weathering of the abundant fresh lavas and pyroclastics, which supplied silica and iron to surface waters. It has been frequently observed that the banding in the silica has been made more distinct by metamorphism.

The Josephine hematite deposit in Michipicoten is unusual because it is the only important deposit so far found in Canada in which hematite is associated with a banded silica member and in which the hematite is distinctly a hydrothermal mineral deposited long after the silica.

Origin of the Banded Silica

On account of the great economic importance of the Precambrian iron ranges and the peculiar nature of the banded silica formation, a great deal of consideration has been given to the origin of this strange rock; an extensive literature exists on the subject, and a number of theories have been advanced. These cannot be reviewed in detail here, and only an outline of the suggestions offered to explain the origin of the silica and its typical banded character will be presented.

The main problem is the source and accumulation of such great quantities of silica, much of it almost free from any other mineral matter, and its deposition with a special structure. The formation of large quantities of quartz from hot ascending waters is a phenomenon widely recognized in quartz veins, silicified rocks, and other types of deposits. It is generally accepted that thinly bedded and laminated carbonate and argillaceous rocks have been replaced by silica, by lead and zinc, and by fluorite and other minerals deposited from hot waters, giving rise to a banded formation.

Some geologists have offered this explanation to account for the origin of the banded silica in the Precambrian iron formations. A few special deposits of iron have been formed in this way, but very few. Injected silica shows crosscutting relations with the country rock, whereas the typical banded silica does not, except where it, as a very hard rock, has been thrust into adjacent soft rocks under pressure applied to the formations during shearing and folding. The banded silica is characteristically concordant with the enclosing rocks, and it is evident that they have been deposited one on top of the other at the surface of the earth.

The silica is regarded mainly as a sediment deposited in surface waters, and because of its purity, except for iron in some places, which can also be deposited in surface waters by chemical action, the silica is considered by nearly all geologists as a chemical sediment. The cryptocrystalline, cherty nature of the silica, except where highly metamorphosed to a granular condition, and the lens-like bodies that make up the bands are characteristic of colloidal deposits.

The main theories that have been advanced to account for the accumulation of the silica and associated iron are as follows: (1) the natural weathering of exposed rocks, the leaching away of the minerals by surface waters, and the precipitation of the iron and silica in basins of water; (2) the heating of salt water in the sea or in salt lakes by lava flows, which caused rapid reaction between the heated water and the lava flows, thus producing solutions containing iron chloride and water glass (sodium silicate), from which silica and iron would be precipitated with the cooling of the hot waters; and (3) the deposition of the silica in surface waters by hot springs and the formation of iron carbonate deposits at the same time and by the same waters through replacement of lavas and tuffs lying beneath the silica.

In all these theories, the banding in the silica is assigned to frequent changes in temperature of the water in the basins in which the materials collect or to the bringing of fresh supplies of solution to the basins of water in which precipitation of the silica occurred.

The first theory was expounded by Van Hise many years ago and elaborated by Grüner in recent years. Van Hise along with Leith[1] later adopted the second theory, which they supported with laboratory experiments. There is no doubt that solution of rock constituents is stimulated when hot lavas enter basins of water and that hot springs and some magmatic waters escaping to the surface in volcanic regions would add their content of dissolved silica. The frequency of lava eruptions required to produce the thick beds of banded silica is, however, a difficulty in this theory. There are many iron formations with little or no lava interbedded with the silica.

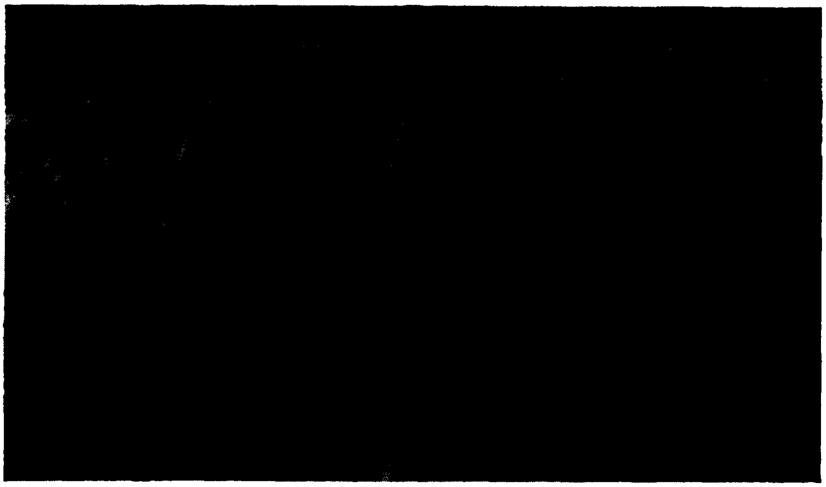
The hot spring theory, suggested by Collins and Quirke,[2] might possibly account for the silica; for some existing hot springs deposit banded siliceous

[1]C. R. Van Hise and C. K. Leith, "The Geology of the Lake Superior Region," U. S. Geol. Surv., Mon. LII, 1911, pp. 478-529.

[2]W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, pt. I, 1926, pp. 73-78.

sinter. But it has been conclusively demonstrated that the associated iron carbonate deposits were not formed at the same time as the banded silica, but in a much later period. The conclusion of Collins and Quirke that the siderite and pyrite were formed by replacement of acid tuffs is, however, absolutely sound, but their association with the silica is due mainly to structural control.

An extensive laboratory investigation coupled with field work was made to try to clarify some of the ideas of various geologists on the chemistry of the iron formations.[1] The results obtained indicate that silica and iron can be carried by surface waters in sufficient quantity to produce the iron formations through leaching of volcanic rocks. Tuffs are particularly favourable for leaching because of their finely divided state, just as finely ground ore in a mill is more readily



Highly crumpled iron formation in the Goulais River iron range.

leached than coarse ore. Where the volcanic rocks are mainly acid, there may be little iron deposited with the silica, which may be nearly white unless iron minerals have later been added by percolating waters.

The iron and silica are taken into solution and transported by streams in the colloidal state, that is they are in the form of gels. These colloidal substances are precipitated when the solution enters salt water, because the salts in the water act as electrolytes and bring about precipitation. In the laboratory, the silica gel precipitates slowly, whereas the ferric iron hydrosol comes down more rapidly. This helps to explain why alternate bands contain more iron with the silica and the intervening bands are higher in silica. It is believed that with each rainfall, fresh supplies of solutions of iron and silica would be brought to the basins of deposition and banding would result.

Woolnough[2] recently made an interesting contribution to the problem of the origin of the iron formations, when he pointed out that topographical and climatic conditions such as have long existed in parts of Australia might help to satisfy the conditions necessary for the formation of the Precambrian iron formations.

[1]E. S. Moore and J. E. Maynard, "Solution, Transportation and Precipitation of Iron and Silica," Econ. Geol., Vol. XXIV, 1929, pp. 272-303, 365-402, and 506-527.

[2]W. G. Woolnough, "Origin of Banded Iron Deposits—A Suggestion," Econ. Geol., Vol. XXXVI, 1941, pp. 465-489.

In regions of volcanic activity, hot springs, magmatic waters escaping to the surface, and waters heated by lavas pouring out into basins of water, all might add their content to the cool surface solutions.

Metamorphism and Deformation of the Iron Formation

A striking feature of many iron formations is their very highly folded and contorted condition. The formation is tremendously contorted in the Goulais River range, but much less so in the ranges carrying siderite in the Michipicoten area. How can such a hard and brittle rock as the iron formation be so complexly folded? The Goulais River range exhibits on a small scale every type of folded structure that could be imagined in bands of plastic substances (see photograph on page 5). Further, these folds have in places been highly brecciated, something to be expected in a brittle rock. We have the anomaly of extensive flowage and fracture, both occurring within a short period of time, in the same rock at the same level in the earth's crust.

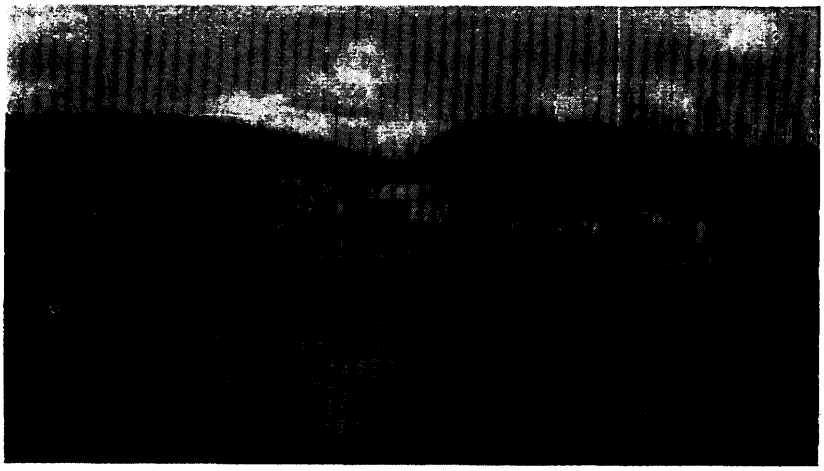
It is believed that the silica-iron gel, which would have a very high water content, gradually lost part of its water through the increasing weight of rocks piled on top of it pressing the water out. Later, the compressive forces that folded the rocks and tilted them up on edge and the accompanying heat caused the gel to crystallize. Before it was fully crystallized, the soft rock readily flowed and became highly contorted. After it was completely crystallized into a hard, brittle rock, further movement faulted and brecciated the iron formation. There were thus two stages in the distortion of the rock.

CHAPTER II

THE GOULAIS RIVER IRON RANGE

Introduction

The Goulais River iron range runs from the valley of the river after which it is named southward to Annibal lake near Morrison lake, one of the large lakes in this area. The range extends about 700 feet north and 18,500 feet south of the boundary between township 22, range XIII, and township 22, range XII. Most of the range, therefore, lies in township 22, range XII, about 50 miles in a straight line northeast of Sault Ste. Marie. Cowie lake is the centre of development operations, and on it Algoma Ore Properties, Limited, which controls most of the iron range, and the diamond-drillers have their camps. This lake is readily



Camp of Algoma Ore Properties, Limited, on Cowie lake. The hill in the left background contains the iron formation and that to the right consists of acid volcanics.

accessible by airplane from the Sault, and it is also connected by a rough tractor road, about 12 miles long, with the Algoma Central and Hudson Bay railway at mile 60.

Acknowledgments

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Previous Work on the Range

The only geological work previously done on this range was that for the Department of Mines in the summer of 1924, when nearly twelve townships were mapped by the senior author.[1] This work was necessarily of a reconnaissance nature, except on the iron ranges, which were very difficult to study at that time. A little diamond-drilling had been done on the Sligh property, or Hillier claims, which covers that part of the Goulais River range lying in township 22, range XIII; but as the whole area was covered with virgin forest, there were very few exposures of rock. The pine was later removed from most of the range, and in 1935 a big fire destroyed almost all of the remaining timber so that, in the summer of 1943, in spite of the presence of much new growth it was possible to plane-table most of the range.

In 1924, this range was recognized as containing a large reserve of magnetite, even before much of it had been drilled, and recent drilling has fulfilled expectations of its possibilities. The Central and Northern ranges in the Mississagi Provincial Forest were also mapped and described at the same time, but they were found to contain a much higher proportion of red jasper with small concentrations of hematite. The hematite is not subject to magnetic concentration as is the Goulais iron.

Mapping of the Range

In mapping, the plane table was used in most of the work. The whole range was mapped in this way from the north end to the south end of Ella lake with the exception of a band about 1,200 feet long covered with thick hardwood and lying just northeast of the northern part of Gut lake. The southern part of the range, between Ella and Annibal lakes is covered with dense hardwood, through which the fire has not passed. In this area, however, the numerous surveyed lines cut out for drill locations were available, and they served as the bases for accurate traverses across the range. The drill sections have been placed on the map (No. 1946-4) to serve as guides in following descriptions of the general geology and ore deposits on the property.

Elevations were computed and placed on that part of the map made by plane table to show the rugged nature of the terrain and especially to facilitate computation of the ore reserves, particularly the part that lies above base level and might be mined by open-pit methods.

The geology of the Goulais River range is very complex. In order to bring out all the important features, map No. 1946-4, "Goulais River Iron Range," has been divided into three sheets: (a) Cowie Lake, (b) Dude-Gut Lake, and (c) Morrison Lake sections. The last name has been adopted for the southern part of the range, even though it does not touch Morrison lake, because it has been commonly so designated by Algoma Ore Properties, Limited.

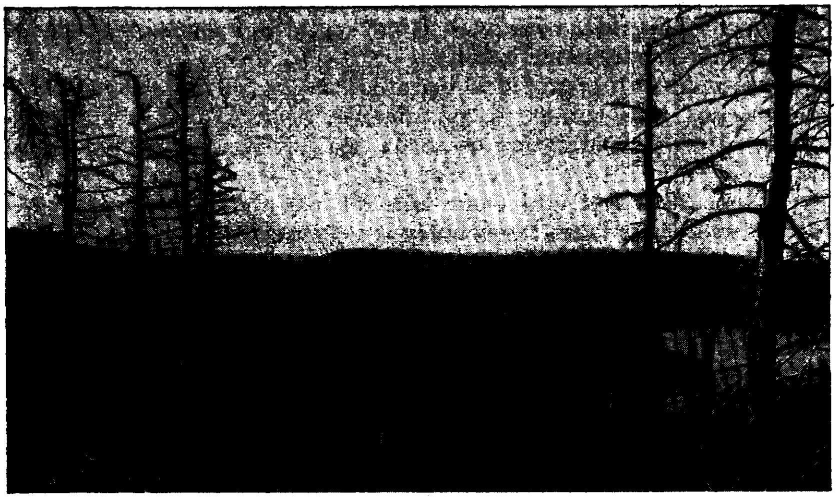
Topography

There are no exact measurements of altitude in the vicinity of the iron range. As the engineers of Algoma Ore Properties, Limited, assume the elevation of Cowie Lake to be 1,120 feet, a figure that is believed to be fairly accurate, this level has been used in all calculations of elevations for the three sections of map No. 1946-4. The level of Cowie lake will to a large extent control the depth to which open-pit mining can be carried on in the main part of the range. It may be possible, by removing dams built by lumbermen and deepening the channel of the outlet stream, to lower Cowie lake from 25 to 30 feet and thus considerably increase the depth of open pits when mining has started.

The relief is high in this area. The hills north of the township line, in what is known as the Hillier or McPhail property, rise 300 feet above Cowie lake, and

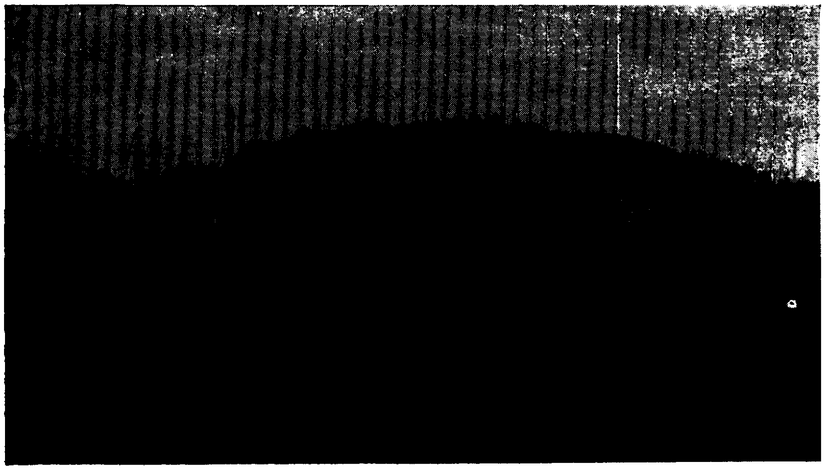
[1]E. S. Moore, "Mississagi Reserve and Goulais River Iron Ranges, District of Algoma," Ont. Dept. Mines, Vol. XXXIV, 1925, pt. 4, pp. 1-33.

a similar elevation is found just south of the township line. In the northwest corner of the map, the highest point on the large hill of agglomerate and lava has an elevation of about 260 feet above the lake.



General view over the area of the Goulais River iron range looking southwest from the high hill near the township line, with Cowie lake on the right.

South of the township line, the elevation decreases as far as the large valley that runs east from the northeast corner of Cowie lake. The head of this valley is only 120 feet above the lake. South of this transverse valley the elevation in-



Rugged hill of greenstone and hornblende schist about 2,000 feet southeast of Cowie lake.

creases rapidly to the top of the high ridge directly east of the lake. This hill is cut by a large olivine diabase dike, and the highest point on it is almost 300 feet above Cowie lake. The surface slopes off to the west and south, and where the creek crosses the iron range, the elevation is only about 50 feet. The iron formation between the creek and the south end of Cowie lake is at a comparatively low level, seldom reaching a height of more than 100 feet above the lake. It is, however, flanked on the west by a high ridge of rhyolite and greenstone, the highest elevation being 210 feet. East of the south end of Cowie lake there is a high ridge of rhyolite, along which a porphyritic diabase dike runs at an elevation of nearly 300 feet. This ridge continues to the south, but south of Cowie lake the land is for the most part much lower.

A very prominent topographical feature is the rugged mass of greenstone and hornblende schist that stands up prominently about 2,000 feet southeast of Cowie lake. It has an elevation of about 225 feet (see second photograph on page 9).

Gut lake is 28.7 feet and Dude lake 20 feet above Cowie lake. On the southeast sides of these lakes the country is very rugged, and hills rise to nearly 200 feet above them.

Ella lake is 43.7 feet higher than Cowie lake. A high ridge east of Ella lake extends southward and reaches its highest elevation between Ella and Annibal lakes. Annibal lake is about 40 feet above Cowie lake, and the iron formation between Annibal and Ella lakes rises very little above these lakes; consequently, the prospect of open-pit mining is not nearly as promising for the Morrison Lake section of the range as for the Cowie Lake section.

The main hill-forming rocks are Keweenawan diabase, iron formation, greenstone, and rather massive rhyolites.

Stratigraphy

The rock formations around the Goulais River range may be classified as follows:—

CENOZOIC	
QUATERNARY:	Glacial drift (Pleistocene); alluvium (Recent).
	Great unconformity
PRECAMBRIAN	
KEWEENAWAN:	Olivine diabase and gabbro.
	Intrusive contact
	Porphyritic quartz diabase.
	Intrusive contact
	Quartz diabase.
	Intrusive contact
ALGOMAN:	Veins and other bodies of quartz.
	Intrusive contact
	Granite, syenite, quartz and feldspar porphyries.
	Intrusive contact
KEEWATIN:	Banded iron formation with some interbedded sediments and tuffs.
	Clastic sediments: Quartzite, arkose, and greywacke; includes some stratified tuffs.
	Volcanics: Rhyolite, andesite, basalt; acid and basic agglomerate, acid tuff; ellipsoidal lava; hornblende schist; massive, coarse-grained intermediate and basic lavas; undifferentiated mixtures.

KEEWATIN

It is difficult to decide whether all the rocks in this area should be considered as Keewatin; the sediments may belong to the Timiskaming. In the senior author's earlier report on the Mississagi Reserve and Goulais River iron ranges[1] the rocks were grouped together in the Batchawana series and tentatively

[1]E. S. Moore, op. cit., pp. 9-15.

classified as Timiskaming, because lavas that might ordinarily be placed in the Keewatin were found interbedded with conglomerate and other sediments of the Timiskaming type. In the immediate vicinity of the Goulais River range, there is no distinctive conglomerate formation that would serve as a good horizon marker. In only two places was any sign of conglomerate seen: on the large hill at the northwest corner of the Cowie Lake section (map No. 1946-4a) and near the creek 2,000 feet southeast of Cowie lake, where fragments in agglomerate have been rounded by water action. These bands of pebbles are too small to be mapped separately. The only area of clastic sediments of appreciable size lies between Ella and Annibal lakes on the northeast and Morrison lake on the southwest. Here the tuff becomes stratified and then grades into arkose and a little greywacke. A few lenses of quartzite occur with the iron formation between Ella and Annibal lakes. There is no conglomerate at the base of the sediments as there is in some parts of the Mississagi Provincial Forest.

The banded silica member of the iron formation is composed of silica and magnetite and is regarded as a chemical sediment; interbanded with it are narrow bands of arkose, quartzite, and tuff.

Greenstone and Ellipsoidal Lavas

Rocks mapped as greenstone range from coarse- to fine-grained types. The coarser types are diabasic, gabbroic, and metadioritic in texture and composition. In places, they have been changed to massive hornblende schist with no well-marked cleavage and they have the appearance of having been metamorphosed under mass-static conditions. The scarcity of chlorite schist derived from basic rocks in this area is in marked contrast to its abundance in many others. In the Michipicoten area, for example, many of the Keewatin basic and acid rocks in the neighbourhood of the iron formations have been changed to chlorite and sericite schists.

The coarser greenstones are partly intrusive, but they also constitute the lower part of some thick flows. They have had a great influence on the structure of the iron formation, which has in many places been highly deformed where squeezed against masses of such rock. They have acted as buffers, which compelled the iron formation to flow around them or to break up into blocks when strong compression was exerted on these rocks during folding.

Ellipsoidal lavas are fairly abundant in the area and may be seen, as indicated on maps Nos. 1946-4a, b, and c, in a number of places. They consist of basalt and andesite. The large hill north of the northeast bay of Cowie lake is largely composed of agglomerate, and a number of thin lava flows are interbanded with the agglomerate. Near the northwest end of Ella lake, small lava flows are interbedded with the banded sediments.

The relation of basic lavas to acid lavas and pyroclastics in the area is very complex. There are a number of alternations in the extrusions of basic and acid lavas, and basic lavas are also interbedded with agglomerate and tuff in which the fragments are mainly acid in character. This complexity in association of the different formations made it impossible to map them separately, even on a scale of 100 feet to the inch, without an unwarranted expenditure of time.

Some of the basic lavas are the oldest rocks found in the Goulais River area. They form a wide band on the east side of the iron range, between it and the large area of granite on that side of the range.

Several thin sections of specimens of greenstone were examined under the microscope. One specimen was taken from a mass of coarse greenstone on cross-section No. 15 (map No. 1946-4a) about 50 feet southeast of the staff-house at the camp on Cowie lake. It is a coarse, greenish-grey, slightly schisted rock. In thin section it is seen to consist mainly of unoriented secondary green hornblende. Much quartz has been introduced into the rock, and it is highly epidotized. A little magnetite is present. The feldspars have been highly altered, and some of them have been recrystallized into a more sodic type. Another thin section, from a specimen taken close to the iron formation on top of the hill east of Cowie lake between cross-sections Nos. 17 and 18, is somewhat similar to the one described. It contains an abundance of blue-green secondary hornblende. The feldspar is similar, and much quartz has been introduced as tiny veinlets. The rock also contains magnetite and a little pyrite.

Acid Lavas

Acid lavas are widespread in the vicinity of the iron range. Rhyolite is the most abundant rock and forms some of the large hills in the area. It is mostly rather massive and contains little schist. Typical examples of this rock may be seen east of the southern part of Cowie lake and southwest of the camp.

Like the massive greenstone, the more massive rhyolite has exerted considerable influence in some places on the structure of the bands of iron formation. This is particularly well shown just northeast of the southeast bay of Cowie lake where the "A" ore body is wrapped around the nose of a large hill of rhyolite. Near the shore of the bay, the south end of the main band of iron formation terminates against the rhyolite.

Thin sections from several of the lavas regarded as acid types were examined. One came from the large hill of rhyolite just mentioned. This rock looks rather massive in the field with dark specks and laths. Under the microscope it shows the effect of shearing. Phenocrysts of orthoclase have been crushed and partly recrystallized. Single crystals, and groups of crystals in lens-like patches, of deep green hornblende account for the dark spots in the hand specimen. Grains of epidote, many of which are arranged in a linear fashion, are abundant. Chlorite occurs in a similar arrangement. Grains of titanite are present.

Another section was made from what appeared to be typical rhyolite on the south side of the bay on which the camp is located. It contains phenocrysts of orthoclase in a recrystallized, fine-grained groundmass of orthoclase and quartz. The rock is full of very small, parallel quartz stringers, some of which have a width of only one grain. There was one large flake and numerous tiny flakes of chlorite, the latter arranged along planes of shearing. As in the last section examined, considerable amounts of epidote were found, mainly in quartz veinlets and associated with grains of pyrite. A few grains of zircon were seen.

The occurrence of introduced epidote in this area is a striking feature. It is unusually abundant in acid volcanics, pyroclastics, iron ore, and other rocks. As it forms numerous veinlets and fills spaces between fragments of siliceous magnetite, many outcrops have a greenish-yellow colour.

Some of the lighter-coloured lavas show a porphyritic texture and closely resemble some of the Algoman feldspar porphyry. Just northeast of the staff-house at the camp, an outcrop of pink rock contains many small lenses, specks, and blotches of hornblende and phenocrysts of pinkish feldspar. Quite large phenocrysts of orthoclase were observed under the microscope in a fine-grained groundmass of quartz and orthoclase, which contains crystals of hornblende. Grains of introduced pyrite and magnetite are abundant. The feldspars are sericitized, and the rock does not appear as fresh as the thin sections of Algoman feldspar porphyry. A little chlorite was also seen.

In the bed of the creek near the camp and about 150 feet above its mouth, a little pillow lava was seen. This, in the field, was supposed to be a rather basic rock. It is fine-grained, and grey in colour. In thin section, it was found to be composed mainly of fine-grained quartz, the grains being nearly uniform in size. It contains many blades of hornblende and a good deal of chlorite with a deep bluish-purple interference colour. Apparently this was an intermediate rock with pillow structure, which now contains much introduced quartz, which has replaced the feldspar.

Pyroclastics

Tuff and agglomerate are very abundant along the Goulais River range, and their distribution is indicated on the accompanying maps. Excellent exposures of agglomerate may be seen northeast and north of the northeast bay of Cowie lake and of tuff along the east side of Ella lake and elsewhere. These rocks are

Agglomerate with white lenses of rhyolite in a dark matrix rich in hornblende, 400 feet northeast of the northeast bay of Cowie lake.

predominantly acid in character, and they grade into sediments, such as arkose and quartzite. The fragments in the agglomerate have a maximum length of more than 2 feet, and owing to the squeezing and folding of the formation the fragments are mostly more or less lens-shaped and stand nearly vertical. Some of the rock shows a mass of light-coloured fragments of rhyolite surrounded by a matrix of hornblende (see photograph above). Where highly squeezed, the agglomerate grades into gneiss with dark and light layers.

In many places, tuff is interbedded with bands of siliceous iron formation. It is believed that the finely divided condition of the rock was a factor in supplying silica to the solutions from which the banded iron formation was precipitated.

A detailed study was made of some specimens of rocks regarded as pyroclastics in the field. One specimen was taken from a band of rock associated with the iron formation on top of the large hill just east of the camp on Cowie lake. In the field this rock is a rather dark grey, medium-grained, granular rock. It is slightly sheared. In thin section it is seen to consist almost entirely of fine-grained quartz, but irregular patches and lenses of indefinite material indicate that it is a tuff. Small blades of hornblende and grains of epidote are scattered along shearing-planes.

A thin section was made from another narrow band of rock interbedded with siliceous magnetite on cross-section No. 16 at the top of the hill mentioned above. The rock is fine-grained and on the weathered surface is pitted with lens-shaped holes as much as three-eighths of an inch deep. Under the microscope, many patches of fine-grained material containing sericite and an indefinite mixture of minerals are seen. The pits on the surface are believed to be the result of the weathering-out of these patches. The rock consists chiefly of quartz with considerable amounts of sericite and hornblende. Blotches composed of groups of quartz grains trail out into little stringers of quartz.

On the east shore of Cowie lake close to the camp, there is a coarsely and imperfectly banded gneiss with wide pinkish to light-grey bands and darker bands with black specks. It is difficult to decide, even in thin section, whether this rock is a sheared tuff or rhyolite. It shows banding and the groundmass consists of fine-grained quartz holding a few grains of orthoclase, which might be phenocrysts. It contains much dark-green to blue-green hornblende, with the crystals parallel and transverse to the banding; some biotite flakes, which show a similar relation to the banding; and a few grains of pyrite.

A lens of unusual rock was observed in the siliceous magnetite near cross-section No. 16 on top of the large hill east of the Cowie Lake camp. The rock, which is a coarse tuff or an agglomerate, weathers brownish, and fragments from a thirty-secondth of an inch to 2 inches in diameter project on the weathered surface. Some of these weather white and some greyish-black; most of them appear to consist of silica. Microscopically, the rock was found to consist mainly of quartz, hornblende, magnetite, and grünerite. The quartz occurs as a fine mosaic with hornblende and small grains of magnetite scattered through it. Small bodies consist of groups of grains of quartz with magnetite. These constitute most of the resistant fragments on the weathered surface. There are also what look like fragments composed of hornblende surrounded by magnetite grains. This pyroclastic was apparently formed from basic rock and banded silica and iron oxide, which later were metamorphosed.

The agglomerate in the hill near the northeast corner of Cowie lake (see photograph on page 13) is quite typical of much of the agglomerate in the area. It is composed mainly of fragments of light-coloured, acid igneous rock with a dark-brown to black matrix rich in hornblende. The acid fragments contain quartz and orthoclase, and most of them are rhyolite. Some darker fragments, which have been squeezed out into bands, consist mainly of hornblende with some epidote, zoisite, and clinozoisite, which indicates that they came from basic lavas. Small bodies of fine-grained quartz are also present. The matrix is mainly hornblendic. It would appear that this agglomerate represents a cross-section of the rocks in the area that were in existence when the eruption that produced it occurred.

It is very difficult in this area to draw a sharp line between the gneisses that have been formed from tuff and small-fragment agglomerate, and some of the arkose.

Sediments

The banded siliceous magnetite, which is regarded as a chemically deposited sediment, will be discussed in detail later. The other sediments along the range are arkose, by far the most abundant, quartzite, and greywacke. The arkose consists mainly of quartz and feldspar, orthoclase and plagioclase, with some biotite, hornblende, and epidote. The quartzite, which is impure and contains many fragments of feldspar, grades into the arkose with a decrease in quartz and an increase in feldspar. It occurs in lenses between bands of siliceous magnetite between Ella and Annibal lakes and is not abundant.

Bands of the clastic sediments occur in many places interbedded with the siliceous magnetite. It is very difficult to distinguish between the tuffs and some of the sediments. The main area of true sediments is found between Ella and Morrison lakes.

The arkosic rocks of this area show some degree of banding or lamination. An outcrop near the creek, about 100 feet below the outlet of Ella lake, consists of a light-grey, rather dense rock, which is partly laminated. Under the microscope, it is seen to be a fine-grained arkose or highly feldspathic quartzite. It contains abundant quartz and many fragments of orthoclase, especially in the coarser bands. Small grains of epidote, tiny flakes of sericite, and small blades of hornblende are scattered throughout the rock. Tiny veinlets of quartz are abundant. The presence of the epidote and veinlets of silica indicates that the rock was affected by the intrusion of the granite, some of which is exposed not far away. The epidote may have been derived from finely divided calcareous material deposited with the other sediments.

An outcrop between Ella and Annibal lakes is composed of a banded and laminated rock. It looks much like a quartzite, but in thin section it is seen to be a fine-grained arkose composed of angular fragments of orthoclase and quartz with sericite, the feldspar being much more abundant than the quartz.

Narrow bands and larger areas of gneisses, some of the latter showing very distinct banding, are regarded as paragneisses. One outcrop a short distance below the outlet of Ella lake consists of a distinctly banded rock. The alternate bands are light-grey to white and dark-grey. They are very narrow except for a few that reach a width of as much as three-sixteenths of an inch. In thin section, fine-grained quartz bands containing some fragments of orthoclase are seen to alternate with wider bands consisting of coarser grains of orthoclase, hornblende, and epidote. There is less quartz in these wide bands than in the others. The hornblende and epidote occur all through the rock, but they are much coarser-grained in the wider bands. The hornblende is green to blue-green in colour. The abundant grains of titanite are mostly associated with the hornblende.

Zones of well-banded, dark-grey rock occur near the northeast side of the outlet of Annibal lake. A thin section shows the rock to be a quartz-hornblende gneiss, apparently a paragneiss. The hornblende is mostly well orientated with respect to the banding, but tiny veinlets of epidote and quartz traverse the hornblende bands. Some quartz has been recrystallized into groups of small grains.

A specimen of a well-banded rock was collected from one of the zones between bands of siliceous magnetite in the vicinity of cross-section No. 33 northeast of Cowie lake near the east side of the range. The rock is a paragneiss, which contains dark hornblendic bands alternating with nearly white to reddish bands. A thin section shows rather wide bands of very fine grained quartz of clastic appearance with bands of interlocking quartz grains three to five times the size of those in the finer-grained bands. One band consists almost entirely of dark-green to strongly blue-green hornblende; the crystals are larger in the centre and become smaller toward the edges of the band, where small crystals extend into the bands of quartz.

The quartzite mentioned as occurring in lenses in the iron formation in the Morrison Lake section of the range is a dense to laminated rock. Some of it is rusty from weathered pyrite. All of it is feldspathic, and it grades into arkose. The orthoclase fragments are not greatly water-worn, and most of them are partly altered to sericite. Most of the rock contains a little chlorite, epidote, and biotite.

In several other places, impure quartzites were found in narrow bands or thin lenses in the iron formation. A specimen of a grey, fine-grained, and slightly laminated rock was collected on top of the large hill just east of the south end of Cowie lake. A thin section of this rock shows it to be composed mainly of quartz grains with some fragments of orthoclase. It contains much green hornblende and sericite, which are arranged parallel to the foliation, and a few grains of epidote. The rock appears to be a partially sorted water-laid tuff.

Another specimen was collected northeast of the northeast bay of Cowie lake near the east border of the iron formation. Here a 10-foot band of this rock is interbedded with siliceous magnetite. It is slightly sheared, of medium grain, and dark-grey in colour, which weathers to a much lighter shade. A thin section shows the rock to be composed mainly of quartz with a few streaks of hornblende and epidote and grains of zoisite. This is probably a water-laid tuff.

ALGOMAN

Intrusions regarded as Algoman in age are distributed from end to end of the Goulais River range. All of these are believed to be related to the granite that appears about 2 miles east of Cowie lake and extends far to the east. In the Ella Lake area, the granite contact is less than a mile to the east, and the granite terminates the iron formation near Annibal lake. As the contact of the granite and iron formation here dips northwest, the granite undercuts the iron formation and is struck in some drill-holes at comparatively shallow depths. A number of minor intrusions of this rock are found in and near the iron formation for a distance of 1,200 feet northwest of Annibal lake; from this point to the north end of the range little real granite is found. Part of an intrusion that underlies the creek 1,600 feet east from the shore of Cowie lake on cross-section No. 11 is granite, and a few small dikes of granite occur between Dude and Ella lakes. It is probable that granite underlies practically the whole of the iron range at varying depths, in some places at great depth and beyond the reach of mining operations on the range. The numerous dikes and stocks of porphyry in the range appear to be offshoots of the magma from which the granite crystallized. An interesting feature supporting the belief that granite underlies the range may be seen on top of the large hill in the northwest corner of the Cowie Lake section. Large angular fragments of red granite are enclosed in a large diabase dike, which indicates that they were torn loose from a body of granite at some unknown depth and floated upward by the diabase when it was in a hot liquid state. No granite is exposed in the vicinity, although there are a number of porphyry dikes.

Feldspar and Quartz Porphyries

Dikes, small stocks, and irregular intrusions of pink to red porphyry, mostly feldspar porphyry, are numerous in the Goulais River range and in the surrounding area and cut all the rocks described above. Many of the dikes are not more than 2 feet wide and many are only a few tens of feet in length. Small veins or irregular bodies of barren quartz are found near a number of these intrusions, and they seem to be closely related to them genetically. The porphyries are mostly quite fresh in appearance and easily distinguished from the acid lavas by their redder colour, except where the lavas are massive and somewhat porphyritic. It is sometimes difficult to distinguish the two types of rock in drill cores and on weathered surfaces, where both weather to a very light colour. It is very important to distinguish the porphyries from the lava flows because the porphyries are younger than the iron formation and some of the intrusions cut out the iron formation, whereas the lavas are concordant with it.

A surprising feature of these porphyries is the unexpected changes from the size and shape of the outcrops found underground. Drilling has shown that a body of considerable size at the surface may disappear or become much smaller a short distance underground. A few swell out and are much larger underground than at the surface, and some may be found in drilling that are not exposed at the surface. Consequently, the surface exposures are often poor guides to what may be found in drilling.

A number of the Keweenawan diabase dikes were injected along the porphyry dikes. In several places, dikes not more than 5 feet in width have been split open by diabase dikes, leaving about half of the porphyry dike on either side of the diabase. Apparently fractures or lines of weakness were followed upward by the porphyry intrusions, and later the diabase found the same lines to be the easiest ones for intrusion.

The porphyries are nearly all very fresh in appearance and show few effects of shearing. This indicates that they were intruded after most of the movement in the formations had taken place. They range in colour from red to almost white, and some of them weather white. On first sight, the lighter-coloured porphyries strongly resemble the quartz porphyries found in many other areas, but they lack conspicuous quartz phenocrysts. An irregular intrusion of this rock cuts up the iron formation between cross-sections Nos. 11 and 23 on top of the large hill just east of the camp on Cowie lake. In thin section, many small phenocrysts of orthoclase occur, but none of quartz. The groundmass is uniform in grain size and is composed of quartz and orthoclase with a little sericite. A small quantity of green hornblende and a few grains of pyrite also occur.

A thin section of another specimen from the south bank of the creek, between cross-sections Nos. 9 and 10, shows that this rock is a feldspar-quartz porphyry. Most of the phenocrysts are orthoclase, but there are a few small ones of quartz, which has been recrystallized into groups of small grains owing to squeezing of the rock. As in the last thin section mentioned, there are a few small crystals of hornblende and grains of pyrite.

The rock is somewhat more acid than most of the porphyries and grades into the granite on the north side of the creek. Drilling shows that this intrusion cuts out the siliceous magnetite under the creek.

Two specimens were collected along the ravine that runs east from the northeast bay on Cowie lake, between cross-sections Nos. 28 and 29. Irregular intrusions of porphyry cut the iron formation on both sides of the gulch in this locality. The main body proved to be very irregular in outline since little of it was cut by the deeper drill-holes. Thin sections of the rock showed it to be feldspar porphyry with distinct phenocrysts of orthoclase and none of quartz, unless some small bodies made up of groups of quartz grains were original phenocrysts that have been crushed and recrystallized. Much quartz occurs in the groundmass. The rock on the north side of the gulch is slightly sheared, and some of the feldspar phenocrysts have been crushed. The specimen contains more hornblende than that from the south side and also a little biotite and epidote. These minerals are arranged along planes of shearing.

Syenite

A few small dikes and other intrusions of hornblende syenite cut the iron formation and associated rocks.

The absence in this area of aplite, lamprophyre, and other diaschistic rocks, which indicate elaborate differentiation of magma, is striking when compared with the frequent occurrence of such rocks in the iron ranges in Michipicoten.

KEWEENAWAN

The Keweenawan system is represented in this area by three varieties of diabase or gabbro: quartz, porphyritic, and olivine. The relative ages of these rocks were established by finding dikes of one variety cutting those of another. The quartz diabase is the oldest, and the olivine the youngest; the peculiar porphyritic variety is intermediate in age.

The diabases cut all the older formations, and many of them cut through the iron formation, which will complicate future mining operations and cause much dead work in drilling. The Keweenawan intrusions do not digest the siliceous magnetite, as the Algoman intrusions do, but simply split it apart and produce almost no metamorphic effect at the contacts (see photograph below). In most places they have not even changed red jasper to siliceous magnetite. There are several examples of a narrow band of siliceous magnetite being split open by a

Olivine diabase dike in sharp contact with banded iron formation on top of the high hill east of Cowie lake.

quartz diabase dike, and the combined widths of the siliceous magnetite bands along the sides of the dike are equal to the width of the original band where the dike does not intrude it. This is true even where the band of siliceous magnetite is only a few feet wide. A few small dikes of Algoman porphyry are also split open in the same way. A good example of this may be seen near the northwest side of the iron formation near Dude lake, a short distance north of Ella lake. The diabase seems to have been forced into all these older rocks like a great wedge, which split them apart without digesting any portion of them. It showed some selection in following the same fractures or lines of weakness taken by the porphyries when intruding older rocks. In at least two places, the quartz diabase floated off blocks of Algoman rocks. At the east side of the iron range, between cross-sections Nos. 30 and 31, inclusions of porphyry torn from a mass of this rock by a diabase dike are suspended in the diabase (see photograph on page 19). A large quartz diabase dike on top of the high hill north of Cowie lake holds several inclusions of red granite, the largest of which is more than 3 feet in diameter. As no granite outcrops in the vicinity of the dike, these inclusions must have floated up to their present level from a great depth.

The diabase intrusions show considerable variety in form. The olivine variety occurs in dikes of fairly constant width, and nearly everywhere they crosscut the older rocks. The intrusions of the porphyritic variety change rapidly in shape and size. In some places they crosscut the rocks intruded and in others follow the bedding like sills. A large dike may end suddenly, as does the one that forms the large hill east of the southern part of Cowie lake. It is exposed in a wide outcrop on the surface, and within 300 feet of the surface drill-holes pass under it. Some of these dikes pinch out and come in again, either in line with the strike or some distance to one side. This irregularity in size and shape apparently holds down the dip as well as along the strike on the surface, and it is confusing in working out the structure from drill logs.

The quartz diabase intrusions have more regularity in size and shape than the porphyritic but less than the olivine variety. Some of them are regular dikes that traverse the beds of older rocks. Many, however, follow the bedding in the

Inclusions of light-coloured feldspar porphyry in a quartz diabase dike, 1,200 feet east of the northeast corner of Cowie lake.

lavas for considerable distances, and these are regarded as sills. Sudden changes in dip were found in some dikes; this complicates the structure for interpretation by drilling and will also make mining more difficult. A few dikes that are many feet in width at the surface were not found in the drill-cores a few hundred feet underground.

Quartz Diabase

The quartz diabase is very similar to the Nipissing diabase found in other parts of the Canadian shield. It ranges from grey-green to dark-green where fresh and from brown to grey-brown on the weathered surface. It is medium-coarse to coarse, some of it being almost gabbroic in texture. In thin section, various stages of alteration may be observed. These range from one in which the feldspars are bright and the ilmenite and pyroxene fresh to one in which the feldspars are dull and ilmenite is altering to leucoxene and pyroxene to amphibole. It is on the whole not as fresh as the olivine variety. The feldspar, which generally constitutes from 60 to 65 per cent. of the rock, consists of plagioclase, which ranges from andesine to labradorite. The plagioclase consists of long laths, which give a distinct ophitic texture to the rock. The quartz occurs in individual grains and also in an intergrowth with feldspar in a graphic or myrmekitic arrangement, which fills interstices between feldspars or between feldspars and pyroxene. This intergrowth was the last portion of the rock to crystallize. The pyroxene is mainly augite with some pigeonite forming the interior part of some crystals.

One of the narrower dikes, which crosses the creek a short distance north of the northeast corner of Cowie lake, differs from those described in lacking quartz, at least in the one thin section studied. This dike outcrops intermittently along an irregular course. It also ranges from coarse- to fine-grained, and has a distinct ophitic texture. The dike is believed to cut porphyritic diabase near its east end, but this cannot be proved because of the drift cover. It is probably of about the same age as the olivine diabase. The feldspar and augite are mostly very fresh. Collins and Quirke[1] have described diabase containing neither quartz nor olivine from the Michipicoten area and considered that it belonged with the younger series of dikes.

Porphyritic Diabase

The porphyritic diabase is a peculiar, spotted rock, which is similar to much of the porphyritic diabase of Matachewan age in other areas. It has a grey-green to brownish-green groundmass, through which white to greenish-white plagioclase phenocrysts are irregularly scattered. The phenocrysts range in diameter from a thirty-secondth of an inch to 2½ inches. Their borders may be irregular or rounded or they may be clear-cut crystal faces. The plagioclase is labradorite. One of the phenocrysts was found in thin section to have been replaced almost entirely by zoisite, epidote, and a felty mass composed of small flakes of kaolin and sericite, or paragonite, which accounts for the greenish tint of some of them. Some specimens are comparatively fresh, the feldspars being little altered and augite only partly altered to uralite. The ilmenite is only partly altered to leucoxene. Some primary hornblende is present.

Primary quartz occurs in small grains and myrmekitic intergrowth in some of this rock. One thin section showed many individual grains of quartz but no intergrowth of quartz and feldspar. The groundmass and the laths of feldspar are highly altered to zoisite, epidote, fibrous amphibole, and chlorite, and the quartz appears to have been introduced into the rock. It would appear that some of the porphyritic dikes carry primary quartz and some do not.

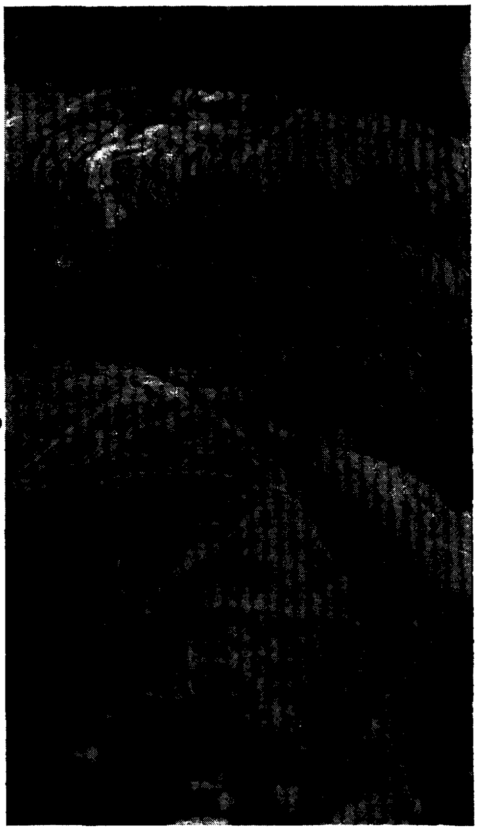
In a large porphyritic diabase dike on top of the hill about two hundred feet north of the township line, an irregular dikelet resembles a basic pegmatite. It is a pinkish-grey, medium-grained feldspathic rock. In thin section, it is seen to be composed mainly of plagioclase (near oligoclase), quartz, hornblende, and epidote. The feldspar is in laths giving in places an ophitic texture to the rock. The hornblende is in small crystals and is blue-green to deep-green in colour. The quartz appears to have crystallized late. A veinlet of epidote indicates that at least some of this mineral has been introduced. This rock is regarded as a differentiate of the diabase and as having a pegmatitic character.

Olivine Diabase and Gabbro

The olivine diabase and gabbro dikes have a width of from 30 to 125 feet. Some are greenish-grey when fresh and show, even in the hand specimen, evidence of ophitic texture. Others are composed of coarse, more nearly equigranular rock, which weathers to a brown colour, as do many Keweenawan olivine diabases. Even these rocks, however, show considerable ophitic texture

[1]W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, pt. I, 1926, pp. 36-38.

in thin section. The olivine variety of diabase is generally much fresher than either the porphyritic or the quartz variety. Many of the feldspar laths, which are composed mainly of labradorite, are almost glassy bright; much of the augite is quite fresh, and so is the ilmenite. In a thin section from the large dike north of Gut lake, the augite shows a faint violet to old rose shade, probably owing to the presence of titanium. A little dark-brown biotite is associated with the olivine in several of the dikes. No orthorhombic pyroxene was found in any



Photograph showing a large block of banded siliceous magnetite that has been displaced and ends abruptly against the mass of coarse greenstone seen in the foreground (between cross-sections Nos. 14 and 15, 1,400 feet east of Cowie lake).

of the dikes. Much of the olivine is quite fresh, but some of it is almost completely altered to serpentine with characteristic pattern. The large dike cutting through the hill east of Cowie lake is more altered than any of the other olivine diabase dikes. Most of the olivine has been changed to serpentine, the augite is partly uralitized, and the feldspars are dull.

PLEISTOCENE

The Goulais River area was completely glaciated, but the drift is not deep except in some of the valleys. Rock exposures are very numerous along most of the range. Between Ella and Annibal lakes the drift is very thick in places, and rock outcrops are much scarcer than they are elsewhere.

The glacier scraped a large amount of magnetite off the iron range and scattered it freely over the surface of the country. This makes a compass unreliable for a considerable distance from the iron formation, and in the sand underlying the sand plains that occur at intervals along the Goulais river, magnetite is a common mineral.

The ice moved in a direction of about S. 25° W. in this area.

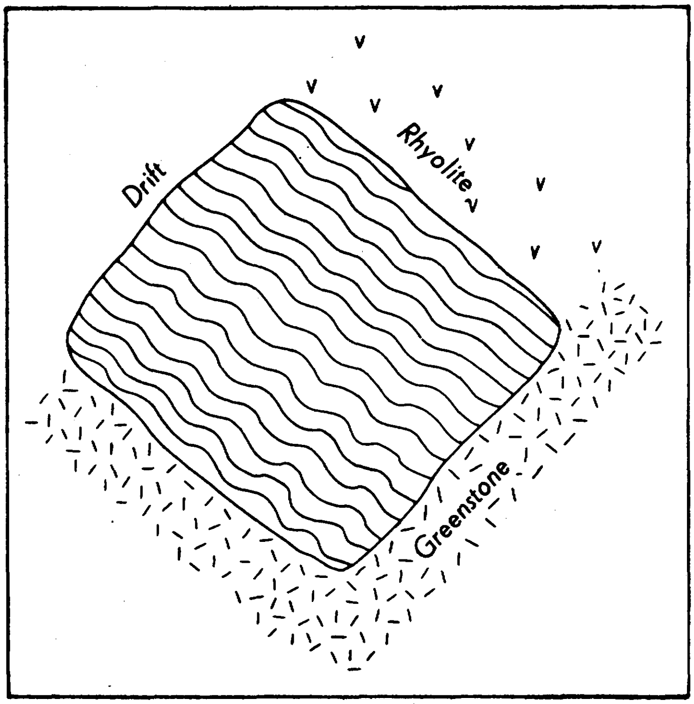
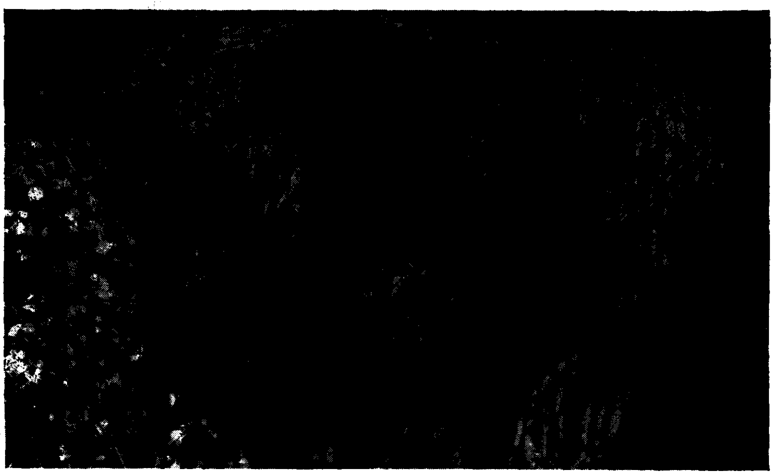


Fig. 2—Diagram showing the structural relations between the iron formation and the greenstone between cross-sections Nos. 14 and 15, 1,400 feet east of Cowie lake (see photograph on page 21).

Structural Geology

The relations of the Algoman and Keweenawan igneous intrusions to the older rocks, which have already been described, have made the structure complex in many places. The relations of the acid and basic lavas to one another and to the pyroclastics have also added complexity to the structure because of their frequent alternations with one another. These rocks have not all responded in the same way to compressional forces and to folding. As the coarser-grained and more massive greenstones and rhyolites have not yielded in folding as readily as the finer-grained lavas and pyroclastics, the folding in the iron formation is much more complicated than it would otherwise have been. The iron formation was forced to flow, fold, and crush around these buffers of unyielding rock, and marked discordances resulted in some places (see photograph on page 21 and Fig. 2). The iron formation is almost everywhere tremendously contorted and contains numerous minor folds, but except for the folding in the "A" ore body between cross-sections Nos. 1 and 5 in the Cowie Lake section, which will be discussed more fully later, the major structure of the iron formation is, in a broad way, comparatively simple. Several small synclines were seen, one of the best of which is on top of the large hill east of the camp, between cross-sections Nos. 15 and 17 (see photograph below). The iron formation comprises a series of roughly parallel lenses, which dip steeply with the enclosing rocks. The general dip ranges between 65° W. and vertical, and the range lies along what is believed to be the east limb of a very large syncline. The rocks in the neighbourhood of the range have almost a monoclinal dip to the west and northwest except where they are vertical. This is brought out in the cross-sections that appear later in this report where the iron formation is discussed in more detail (see Fig. 7 on page 30).

No large faults were found in the iron range. A few small ones offset it in places, for example, on cross-sections Nos. 36 and 37 in the Cowie Lake section; east of Gut lake; and near the south end of Ella lake.



South end of a small syncline pitching north on top of a hill between cross-sections Nos. 15 and 17, 1,400 feet east of Cowie lake.

Economic Geology

Magnetite is the only mineral that has been found in this area in economic quantities. Some veins and other bodies of quartz occur, but they are barren. An insignificant amount of molybdenite was found in one vein a short distance up the creek that enters Ella lake at its north end.

THE IRON FORMATION

The iron formation is composed of the siliceous magnetite member, which in places is rich in iron and in sufficient volume to make ore, and bands of other rocks. These rocks are tuff, agglomerate, arkose, quartzite, greywacke, and basic and acid lavas, but they do not all occur in one locality. They are interbedded with layers of siliceous magnetite, the whole assemblage of bands being included in what is commonly called the "iron formation."

As the iron formation extends almost continuously from a point near the Goulais river to Annibal lake and the main part of it was, in 1925, named by the senior author the Goulais River or Southern range,[1] the former name has been

[1]E. S. Moore, op. cit., p. 18.

extended to include what has been known by some as the Gut Lake and Morrison Lake ranges. The range is not of economic interest throughout its length, and diamond-drilling has been restricted to certain sections that will be described and mapped as the Cowie Lake, Dude-Gut Lakes, and Morrison Lake sections (see insert map facing this page). When the Cowie Lake section of the Goulais River range was studied and the surrounding area mapped in a reconnaissance way, in 1924, the narrow band of iron formation extending southward was not seen in the forest-covered area, and iron was not discovered in the southern sections until a later date.

The Goulais River range has a total length of nearly 20,000 feet. The iron formation ranges in width from a few feet to about 600 feet, but the width of the widest band of siliceous magnetite at the surface is only about 275 feet. Bands that are almost as wide have been cut by the drill at a depth of more than 1,000 feet. Any single band with a width of less than 40 feet can scarcely be considered as minable in the near future. Some of the bands of siliceous magnetite are quite short, others continue for long distances; and the geological complexity of the iron formation can best be realized by referring to the accompanying maps, Nos. 1946-4a, b, and c.

Origin

The origin of the banded silica member of the iron formation has been discussed previously in this report.[1] Although the banded silica is the most conspicuous rock in all the ranges described, there is a marked difference between the banded silica in the Goulais River range and that in the Michipicoten ranges. In the former, the banded silica contains the iron within the silica as part of the original chemical sediment. In the Michipicoten ranges, the banded silica was laid down with very little iron, and the siderite or hematite, as the case may be, was introduced into the banded silica and along its footwall by hot waters at a very much later time. The banded silica in the Goulais River range, with its enclosed magnetite, therefore, constitutes the ore in this range.

Structure

The broader structural features of the Goulais River range have been briefly described under Structural Geology,[2] but a knowledge of the details of the structure within the iron formation itself is essential to planning development and mining operations. Such knowledge can be gained only if the conditions under which the formation was deposited are understood.

It is evident from the relations among magnetite, banded silica, lava flows, and pyroclastics that there was much volcanic activity in the Goulais River area during the deposition of the iron formation. Basic lavas and acid lavas were being erupted at intervals. The basic lavas seem to have predominated preceding the formation of the iron formation; then acid lavas became relatively more abundant. At the time the banded silica was being deposited volcanic explosions shot out large quantities of pyroclastic rock. The coarser fragments accumulated to form the agglomerate, and the finer particles, including much volcanic ash or dust, were consolidated into tuff. Lakes that became charged with salts existed in the area during this time. Some of the tuff and agglomerate were partly sorted by the water to form the narrow bands of arkose, stratified tuff, and lenses of impure quartzite that are interbedded with the banded silica. The size and thickness of the individual lava flows and of the deposits of pyroclastics would differ greatly, as may be seen in any area of recent volcanic activity.

[1]Pages 3 to 6.
[2]Pages 22 and 23.

During the deposition of the lavas and pyroclastics, the silica and iron would be leached away from these rocks by surface waters, and to these waters would be added the silica and iron carried by magmatic water escaping to the surface from great depth and by hot springs. The fresh lavas and pyroclastics would also heat the surface waters considerably from time to time and increase their chemical activity. The solutions would all accumulate in the lakes. A lava flow or a deposit of the pyroclastics might completely fill a small lake or be thick enough to form islands in a large lake or only thick enough to make low hills on the bottom of it. These conditions would give rise to a very irregular surface in such an area.

The colloidal silica and iron would be deposited in the basins of open water in the form of a gel, a soft deposit very high in water content. Small deposits would be made in small lakes and large deposits in large lakes. Parts of the larger lakes might be cut off, and the deposits of iron and silica made in them would

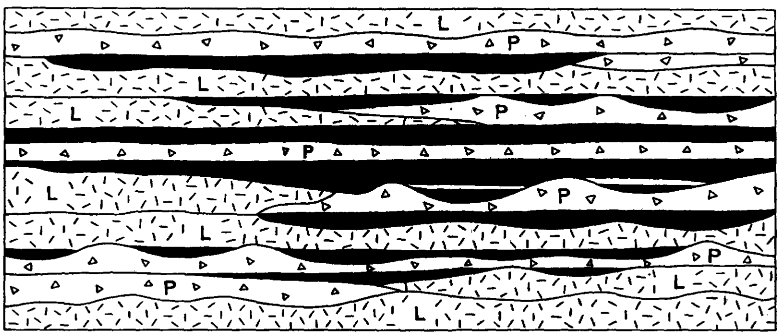


Fig. 3—Diagram showing the conditions of deposition of the siliceous magnetite (black) with the lavas (L) and pyroclastics (P), Goulais River range.

become isolated from the main body formed in the larger part of the lake. The deposits would be thicker in the centre than at the edges and would thus form lenses of ore. Where lava or pyroclastics covered the edges of a large deposit of iron and silica forming in a lake, a wedge of one of these rocks would project out into the lake, and when fresh iron and silica were deposited on top of it there would be two thin beds of these materials formed around the border of the lake, which would merge into one thick bed in the centre of the basin. There would thus be deposited large and small lenses of the iron formation, and these would be separated by layers of the other rocks. Several beds of the iron formation might form one above the other in an area, just as several coal seams form one above the other in a coal field. The iron formation would have partings and splits which join a main bed just as coal seams do.

The accompanying diagrams (Figs. 3 and 4) are attempts to illustrate the general structure in the iron formation just after its deposition and after it had been tilted up on edge during folding. They illustrate the structural conditions in most of the range.

On the accompanying maps, it will be observed that the main band of ore pinches out about 600 feet north of the township line between ranges XIII and XII. The band widens rapidly until it is crossed by a ravine between cross-sections Nos. 36 and 38, where the outcrop is 400 feet wide. This great width is due to a fold in which the formation is dragged to the west and faulted by a transverse fault. Evidence of this fault is seen in the strike of the banded formation, which is exposed on the south side of the ravine and heads directly into a low cliff of massive greenstone on the opposite side. The horizontal displacement on the fault is not great, probably less than 100 feet. Continuing south, the ore body maintains a good width, but it is split up somewhat by interbedded rock and diabase dikes. Between cross-sections Nos. 22 and 28, the main body is split up into several bands and practically dies out as an ore body where the large diabase dike cuts through the formation near cross-section 20 on top of a large hill.

North of the township line, there are a number of lenses of ore considerably east of the main band, and some of these have been drilled.

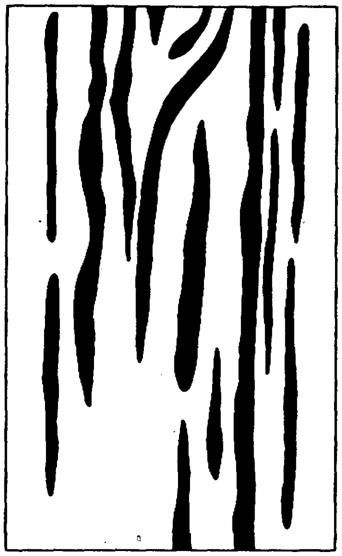


Fig. 4—Diagram showing in a general way the relations of the iron deposits to one another after being tilted on edge and locally folded, Goulais River range. This shows how lenses of ore may be found in drilling although they do not outcrop. Some beds continue to great depth; others have but a short vertical range.

Between cross-sections Nos. 20 and 10, besides the main band of ore, there are several roughly parallel bands too narrow to be worked by themselves.

On section No. 10, the ore body is partly cut out by a body of Algoman granite and porphyry, which underlies the creek and outcrops on its banks. The main band continues to the south a little beyond cross-section No. 5, where it pinches out. Many subsidiary narrow and roughly parallel bands of siliceous magnetite occur between cross-sections Nos. 3 and 10 on the northeast side of the large porphyritic diabase dike. The ore body in here is known by Algoma Ore Properties as the "B" ore body.

The relations between the "B" ore body on the northeast side and the "A" ore body on the southwest side of the dike are rather complex. On the northeast side of the dike, the rocks dip almost vertically and strike from north-south to N. 25° W. The strike of the "A" ore body between cross-section F, near its south end, and No. 1 is from north-south to N. 25° W., but a long arm of the body suddenly swings off directly east between cross-sections Nos. 1 and 3, and the dip in this arm is nearly constant, being between 45° and 55° N. It is evident that "A" and "B" ore bodies are practically isolated from one another.

The writers interpret this situation as being due to a large drag fold, the axis of which has been followed by the large diabase dike (see Fig. 5). This fold

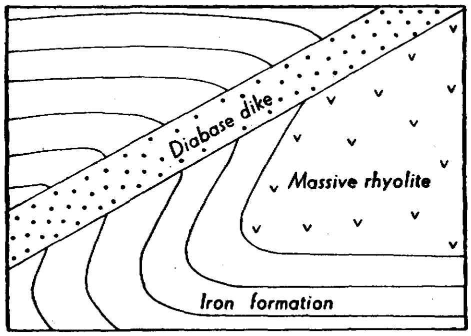


Fig. 5—Diagram of the drag fold between "A" and "B" ore bodies, between cross-sections Nos. 1 and 6, Cowie Lake sheet.

plunges to the northwest. The folding is in a nearly horizontal rather than a vertical plane. The axial plane of the fold would, therefore, have been nearly vertical if all the rocks involved had been equally competent.

There is, however, a large hill of nearly massive rhyolite on the south side of the eastward-projecting arm of the "A" ore body which did not yield readily

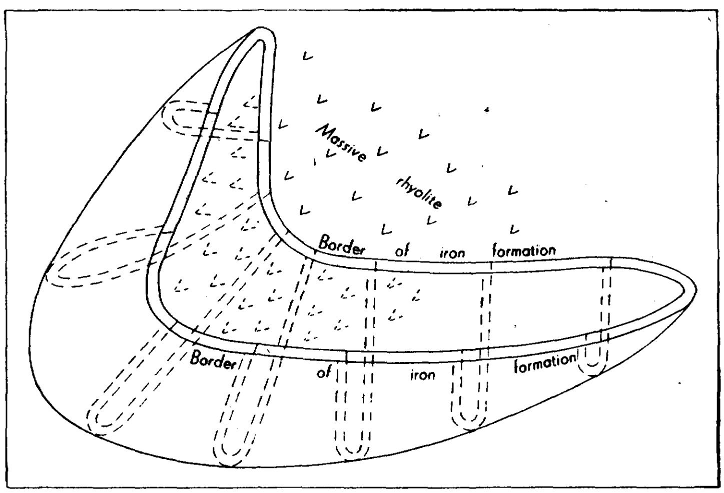


Fig. 6—Diagram of the folded syncline containing the "A" ore body, between cross-sections Nos. 5 and F, Cowie Lake sheet. The syncline is under thrust by the large body of massive rhyolite.

in the folding, and it has distorted the main fold. Further, the "A" body is a local, closely compressed syncline, which has been warped. The evidence for this being a syncline is found in the fact that drilling showed that the ore body pitches up to the south and is very shallow in the southern part. Some holes passed beneath the ore near the south and; others showed that the ore increased in depth toward the north end. The ore also pitches up to the east and dies out near the diabase dike, as demonstrated by drilling. The uniform dip to the north of all the siliceous magnetite in the easterly projection of the ore body proves that it is in a closed fold forming a homocline. This situation is interpreted as being caused by the large mass of rhyolite on the southeast side of the ore body having underthrust it and thrown the eastern part over on its side. Evidence of this can be seen along the contact of the ore and the rhyolite, where the former lies on the face of the latter (see Fig. 6).

As there is no country rock between the two limbs of ore in the syncline in the easterly projection, these do not stand out distinctly. A similar fold in the neighbourhood, however, very clearly demonstrates the synclinal character of a transverse fold of the same type. Between cross-sections B and C, near the diabase dike mentioned and the top of the hill, the siliceous magnetite is folded so that the strike suddenly changes from nearly north-south to east-west, and the dip from nearly vertical to 50° N. The fold is almost identical to that containing the "A" ore body except that there is a narrow band of greenstone in the centre between the two limbs of siliceous magnetite. This brings out clearly the close folding of the two rocks and the toppling over on its side of the syncline where it swings to the east.

From Cowie lake south to a point opposite the north end of Gut lake, the range presents little of economic interest. Three holes were drilled in a locality about 1,000 feet southeast of Cowie lake, where a band of siliceous magnetite widens out. The results were disappointing because the ore body is shallow and pinches out rapidly to the south. In fact, the iron formation almost disappears in a section beginning about 500 feet south of these holes, and only a few small bands or lenses occur for a distance of about 1,400 feet along the strike of the range. Here the iron formation passes under drift for another 1,400 feet, except for one small outcrop in the green timber area shown on the accompanying map of the Dude-Gut Lakes section (map No. 1946-4b). The presence of magnetite, however, was shown by the dip needle. Recent drilling has indicated a band of siliceous magnetite from 60 to 174 feet wide in this part of the range. On the southwest edge of the woods, a band of good siliceous magnetite about 60 feet wide is exposed, but the iron formation splits up to the south.

Just east of Dude lake, a band of ore 60 feet wide has been drilled for about 1,000 feet along its strike. It is mostly covered with drift. Around Ella lake, the iron formation is disappointing; it contains only narrow bands of magnetite separated by beds of sediment and tuff. One large band occurs in an outcrop at the southeast corner of the lake, but it pinches out quickly underground. This band is enlarged by duplication of beds due to a small fault.

Between Ella and Annibal lakes the iron formation is wide, but the siliceous magnetite is split up into numerous bands, some of which are separated from each other by thick beds of tuff or sediment. This part of the range is heavily drift-covered in many places; it has been extensively drilled but on the whole has been found to be much less promising than the Cowie Lake section of the range. A zone extending about 1,500 feet northward from a point opposite the outlet of Annibal lake, however, contains a considerable amount of ore. It is cut by several diabase and granite dikes, and the ore is shallow at the south end where the granite undercuts it.

Metamorphism and Deformation of the Banded Silica

As described above, the iron and silica were deposited as a gel, a soft deposit very high in water. As the deposit was built up and rocks were piled on top of the gel, the accumulating weight would squeeze out some of the water. The great change, however, probably came in Algoman time, when the whole region was highly compressed and the granite and porphyries were injected. Strong forces folded the rocks on a large scale, tilting up the strata in the Goulais River range until they stood almost vertically. In addition to heavy pressure, a great deal of heat from the Algoman magma was doubtless applied to the formations. These agents forced the water out of the gel and caused it to crystallize into a hard, brittle siliceous magnetite. The hydrous iron oxide was almost completely changed to magnetite, and now only 4 or 5 per cent. of the iron in most of the iron formation remains as hematite in red jasper, or in iron silicates, such as grünerite, actinolite, and hornblende. Fortunately, the temperature was apparently not high enough to change much of the iron and silica into the iron silicates.

In some parts of the range, the proportion of iron in red jasper is higher than that mentioned above. In an area on the east side of the range, lying approximately between cross-section No. 30 and the township line between ranges XII and XIII, the proportion of red jasper may be as much as one-third of the total banded silica, and in a few other areas the red jasper is high. It was observed that where this is the case in the northern part of the range, there is usually more sediment or tuff interbedded with the banded silica than there is where red jasper is less abundant. These softer rocks may have yielded more to pressure than the other rocks, so that the banded silica was not as highly squeezed as it was where the iron has been almost entirely changed to magnetite. The red jasper is, as a rule, scarcer in the wide bands of silica than in the narrower ones.

A remarkable feature of the iron formation is the intense contortion and crumpling of the siliceous magnetite. The most striking small folds, anticlinoria, synclinoria, and drag folds that can be seen anywhere in rocks may be observed in abundance in this iron formation. The strange thing about it is that this very hard and brittle siliceous magnetite could fold in this way. It has been brecciated, and large blocks have been pushed around, and we have the puzzling phenomenon of a hard, brittle rock having been most intricately folded and brecciated. The rock must have flowed readily to produce the folds, and it is evident that all the flowage occurred at a stage when the gel was passing from a fairly soft, somewhat plastic material to a crystalline, hard, brittle rock that could be readily brecciated.

IRON DEPOSITS

The iron deposits in the Goulais River range consist entirely of siliceous magnetite in long tabular bodies, and lenses, which stand vertical or nearly so in most places. They are cut at many points by large diabase dikes and small dikes and stocks of Algoman porphyries and granite. These intrusions will add to the cost of mining because they will produce much waste rock in some workings. Many of the ore bodies are very wide, however, and this will permit handling ore on a large scale.

DEVELOPMENT WORK

Two interests control the deposits in this range. Algoma Ore Properties, Limited, a wholly-owned subsidiary of the Algoma Steel Corporation, chartered to control the mining properties and to operate the mines, has possession of the iron-bearing lands in township 22, range XII, which cover most of the iron range. That part of the range lying in township 22, range XIII, was known at one time as the Sligh property, then as the Hillier claims, and later as the McPhail property. It is now generally known by the last name because John A. McPhail, of Sault Ste. Marie, Ont., represents the interests controlling it.

The McPhail property covers nine surveyed claims between the township line and the Goulais river. In 1922, seven diamond-drill holes were bored, and a brief description of the results has been given by the senior author.[1] No work has been done since 1922 on this property.

The property in township 22, range XII, was formerly in one of the Algoma Central and Hudson Bay Railway townships. Twelve claims were staked and

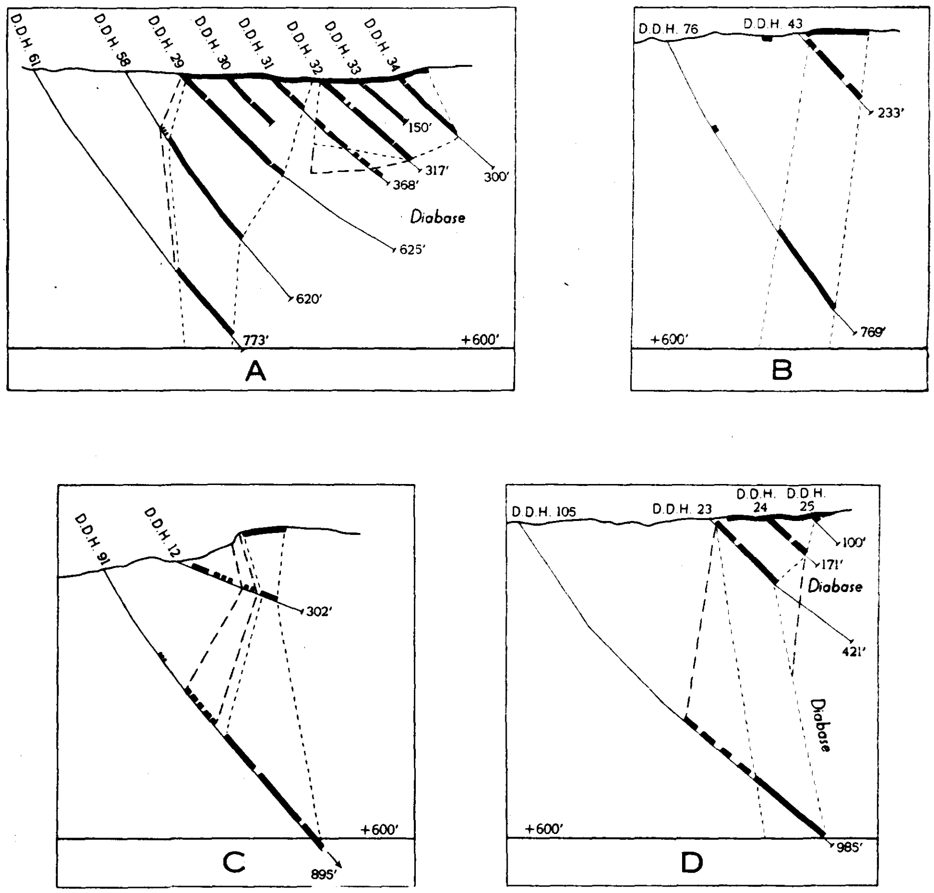


Fig. 7—Cross-sections of the ore bodies as revealed by drilling in the Cowie Lake section. Siliceous magnetite, where actually observed, is shown in black.

A—Cross-section No. 3. B—Cross-section No. 15.
C—Cross-section No. 30. D—Cross-section No. 38.

surveyed at an early date. These covered the main part of the iron formation in the Cowie Lake section. Township 22, range XII, has reverted to the Province of Ontario, but Algoma Ore Properties, Limited, has secured control of the iron range from the north end of the township south to Annibal lake. No work had been done on the property until recently beyond taking out some large samples of ore for testing.

In January, 1941, a large programme of diamond-drilling was started on the Cowie Lake section of the range. This work was completed in the spring of 1944.

[1] E. S. Moore, op. cit., pp. 24-26.

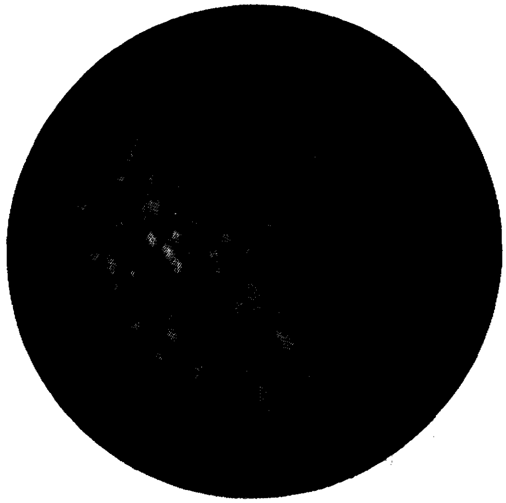
East-west drill sections were surveyed across the property, and the drilling has been systematically carried out by means of shallow holes to test the width of the bands of ore and deep holes to determine its extent at depth. Later in the year, the extension of the range to the south was found in the Morrison Lake section. Trenching and, a little later, diamond-drilling were done in this section and still later on the Dude-Gut Lakes section. The company reported in April, 1944, that 207 holes had been bored on the whole property for a total footage of 119,522 feet. Of these holes, 157 have been drilled in the Cowie Lake section of the range for a footage of 96,672 feet. The deepest hole so far drilled has cut the ore at a level more than 2,200 feet vertically below the outcrop on cross-section No. 29. Several cross-sections of the ore bodies obtained by drilling are shown in Fig. 7. The drilling has proved that the outcrops of dikes and, to a lesser extent,

Photomicrograph of siliceous magnetite ore, Goulais River range, showing banded, fine-grained silica and magnetite (black). (X 15.)

of the siliceous magnetite are not always a reliable guide to the size and form of these bodies underground. The bands of magnetite thicken and thin, coalesce and divide, and some of them are deformed by folding.

Character of the Ore

Banded silica is the most abundant mineral in the ore. The bands usually range from a sixteenth to a quarter of an inch in width, but some are narrower and some wider than this, the maximum width probably not exceeding half an inch. They are black, grey, or green in colour, and a few are composed of red jasper. The colour of the green bands is due to hornblende or actinolite. A considerable amount of grünerite, a brownish-coloured amphibole, occurs in some sections. The silica bands vary greatly in the size of grain. Some very fine grained ones alternate with much coarser ones, the larger grains being as much as ten times as large as the smaller ones. The distribution of the magnetite varies considerably. In some thin sections it occurs nearly evenly distributed as small specks all through both coarse and fine silica, with bands of larger grains. In others, more magnetite occurs in the finer-grained layers both within and between the grains of silica (see photomicrographs on pages 31, 32, and 33). The grains of magnetite range in size from microscopic specks to grains 1'.5 mm. in greatest diameter. In these larger grains it appears that several small grains have grown together along one of the bands. Magnetite grains usually occur in



Photomicrograph of siliceous magnetite ore, Goulais River range, showing coarse- and fine-grained magnetite (black) and silica. (Crossed nicols, × 15.)

the bands that contain the amphiboles, and many of the crystals of these minerals are orientated parallel to the bedding, which indicates that they have developed with the metamorphism of the iron formation.

Photomicrograph of siliceous magnetite ore, Goulais River range, showing fine-grained silica and actinolite with coarse- and fine-grained magnetite (black). (× 15.)

The company has analysed most of the drill cores in 5-foot sections. The analyses show that what is regarded as material that may be mined runs between about 25 and 40 per cent. total iron. Across the ore bodies drilled, most of the ore averages from 30 to 32 per cent. total iron and is regarded as of commercial importance. The magnetic iron mostly runs between 3 and 4 per cent. less than the total iron, although it may be considerably higher or lower than this in some ore bodies. Results of experiments on concentration of the ore show that some of the iron not contained in magnetite is also recovered, which somewhat increases the total recovery.

The phosphorus in the raw ore is quite uniform in distribution, and it generally runs between 0.05 and 0.06 per cent. As the phosphorus is reduced to about 0.023 per cent. in the concentrate, some of it at least appears to be associated with the silica. In most of the ore, sulphur is less than 1 per cent., but in spots it is high. Sulphur in the form of pyrite has been introduced into the iron formation near some dikes. The pyrite will not be at all objectionable if the concentrate is sintered and will even reduce the cost of fuel in the process.

Photomicrograph of siliceous magnetite ore, Goulais River range, showing fine and coarse bands of silica with coarse magnetite (black) in a band rich in grünerite. (× 15.)

Ore Reserves

In 1924, the senior author ventured to make an estimate of the tonnage of ore in the range as it was then known.[1] At that time the surface was heavily covered with timber and moss and not all of the iron formation was exposed. Seven holes had been drilled on the McPhail property, some of which were vertical and not placed in positions to supply the maximum information desired. Copies of the logs of these holes were obtained at that time. The figures arrived at for this property were as follows:[2] 500,000 gross tons for each 100 feet in depth from the west ore body, with a total of 1,500,000 gross tons of ore, averaging 31 per cent. in total iron; and 5,000,000 tons for the remainder of the property, which might be mined to a depth of 400 feet and carry 32 per cent. iron. As it is now known that the iron formation in that area contains much barren rock interbedded with the magnetite, the figure for the eastern part of the property is probably too high.

[1]E. S. Moore, op. cit., pp. 26-27
[2]Ibid, p. 27.

It was further estimated that the Cowie Lake section of the Goulais River range might contain 18,500,000 tons of ore, carrying 31 per cent. or more of iron above 500 feet in depth. This did not include any of the range except the Cowie Lake section.

George W. MacLeod, general manager of Algoma Ore Properties, Limited, has recently estimated that drilling indicates as much as 70,000,000 long tons of ore on the property of the company.

The following estimates have been worked out by the senior author for the different sections of this property, except for the Morrison Lake section, for which the figures were supplied by the company and accepted as reasonable. In making the computations, ore above the present level of Cowie lake (assumed as 1,120 feet) was calculated separately, because most of this ore can probably be mined by open-pit methods. The lake could be lowered 25 or 30 feet without great expense and thus increase the depth of open-pit mining in some sections of the range. In others the height of the surface above the lake is so great that the pits would become very deep if carried below present lake level. Ten cubic feet of siliceous magnetite per long ton was the figure used by the company's engineers in calculating tonnage, which is very close to the figure obtained if it is assumed that the ore averages 30 per cent. iron in the form of magnetite. This gives an average of 42 per cent. magnetite and 58 per cent. silica. When the specific gravity of these substances is taken in that ratio, the weight of 10 cubic feet of ore is slightly more than 2,200 pounds.

It has been considered that 40 feet is about the minimum thickness of a bed of ore that could be mined economically if isolated from larger beds. Narrower bands or lenses might be mined if directly connected with larger bodies that were being worked.

The estimate of reserves for lands of Algoma Ore Properties, Limited, is as follows:—

	Long tons
Cowie Lake Section of Range	
Above the level of Cowie lake	7,728,489
From lake level to 1,000 feet below it	54,934,195
Total	62,662,684
Section near Dude Lake	
To depth of 600 feet below surface	3,195,000
Morrison Lake Section	
Average depth below surface for different bodies, 200 and 318 feet	4,575,000
Total for range	70,432,684

These figures are close to those obtained by the company's engineers. Their figures are actually, however, a little lower because they carried the ore to the zero datum plane, which would add something to these figures in some drill sections but nothing in many others because the ore was bottomed above the upper datum plane.

This estimate does not include ore that has been found northeast of Gut lake, where drilling was completed in 1944 and where it is reported by the company that an ore body at least 1,000 feet long and from 60 to 180 feet wide has been cut on several sections in a heavily drift-covered and timbered area.

The writers are of the opinion that a considerable quantity of ore may be recovered by surface mining from the numerous bands of ore that outcrop but are not included in the calculations of tonnage. Many of them are shallow and were not cut by the drill. Further, there is unquestionably much ore below the bottom levels used in the estimate. In a number of sections the deepest holes show the ore bodies widening with depth.

The ore in the Morrison Lake section is relatively shallow and lower in grade on the average than that in the Cowie Lake section of the range. The average runs between 27.4 per cent. and 28.9 per cent. The ore body near Dude lake is remarkably uniform in thickness. It runs between 50 and 65 feet in width and dips about 83 degrees. It is also of good quality.

Mining and Concentration of the Ore

The large tonnage of ore that can be mined from open pits will supply material for the early mining operations. Most of the ore lying above Cowie lake can be worked by this method, and mining costs should be low. Later, it will be necessary to go underground. The ore can easily be carried down grade to a concentrating plant on the east shore of Cowie lake. A branch railway will have to be constructed from the plant to the main line of the Algoma Central Railway, which lies about 11 miles in a straight line to the west near mile 60. The terrain is, however, very hilly, and it will be necessary to follow valleys between the hills, coming out to the main line somewhere in the vicinity of mile 64. This will increase the length of the branch line to about 15 miles. An alternative route for the branch might be found to the southwest, reaching the main line near Searchmont, which is much nearer the Sault. Such a branch would be much longer.

The Goulais ore can be concentrated by magnetic methods. More than thirty years ago, tests were made on a 15-ton sample in the Department of Mines Laboratory at Ottawa[1] and described in the senior author's report[2] on the Goulais River range. In those tests, it was found necessary to grind the ore to 200 mesh, a costly operation. Concentrating methods have been greatly improved in recent years because the growing demand for high-grade iron ore has made it necessary to look more seriously to the beneficiating of low-grade ores as a means of meeting the demand. It has been found that the fine grinding of all the ore, which has been one of the drawbacks to its utilization, can be avoided, with considerable saving in cost of concentration.

A quantity of ore from lands of Algoma Ore Properties has been tested in the laboratory at the University of Minnesota and the experimental plant of the Bethlehem Steel Corporation. From the results of these tests George W. MacLeod reports that the process of concentration outlined below can be expected to give the results indicated.

The raw ore will average 29 per cent. total iron and 26 per cent. magnetic iron as a minimum. Primary crushing will break the ore to 6-inch size, and magnetic cobbers will reject a considerable amount of waste rock. The material from the cobbers will be crushed to three-eighths of an inch, and about 20 per cent. by weight of the material will be discarded, thus raising the iron content to 36 or 37 per cent. A third crushing to 16 mesh will eliminate 20 per cent. by weight of the material and increase the iron to about 45 per cent. The remaining 60 per cent. will be completely ground to minus 100 mesh, and another 20 per cent. of the silica will be rejected in the magnetic separator. This should give a final concentrate running as follows:—

	Per cent.
Fe	64–65
SiO_2	10–11
P	0.023
S	0.03

[1]Report by George C. Mackenzie, Sum. Rept., Mines Branch, Can. Dept. Mines, 1911, pp. 71-75.

[2]E. S. Moore, op. cit., p. 22.

It has been found that nearly all the magnetic iron is recovered, and any loss during concentration is practically balanced by the recovery of some of the iron in non-magnetic minerals.

This method, if it is found satisfactory for large-scale production, will avoid much of the fine grinding that was done in the older experiments and will reduce costs.

The concentrates will require treatment to agglomerate them before they are in a suitable condition for the blast furnace. Sintering has been proved to be quite satisfactory and will probably be adopted. A new method, which might be called "pelletizing" or "balling," has recently been suggested and is in an experimental stage. In this method the fines are fed into a rotating mill, like a ball mill without the balls, along with a fixed proportion of moisture. The mill is closed, heated, and rotated, and according to reports the iron concentrate forms round red pellets an inch or more in diameter. The properties of these balls are such that they make a good furnace charge. If this method of agglomeration of concentrates proves satisfactory, it should be cheaper than sintering.

CHAPTER III

THE JOSEPHINE-BARTLETT IRON RANGE

Introduction

The area covered by the Josephine-Bartlett iron range has been previously described as the Josephine mine and the Bartlett iron range.[1] As the range is continuous, except for two small breaks under Parks lake, which are believed to be due to faulting, the Josephine-Bartlett range seems to be an appropriate name. It comprises the eastern 3¼ miles of what was originally a continuous range 6½ miles long, now broken up by transverse faults into three segments: the Josephine-Bartlett, Ruth (Long Lake), and Lucy (Brooks Lake) ranges (see Fig. 8 facing page 38). The iron formation in the Josephine-Bartlett differs from that of the other ranges mentioned and the Helen, in that the ore body on the Josephine property consists of hematite, whereas the ore on all the other properties is siderite with varying proportions of pyrite.

History of the Josephine and Bartlett Properties

In 1899, Alois Goetz discovered iron oxide near Parks lake, on which the Josephine mine is located, and staked a number of claims. A dispute arose concerning the ownership of the property because the lands covered by the claims had been included in a concession to the E. V. Clergue interests. Goetz and his associates claimed the property by virtue of original discovery, and the Algoma Central and Hudson Bay Railway company claimed it under a grant made by the Legislative Assembly of Ontario. While ownership of the lands was still in dispute, H. A. Wiley, of Port Arthur, obtained an option from Goetz and drilled three short holes, two of them very shallow, from Jasper island in Parks lake. They cut little or nothing but banded silica. Between 1900 and 1906, the Clergue interests launched a campaign of drilling and shaft-sinking. A railway spur was built from Josephine Junction to the location of the present mine. Twenty-one holes were drilled, which showed considerable amounts of hematite, and two shafts were sunk (see map No. 1946-8). One of these shafts, 150 feet deep, is located on the south side of Parks lake, and the other, 50 feet deep, at the east end of the lake. No ore was raised because of the uncertainty about the ownership of the property.[2]

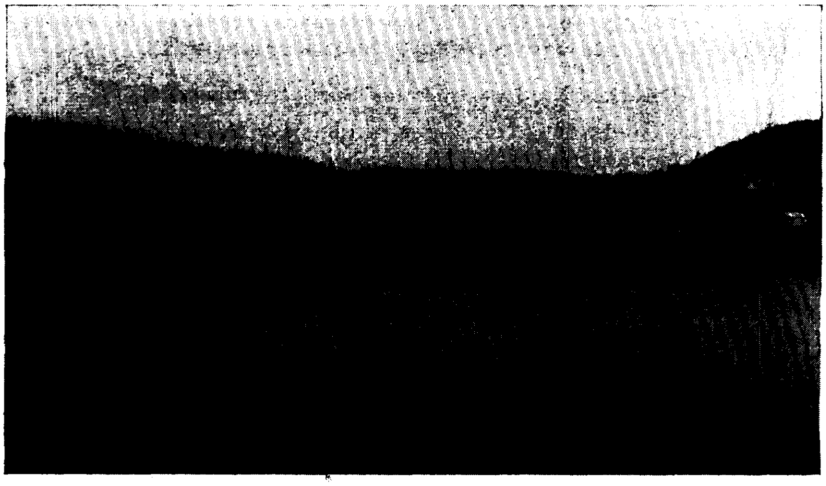
In 1906, Hon. Frank Cochrane, then Minister of Mines for Ontario, took action to settle the matter of ownership and recognized Goetz's claim by right of discovery, with the proviso that as the opposing claimants had spent so much money in development work, they should have the right of purchase at a reasonable figure. This was fixed at $50,000 for 10 claims. It was further ruled that if an agreement to purchase was not reached within thirty days, Goetz should have his choice of 5 of the 10 claims. He selected claims Nos. 738, 739, 744, 745, and 746 (the first two on the Ruth range) and had them surveyed during the autumn as Y. 455, 454, 451, 452, and 453, respectively. The last three claims have been for a long time known as the Josephine property.

The Algoma Steel Corporation secured from Goetz a lease and option to purchase the property, and during 1913 and 1914 five more quite deep diamond-drill holes were sunk and some old holes deepened. The option was then dropped and the steel removed from the railway spur to the property.

[1]W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, pt. I, 1926, pp. 91-92, 121-123.
[2]Ibid, p. 121.

Altogether twenty-nine holes were drilled, bringing the total footage to more than 10,400 feet. Several of these holes were more than 1,000 feet in length, the deepest being 1,696 feet. The holes were distributed almost from end to end of Parks lake, and they gave a fairly comprehensive picture of the ore situation.

No further work appears to have been done on the property until early in 1941, when the Frobisher Exploration Company, Limited, optioned it from Alois Goetz and his associates, along with the Ruth and Lucy properties. In May of that year diamond-drilling was started under the direction of Sherritt Gordon Mines, Limited, to check the records of previous drilling. Six holes were drilled (see map No. 1946-8), for a total footage of 6,500 feet, from Greenstone island in Parks lake, five of which cut the ore zone. Two holes were drilled from Schist island and one from the south side of Parks lake near the east end.



View of Parks lake after it was dewatered. The shaft of the Josephine mine is seen on the hill at the right.

On the strength of the drilling results, further operations seemed justified, and Michipicoten Iron Mines, Limited, was organized in October, 1941, to control these properties. This company is a subsidiary of Sherritt Gordon Mines, Limited, the staff of which directs the operations. Construction work was started on camps that fall, and power was brought in from the Great Lakes Power Company's line at Hawk Junction. In February, 1942, a 3-compartment shaft, each compartment 5 by 5½ feet, was started, and in September it had been completed to a depth of 1,055 feet. Stations were cut at 265, 415, 565, 715, 865, and 1,055 feet. During shaft-sinking operations lateral diamond-drill holes were bored to gain additional information regarding the ore.

In the mean time, permission to pump out Parks lake, which had a maximum depth of 70 feet, was secured from the Ontario Mining Court because it was found from the drilling that there was direct connection between the lake water and that encountered in drilling at considerable depth. The operation was started in March, 1942, with four pumps having a combined capacity of 6,000 Imperial gallons per minute. By the end of October, the lake was dewatered except for water in some local depressions and in the mud on the bottom and that slumping in from the sides. It was necessary to divert a creek entering

Parks lake at the east end by driving a tunnel from Endless lake to Cliff lake, thus by-passing Parks lake.

Michipicoten Iron Mines proceeded to secure lands in addition to claims Y. 451 to 453, which constitute the Josephine property; and 26 claims (A.C. 4,253 to 4,258, 4,262 to 4,264, 4,273 to 4,286, 4,299 to 4,301) were staked and surveyed. These border the range on the north and south.

The Algoma Steel Corporation through its wholly-owned subsidiary, Algoma Ore Properties, Limited, owns twelve claims along the range: three (A.C. 741 to 743) at the southwest end, and nine (A.C. 289 to 297) east of the Josephine property. The latter group of claims covers ground staked by James Bartlett and W. M. Goodwin for the Algoma Steel Corporation. As old trenches may still be seen along the iron formation, a considerable amount of work must have been done on the property, which has been known as the Bartlett range. In 1912, the Algoma Steel Corporation did diamond-drilling on the siderite-pyrite deposits along the south side of the banded silica in the vicinity of the small lake on claim A.C. 293, and this indicated a band of ore about 2,000 feet long (see map No. 1946-8). A further account of the results of the drilling will be found under the description of the ore deposits in the Bartlett section of the range.[1]

Acknowledgments

The officials of Michipicoten Iron Mines, Limited, gave very valuable assistance during the writers' work on the Josephine and Ruth properties. Maps, drilling results, and figures for ore reserves were all freely placed at their disposal, and the hospitality of their camp was enjoyed. The writers express their sincere thanks to Eldon L. Brown, general manager; W. D. Mackenzie, superintendent; A. E. Gallie, chief engineer; and W. F. Morrison, geologist.

Location

The Josephine-Bartlett range is situated in township 28, range XXV. At the east end it is cut off by granite, which extends under the sand plain near McVeigh creek, 1¾ miles above Hawk Junction on the main line of the Algoma Central and Hudson Bay Railway at 165 miles from Sault Ste. Marie. It extends westward about 3¼ miles to Josephine Junction on the Michipicoten branch of the railway, on the north side of Goetz lake, where it is terminated by a large fault. It lies from half a mile to 1 mile north of this branch of the railway throughout its length. Josephine Junction is 6 miles from Hawk Junction and 20 miles from Michipicoten Harbour on Lake Superior, the shipping point for iron ore from the Michipicoten area.

The Ruth range, another segment of the original long range, which also included the Lucy range, lies on the other side of a large fault and half a mile southeast of Josephine Junction.

The new shaft of the Josephine mine is located slightly more than a mile from Josephine, and steel has now been laid on the grade of the old spur-line from the Michipicoten branch to the mine.

Topography

Parks lake, before it was dewatered, had an altitude of 1,168 feet, and Goetz lake, into which it drained, of 1,106 feet. With this amount of fall between these lakes, it was an easy matter to dispose of the water in Parks lake. No large streams flowed into Parks lake. A rivulet enters the lake from the east at the camp, and a creek drained a chain of small lakes extending eastward from Endless

[1]Pages 57 and 58.

lake to and beyond Kimball lake. This creek, which flowed through a canyon to enter the northeast end of Parks lake, was easily diverted from Endless lake to Cliff lake by a tunnel and ditch and brought around to the outlet of Parks lake at its northwest corner. Two dams, one of concrete and the other of earth, were constructed to raise the water in Endless lake so that it flooded the valley to the east. A pipe line was then laid from the concrete dam down the bed of the creek and along the shore of Parks lake to supply water to the Josephine mine camp.

Steep cliffs rise along the northwest and southeast sides of Parks lake, and consequently there is almost no level land on which to construct a camp. The townsite had to be located on top of the hill southeast of the camp. It is reached by a road about a quarter of a mile long running up the valley to the east along the little creek coming down to Parks lake.

Most of the area surrounding the Josephine-Bartlett range has high relief. A high cliff runs along the northwest side of Cliff lake, and both sides of a deep valley extending from Parks lake eastward as far as Kimball lake are bounded by ridges. The ridge of banded silica on the south rises more than 200 feet, and the schists on the north to about 150 feet above the bottom of the depression. In the northern part of the area, the relief is much lower except near the east end, where there is a series of very high cliffs facing southward; the relief is estimated to be more than 300 feet in some sections. South of the main iron range, many high hills and southward-facing cliffs are found.

Except for a section of the range just east of Parks lake, the iron formation does not stand up above the other rocks as a prominent ridge.

Stratigraphy

All the rocks in this area, except the glacial drift and alluvium, are Precambrian in age. They are classified as follows:—

PRECAMBRIAN

KEWEENAWAN:	Olivine diabase, diabase. *Intrusive contact* Quartz diabase.
	Intrusive contact
ALGOMAN:	Carbonatized Keewatin lavas and pyroclastics. Hematite. Siderite and pyrite. Feldspar porphyry; quartz porphyry; aplite, syenite, granite, and granodiorite.
	Intrusive contact
KEEWATIN:	Clastic sediments; conglomerate, arkose, greywacke. Banded silica. Acid to intermediate volcanics; rhyolite, dacite; sericite-carbonate schist, ottrelite schist. Pyroclastics, acid to basic; agglomerate, tuff. Basic volcanics; ellipsoidal andesite and basalt; chlorite schist.

KEEWATIN

The rocks here classed as Keewatin were designated by Collins and Quirke[1] as the post-Dorean series, but the writers are of the opinion that they are more correctly placed with similar rocks known elsewhere as Keewatin. They show much variation in character. An alternate outpouring of basic and acid to intermediate lavas was accompanied by the deposition of great quantities of pyroclastics, which are mostly acid. Alternating with the igneous activity were stages when the chemically deposited banded silica was laid down and minor deposits of clastic sediments formed.

[1]W. H. Collins and T. T. Quirke, op. cit., p. 12.

Basic Volcanics

The basic volcanics, which are of the usual Keewatin type of greenstone, are composed of altered basalt and andesite. Some of the lava is distinctly ellipsoidal, and good specimens of pillows may be seen on the south side of Endless lake between the dam and tunnel, and in other places, as indicated on map No. 1946-8.

Along the southeast side of Greenstone island in Parks lake, there is a diabase intrusion, which is regarded as younger than the basic lavas but older than the Keweenawan diabase and is designated by the company's geologist as the "older diabase." It is difficult to fix its contacts in the field because it so closely resembles the greenstone. In thin sections from drill cores, however, the rock proves to be diabase, which is much altered and somewhat sheared. The ophitic texture is quite evident, although the feldspars are saussuritized. The rock contains a little epidote and much chlorite and serpentine. Little to much carbonate has been introduced in various places. The ilmenite has been changed to leucoxene, and the pyroxene has all been altered. The rock is certainly much older than Keweenawan, but whether it was introduced about the time the later basic lavas erupted or later cannot be determined. In view of the great amount of intrusive greenstone found in the Helen area, it seems possible that this old diabase might be equivalent to the gabbro-diabase-metadiorite in that area. It is considered as probably Haileyburian or early Algoman in age.

South of the iron range, the basic volcanics are for the most part changed to chlorite schist; on the north the schisting is not quite so prominent.

These rocks occupy two zones, one north of the range and the other south, and they extend far beyond the borders of the area mapped. A first glance suggests that these zones might represent the limbs of a large syncline enclosing the iron range, but the relations of the iron formation to the pyroclastics and acid lavas are not explained by this assumption, and the structure of the formations is believed to be homoclinal or at least monoclinal.

Pyroclastics

A wide band of pyroclastics interbedded with the acid and intermediate volcanics extends along the south side of the banded silica throughout most of its length. The formation ranges from tuff to agglomerate and in composition from acid to intermediate, with some bands approaching basic rock. The agglomerate is composed mainly of small fragments, mostly less than 6 inches in diameter. Acid to intermediate lava makes up most of the fragments, but granular quartz composes many of the smaller ones. The thickness of the pyroclastics varies greatly in different sections of the area, and because of folding and shearing an accurate estimate of their thickness cannot be made. They have been highly schisted in many places, and sericite schists are widely distributed. The sericite schists are often carbonatized, some of them to a high degree, and the distinction of such schists, derived from pyroclastics, from those derived from the acid volcanics is often very difficult. A wide band of sericite schist runs along the southeast shore of Parks lake in the vicinity of the mine. This rock had previously been identified as talc schist because of its smooth feel and the difficulty of distinguishing sericite from talc under the microscope. Two specimens, however, were tested by V. B. Meen in the Provincial Assayer's office and found to contain only 0.52 and 0.51 per cent. of magnesia and to be high in potash. The rock is light-grey and weathers to yellowish and brownish shades, apparently from a little iron carbonate, which has been introduced. In thin sections, it is found to consist almost entirely of sericite and quartz. Some patches of sericite suggest by their shape a derivation from fragments of feldspar.

A number of thin sections of the tuff and agglomerate were examined. Agglomerate collected from the crosscut from the shaft to the ore body on the first level in the mine showed fragments of quartz and orthoclase scattered through a fine-grained groundmass of quartz and sericite. Larger bodies of what appear to have originally been tuff are partially carbonatized and are composed mainly of sericite and very small flakes of chlorite. They contain, however, some fragments of quartz and a few of orthoclase.

Agglomerate containing many fragments of quartz, some roughly rounded, outcrops on the northwest corner of Schist island. The fragments lie in a coarse-grained tuffaceous matrix of quartz, in grains and groups of grains, and sericite. The matrix also contains patches and streaks, apparently of some rock that has been completely altered to sericite, and some very fine-grained greenish material, probably chlorite.

The specimens of tuff collected around Parks lake show certain common features. They contain many fragments of quartz and some of orthoclase in a matrix consisting mainly of sericite and very fine grained quartz. In some, small groups of grains of quartz appear in the hand specimens like "quartz eyes." Many of the thin sections contain irregular patches, which are composed mainly of sericite with a little small-flake chlorite. These appear to have been fragments of rock deposited in the tuff and later completely altered. Many of these patches contain considerable amounts of carbonate. The tuffs are generally carbonatized, one specimen to the extent of 35 per cent. of its volume. The carbonate weathers yellow or brown.

The tuff on the road along Parks lake just south of Schist island is a blue-grey rock, which weathers brown. It is fine-grained and somewhat resembles limestone. It has been sheared and slickensided and contains quartz, which appears to have been fragments of quartz recrystallized into groups of grains.

A specimen collected from the north-central part of the bottom of Parks lake near the banded sediments is a tuff approaching impure quartzite. The thin section is full of small angular grains of quartz, which are nearly uniform in size and are scattered evenly through the rock. The matrix of the groundmass consists of sericite and a very fine grained indefinite material and shows considerable replacement by siderite, which is partly weathered to brown iron oxide. The banded sediments in the vicinity are believed to represent water-laid assorted tuffaceous materials. These tuffs are similar to the tuffs on the Ruth and Helen ranges, which Coleman and Willmott named the Wawa tuffs.[1]

Acid to Intermediate Volcanics

A wide band of acid to intermediate volcanics occurs on both the north and south sides of the Josephine-Bartlett iron range. They are interbedded with and overlie the pyroclastics and the banded silica. They overlie the basic lavas in the southern part of the area and are overlain by similar basic volcanics in the northern part. They comprise lavas from rhyolite to dacite in composition, and the different types are pretty well mixed. Some of the most conspicuous areas of each type are indicated on map No. 1946-8. A typical mass of rhyolite may be seen along the south side of the iron range, west of the southwest corner of Kimball lake. Rhyolite is also exposed in the mine workings.

The acid to intermediate volcanics have been greatly sheared in many places and changed to sericite schists, many of which are highly carbonatized and difficult to distinguish from similar sericite schists formed from the acid pyro-

[1]A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines, Vol. XI, 1902, p. 156.

clastics. In the northern part of the area particularly, much of the sericite and sericite-carbonate schist weathers to a typical yellowish-brown colour.

The acid volcanics, like the pyroclastics, have been replaced by siderite-pyrite ore on the footwall side of the banded silica.

Ottrelite Schist.—Ottrelite or chloritoid schist is a common rock in this area, as it is near the Helen range. The mineral has been described by Collins and Quirke[1] from the Michipicoten and Goudreau areas and by the senior author from Goudreau.[2] It is rather surprising to find it so abundant in this region when it is infrequently seen in other parts of the Canadian shield. It may be seen in quartz porphyry, tuff, and sericite schists derived from these rocks and acid volcanics, and it may be so abundant as to make up as much as 15 or 20 per cent. of the

Photomicrograph of ottrelite schist, Josephine-Bartlett range. (× 15.) Note the lack of orientation of the crystals.

rock. It is bluish-green to dark-green, some of it appearing almost black in the hand specimen, and it is pale bluish-green in thin section. Pleochroism is distinct and as follows: A = green, B = bluish-green to light-blue, and C = yellowish-green to greenish-yellow. The index of refraction for B, as determined by Eugene Poitevin of the Geological Survey,[3] is only 1.708 ± 0.005, but he regarded this mineral as a variety of ottrelite, although the index of refraction for B in chloritoid or ottrelite is normally 1.75 or higher. Some crystals are polysynthetically twinned normal to the C axis. Extinction varies from parallel to more than 15 degrees. The crystals are usually frayed on one side, and some of them are sieve-like. There is usually a distinct fracture normal to the longer dimension of the crystal. The crystals occur singly and in sheaf-like bundles and rosettes (see photomicrograph above).

Collins and Quirke favoured a pyrogenetic origin for this mineral, but the senior author of this report favours a secondary origin for the ottrelite of Goud-

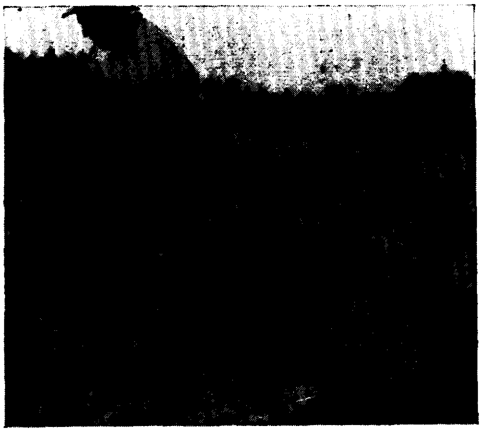
[1]W. H. Collins and T. T. Quirke, op. cit., pp. 29-30.
[2]E. S. Moore, "Goudreau and Michipicoten Gold Areas, District of Algoma," Ont. Dept. Mines, Vol. XL, 1931, pt. 4, pp. 5-6.
[3]W. H. Collins and T. T. Quirke, op. cit., p. 30.

reau.[1] The secondary nature of the mineral is also apparent in thin sections of rocks from the Helen and Josephine-Bartlett range made for the present authors. The crystals have no regular orientation in the schists, which indicates that they developed after the main shearing had ceased. They are arranged like other minerals developed under mass-static metamorphic conditions.

Much ottrelite schist was found in the band of acid volcanics extending across the southern part of the area, and a small amount of the mineral was seen in some thin sections from the dikes that cut the bed of Parks lake.

Banded Silica

The banded silica member of the iron formation outcrops almost continuously for 3¼ miles through the central part of the area. The rock is regarded as a chemical precipitate, as described on pages 3 to 6. It stands practically on edge, and the dip in most places varies little to the north or south from vertical. It is only about 80 feet thick at the east end of the group of claims staked on the range.



Banded silica boulders on the bottom of Parks lake.

It widens to 520 feet in the central part of the area near Kimball lake, and the outcrop expands in claim Y. 453 to a width of 700 feet. Part of this great increase in thickness may be due to duplication by local folding and flattening of dip. In the bottom of Parks lake, the formation disappears in two places, apparently because of faulting, and the maximum thickness of the rock exposed on Jasper island is about 300 feet. Southwest of the lake, the width increases again; and at the large fault that separates this range from the Ruth, the width of the outcrop is 400 feet. This rock forms a very prominent ridge just east of the northeast end of Parks lake, but it gradually sinks to the east and in many places in the eastern part of the area it has little relief. Between the southwest end of Parks lake and the fault, the banded silica stands up in a ridge of only medium height.

The silica member is a finely to coarsely banded, fine to rather coarse grained rock (see photograph above). It ranges in colour from pure white to brown and yellow where impregnated with pyrite and siderite, which are weathered near the surface. On the bottom of Parks lake, the silica is greatly brecciated in many places, and at some points a large amount of quartz has been introduced. This may be well observed on Jasper island. Incidentally, the name of this island

[1] E. S. Moore, op. cit., p. 6.

was not well chosen because there is little real jasper on it or, for that matter, in the silica member anywhere else.

The banded silica member has played an important part in the deposition of the ore in this range, as it has in the Ruth, Lucy, and Helen ranges. It differs greatly from the Goulais River banded silica because here little iron was deposited with the silica, whereas in the Goulais River range the iron and silica were deposited at the same time and together they constitute the ore. The part played is mainly a structural one. The siderite-pyrite deposits in the Bartlett section and the hematite in the Josephine section of the range all occur close to the south or footwall side of the banded silica or in it near the bottom. The ascending hot waters, which deposited all the ore, followed up the contact between the silica member and the pyroclastics or the acid volcanics; this was a favourable zone for migration, especially where the brittle silica was brecciated. The ore minerals in this range are distinctly later than the banded silica.

In addition to the main band of silica, a small band lies 1,600 feet south of Kimball lake in the acid volcanics. It has a length of 1,800 feet and a maximum width of 60 feet and is cut by a mass of porphyry at the west end. It consists of banded white silica with greyish carbonate and disseminated pyrite. This band seems to line up fairly well with the smaller one on the road to the townsite.

About 200 feet south of this band of silica, a shorter, wider body 600 feet long and as much as 160 feet wide, lies on the west side of the adjacent lake and extends out on a point in the lake. These bands of iron formation are not of economic importance.

Clastic Sediments

Several bands of clastic sediments occur in the Josephine-Bartlett area. These were correlated by Coleman and Willmott with the Eleanor slate.[1] One runs for 4,800 feet along the northwest shore of Parks lake and has a maximum width of 380 feet at the northwest corner of the lake. It is displaced by the faults under the eastern part of the lake. An extension of this sedimentary zone, however, occurs beyond the fault and extends to Endless lake. In all probability these sediments are connected with those north of Kimball lake, but the water and drift-covered areas between them make it difficult to follow the formation throughout. Another lies just northwest of the lake, near its northeast end; it is at least 1,200 feet long and 80 feet wide. A third occurs in the north-central part of the area, north of Kimball lake, and has a length of 4,500 feet and a maximum width of 240 feet. The first band is mainly arkose with some impure quartzite and a little greywacke. Thin bands and patches of conglomerate containing quartz pebbles with a maximum diameter of about 2 inches outcrop on the bottom of Parks lake just southeast of Greenstone island. The conglomerate here, as in some other places in the Michipicoten area, grades into the pyroclastics, and it is often difficult to know where one rock begins and the other ends. A band of such rock runs from the southwest corner of claim Y. 451 along the north side of the thin zone of banded silica northwest of the townsite road. It contains a number of pebbles of cherty silica from the iron formation. Some of these are partially rounded and others quite angular. Other pebbles consist of rhyolite, greenstone, and other local rocks.

The second band mentioned consists of a fine-grained, almost slaty, and somewhat laminated greywacke. It is so fine grained and dark in colour that, except for some flakes of sericite, the individual minerals composing it cannot be distinguished in thin section. It contains veinlets and small lenses of very fine grained quartz accompanied by a little muscovite and siderite.

[1]A. P. Coleman and A. B. Willmott, op. cit., p. 158.

The arkoses are light-coloured, granular, and in places laminated rocks. They are composed, as revealed by thin sections, of angular fragments of quartz, orthoclase, and plagioclase of sodic type scattered indiscriminately through a matrix of sericite and fine-grained quartz. Most of the thin sections show a little iron carbonate and grains of pyrite. In one section made from a specimen collected on the bottom of Parks lake, about 200 feet from the southeast side of Greenstone island, the arkose is highly altered. Numerous large and small angular fragments of quartz occur all through a matrix that contains also irregular bodies which may have been feldspar but which are now altered to a dirty-grey clay. There is much sericite and chlorite with flakes of muscovite. The chlorite indicates that some ferromagnesian material was deposited with the other constituents.

These bands of sediment are regarded as representing deposits, mainly of poorly sorted and little weathered pyroclastic materials, which were laid down in local basins of water in a volcanic region between eruptions. They were buried by lava flows and pyroclastics and incorporated in the volcanic series.

ALGOMAN

The Algoman system is represented in the Josephine-Bartlett area by dikes and other small intrusions and by the large mass of granite and granodiorite that cuts off the iron formation at the east end, as well as by the siderite, pyrite, and hematite deposits.

The smaller intrusions present quite a variety of rocks: feldspar and quartz porphyry, granite porphyry, syenite, dioritic types, and aplite. These intrusions seem to be located mainly on the south side of the iron range and in the bottom of Parks lake near the hematite deposits. It is probable that the drilling of the siderite-pyrite deposits in the Bartlett section of the range might bring to light many more dikes that have not been seen at the surface, as it did on the Ruth range. Many of those located under Parks lake would never have been found had the lake not been pumped out or drilling and mining operations carried on.

The two largest intrusions of Algoman rocks, except for the granite and granodiorite at the east end of the range, are porphyries. The larger one cuts across claim A.C. 4,280 and extends into the adjacent claims. It is 1,700 feet long and has a maximum width of 200 feet. The rock is pink in colour and medium-grained and has small dark crystals and phenocrysts of orthoclase and microcline. Thin sections show only a little sodic plagioclase, but many euhedral crystals of orthoclase and microcline occur in a fine-grained groundmass consisting of quartz, feldspar, and muscovite with a little chlorite, small crystals of titanite, and grains of introduced carbonate. The rock is a typical feldspar porphyry.

The other intrusion, on the shore of Summit lake, is 500 feet by 120 feet in size. It is grey in colour and of medium grain, with quartz eyes, and it is considerably altered. In thin section, large grains of quartz and feldspar, mostly orthoclase with some of albite and oligoclase, are seen. Many of the quartz and feldspar grains have been crushed. Biotite and chlorite are present, as well as several crystals of tourmaline and some pyrite, siderite, and magnetite, all of which, with the exception of the biotite and chlorite, have been introduced into the altered parts of the rock. This rock might be classed as a granite porphyry.

A narrow dike of biotite syenite crosses the south boundary of claim A.C. 4,264 at a point 500 feet east of the No. 3 post. A thin section of this rock shows that it is composed of orthoclase and microcline with some plagioclase and much brown and green biotite. Specks of magnetite occur all through the section, and there are large rhombs of siderite.

Dikes in Parks Lake

A group of peculiar dikes occur in and near the Josephine mine. It was expected that these would prove to be similar to the lamprophyres found in many other mining camps where Algoman rocks occur. When studied in thin section, however, none of them could be classed as lamprophyres; they range from practically pure quartz through aplite and quartz porphyry to feldspar porphyry. As stringers of ore cut several of these dikes and some have been slightly folded and faulted, they are probably all older than the hematite.

One peculiar dike or vein 6 inches in width was followed up a raise from the 6th to the 5th level in the mine. It was situated well out in the ore body and was penetrated by fingers of hematite, which indicates that it is older than the hematite and not readily replaced by ore. The rock is very tough and somewhat cherty in appearance and in places shows conchoidal fracture. In thin section, it was found to be composed entirely of fine-grained silica, except for a few spots of green serpentine. The origin of this rock is puzzling because it is more like a cherty vein than a dike, unless it is assumed that it represents the extreme phase in acid differentiation and is a particularly acid type of aplite. It is also difficult to account for spots of an apple-green mineral. W. F. Morrison, geologist of Michipicoten Iron Mines, had one specimen, which was regarded as rare, showing these green areas scattered all through the rock, and he stated that a chemical analysis of the mineral proved that it was serpentine. The specimens of similar dike rock that the writers were able to secure showed some of these spots, but the rock was considerably altered and it was difficult to gain much knowledge of their origin.

Several narrow dikes occur on former small islands along the northwest shore of Parks lake southwest of Greenstone island. These dikes range from 2 to 10 feet in width, and one is exposed for 1,400 feet along the strike. The rock in this dike is a rather coarse, granular, grey type, which is slightly schisted and weathers yellowish-brown. A thin section shows that it contains much orthoclase and serpentine, the latter in stringers and elongated sheets, and a little quartz in scattered grains. The groundmass of quartz and feldspar is very fine grained. Much carbonate has been introduced into the rock. Some of the serpentine must have developed from a ferromagnesian mineral because it occurs in patches that suggest the former presence of biotite or pyroxene. It is difficult to classify this rock, but feldspar porphyry is very close to it.

A short dike 4 feet wide in the same area as the one described is composed of a fine-grained grey rock, which weathers a light-brown. It is slightly schisted and full of veinlets of quartz and carbonate. The effects of shearing and fracturing are very evident in thin section, and the rock would be taken for a clastic type if it did not occur in a distinct dike. Under the microscope, countless angular grains of quartz and orthoclase with a few of albite may be seen. A few orthoclase grains are a little larger than the rest, and this gives a somewhat porphyritic appearance to the rock; but it might be classed as an aplite.

A 2-foot dike in the east central part of Parks lake is composed of a medium- to fine-grained grey rock. A thin section shows quartz grains, irregular to roughly spherical, and groups of grains also roughly spherical in shape. They are regarded as probably quartz phenocrysts that have recrystallized. Large grains of orthoclase have been crushed and partly replaced by siderite. These are believed to have been phenocrysts. There are patches and irregular bands of serpentine, and blades of muscovite cut across the serpentine and through the groundmass, which shows that it was developed at a later stage. The groundmass is very fine grained and, so far as can be determined, consists mainly of quartz. It has been partially, in a few places almost completely, replaced by carbonate.

Two other specimens of these peculiar dike rocks from the bottom of Parks lake were examined. One was taken from a boulder which Mr. Morrison, the company geologist, said was similar to the rock in a dike underground in the mine, and the other from a small, poorly exposed dike in the bottom of the lake. These rocks are grey to greenish and yellowish-green in colour and medium in grain size. They contain apple-green specks and blotches, which, according to Mr. Morrison, have been analysed and found to be serpentine. Under the microscope, they had a groundmass of quartz, sericite, and a green mica considered to be fuchsite. One specimen also contained much ottrelite with the crystals lying in all directions. Patches of serpentine were in evidence. No feldspar was recognized, but some groups of grains suggested phenocrysts of quartz recrystallized, and these dikes are therefore considered to be quartz porphyry. They are cut by veinlets of hematite.

In the construction of the new mill, another dike has recently been uncovered about 190 feet north of the shaft; it ranges from about 2 to 4 feet in width and strikes nearly northeast. It weathers yellowish-brown like some of the carbonatized mica diorites at the Helen mine. The unweathered rock shows green patches like some of those in the dikes under Parks lake. A thin section reveals these as green mica, fuchsite or mariposite, in irregular lens-like patches and streaks. Quartz occurs with the mica, and these bodies are in a fine-grained, dark-grey groundmass composed mainly of ferruginous carbonate. It is impossible to classify the original rock because of this excessive replacement.

Hematite, Siderite, and Pyrite Deposits

The hematite, siderite, and pyrite deposits will be fully described under Economic Geology. They are mentioned here to show that they are regarded as having originated in the Algoman period from hot solutions ascending from a deep-seated magma. In addition to the ore deposits there are many zones of carbonatized sericite schists, and some of tuffs, and acid and basic volcanics, as shown on map No. 1946-8.

KEWEENAWAN

The Keweenawan system in the Josephine-Bartlett area is represented by a series of diabase dikes very similar to those found almost everywhere in the district of Algoma. This area differs from the Goulais River and Ruth areas, however, in lacking the porphyritic diabase. An older quartz diabase and a younger diabase with or without olivine similar to those described in the Goulais River range[1] occur. The dikes range in width from 20 to 140 feet, and the longest are several miles in length.

The large dike along the great fault that shifted the range at the southwest end is quartz diabase and so are many of the other dikes in the area that were examined in thin section. These have all been shown on map No. 1946-8 as belonging to the older set of dikes. As the dikes of olivine, normal diabase, and quartz diabase in this area were more difficult to distinguish from one another than in many other areas and as some that appeared to be of the olivine variety in the field proved in thin section to contain quartz and no olivine, all those that have not been identified in thin section have been mapped in one colour. Some of the dikes classified on the map as belonging to the younger group will undoubtedly prove to be quartz diabase. These dikes are, however, all later than

[1]Pages 18 to 21.

the ore deposits, and they will all have the same practical importance in mining, except that in the Michipicoten area faulting accompanied the injection of many dikes of quartz diabase but not the later olivine and normal diabase.

Thin sections of the quartz diabase show that it is generally fairly fresh in appearance, some of the plagioclase being almost glassy. The plagioclase is mainly sodic labradorite with some calcic andesine. The augite is mostly fresh, and so is much of the ilmenite or titaniferous magnetite. The quartz in some specimens occurs partly in individual grains and partly in graphic or myrmekitic intergrowth with feldspar in the interstices between feldspar grains or between grains of feldspar and augite. In other specimens the quartz is all found in this graphic intergrowth, which crystallized late in the solidification of the rock.

A diabase intrusion along the southeast side of Greenstone island in Parks lake seems to be much older and much more altered than the Keweenawan diabase. It may belong to the Haileyburian; many intrusions of a gabbro-diabase-metadiorite formation, regarded as being of that age, were found in the Helen area.

PLEISTOCENE

The Josephine-Bartlett range has been glaciated. The drift-covered areas have not been delineated on the map because, on the whole, rock outcrops are numerous and time did not permit of mapping drift areas in detail. The ice moved down the depression occupied by Parks lake and deposited large boulders of hematite and brown iron ore southwest of the lake. These were recognized by prospectors searching for ore and indicated that there might be an ore body under the lake.

Most of the large cliffs in the area face south, but there are a few exceptions, especially in the northern part of the area. Examples of these are found along the north boundary of claim A.C. 4,276, near the northeast corner of the map-sheet, and on the southeast side of the east end of the lake in claims A.C. 4,274 and 4,275. The large hill of banded silica on claims Y. 452 and 453 has been rounded off and polished by the ice on the northwest side.

Structural Geology

The major structural feature of this range is a great homocline, or perhaps more properly speaking a monocline forming the southern limb of a large syncline. The rocks stand almost on edge in most places with the tops facing north and form a large arc across the area. The dip is generally between 80 and 90 degrees but is as low as 60 degrees in one place. The strike ranges from northeast at the southwest end of the range through east-west in the central part to S. 55° E. at the southeast end

Small folds occur on the major structure. A striking example may be seen on one of the former very small islands just southwest of Greenstone island in Parks lake. The banded silica here has been crumpled very little as compared with that in the Goulais River and many other iron ranges. In some places, however, it has been greatly brecciated. One of the best places at which this brecciation may be observed is on the bottom of Parks lake. The brecciation there is related to the faulting, which is believed to have been an important factor in the formation of the hematite deposits.

Faulting

The large fault running about N. 20° W. that cuts off the range at the southwest end and shifts it southeastward for half a mile to the Ruth property is the largest in the area. It is followed almost throughout its length by a large quartz diabase dike, which in some places is nearly a hundred feet in width. No faulting was detected in connection with the other diabase dikes.

On claim A.C. 291, a north-south fault offsets the iron formation 400 feet horizontally, and it is believed that another fault runs under the upper end of Cliff lake and across to Endless lake. There are two reasons for placing a fault in this locality. One is based on topographical features and the other on the abrupt ending of the diabase dike that is crossed by the west boundary of claim A.C. 4,256. The northwest shore of Cliff lake near its northeast end is a steep cliff of schist, and between this lake and Endless lake the land is low and drift-covered. The diabase dike ends abruptly in a steep cliff rising from this low land. No trace of it could be found to the southwest along the strike, and it is believed to have been offset towards Cliff lake on the south side of the fault.

Scarp of the Morrison fault, Parks lake. Gouge lies along the foot of the scarp, which is composed of squeezed conglomerate.

The structure in the bottom of Parks lake is not entirely clear. The two breaks in the banded silica formation under Parks lake are interpreted by the writers as due to a nearly vertical, curving fault, which cuts this rock near the ends of the lake, as shown on map No. 1946-8. Such a fault, it is believed, would account for the gaps in the iron formation, the presence of the hematite deposits, the extensive brecciation of the silica, and the injection of much quartz in this locality. It would also help to explain some topographical features, such as the deep valley running eastward from the northeast end of Parks lake. Contemporary subsidiary fracturing would also help to account for certain bands of hematite, which were found by drilling to be parallel to the main ore body in the banded silica. This would be a strike fault for part of its course and an oblique fault in other parts.

It is assumed that this large fault and its subsidiary faults were pre-ore in age and that they were a controlling factor in the formation of hematite deposits in this locality. Post-ore movement along the same zone seems to be the best explanation for the large amount of soft, even muddy ore in the main ore body.

In addition to the pre-ore faults, there are several post-ore faults somewhat similar to those cutting the Helen ore. Most of these are roughly transverse to the strike of the ore bodies and they may be related to the other faults with which Keweenawan diabase dikes are associated in the Michipicoten area.

One of these faults may be plainly seen at the southwest end of Jasper island. Another, which is known at the mine as the Morrison fault, after W. F. Morrison, who first recognized it and worked out its course, cuts off the ore at the east end. This fault may be seen on the surface in the bottom of the northeastern part of Parks lake (see photograph on page 50). The fracture and slickensiding are distinct in that locality, but the horizontal offset in the formations is not very great. Similar sediments occur on both sides of the fault. It strikes at N. 5° W., and its dip is between 85° W. and vertical. There is a band of gouge along the fracture, and although there are no distinct striations on the face the movement appears to have been mainly almost vertical. The ore body ends at this fault, and it is hoped that it may be picked up to the east of it. So far, however, drilling has located only thin zones of hematite; but it has disclosed considerable quantities of pyrite on the east side. As the fault does not appear to be of such magnitude as to have displaced the ore for so great a vertical distance as would be necessary to account for its absence on the east side, it may be that it had nothing to do with the termination of the ore body.

Another fault, nearly parallel to the one described, has also been located by Mr. Morrison and recently studied in some detail by the senior author. Its scarp may be readily seen in the high cliff just south of the company's store, which was formerly the office and staff-house. A pit has been dug in the narrow banded silica member at the foot of the cliff, which is a very prominent topographical feature in the wooded hill to the south. The banded silica has been offset to the south about 75 feet on the west side of the fault. The course of the fault can be followed along a depression running up the hill near the shaft, and it passes under the pilot mill, which now forms the eastern part of the new mill. At this point there is some change in the strike of the rocks on the opposite sides of the fault, and those on the east side are darker, more chloritic, and less sericitic than those on the west side. The east side ofthe fault is marked by the remnant of the scarp in a steep section of the shore of Parks lake. The position of the fault is then lost in the bottom of the lake, but beyond the lake it lies in the sharp-walled canyon through which the creek formerly flowed from Endless lake to Parks lake. In this canyon there is evidence of horizontal displacement of the formations of as much as 60 feet.

There appears to be another fault, probably a branch of the large fault in the ore zone, running up a depression from Parks lake to the earth dam on Endless lake. Sediments and basic lavas are brought into juxtaposition along this depression.

It is believed that a fault runs up the little creek that enters Parks lake near the store at the foot of the hill. It would run under Parks lake and join the fault along the ore zone near Jasper island. There is not enough evidence to prove the existence of such a fault because along the creek it would have a course nearly parallel to the strike of the formations and it would be difficult to secure definite evidence of displacement even if it had occurred.

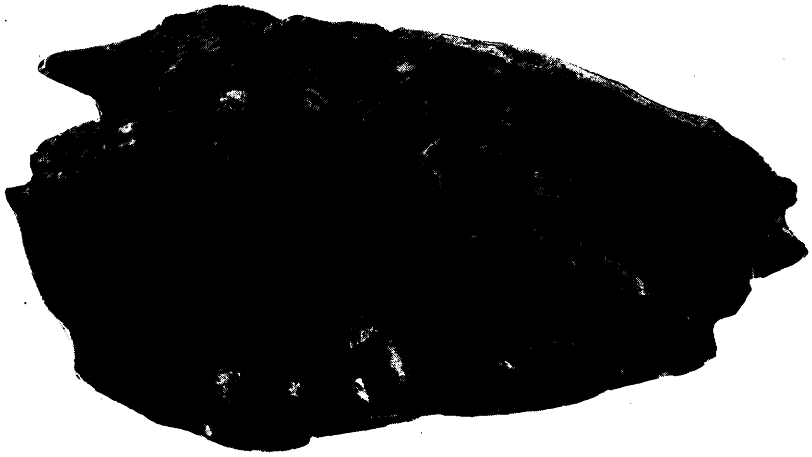
Economic Geology

Deposits of economic importance in the Josephine-Bartlett area consist of hematite, siderite, and pyrite. Some claims have been staked for gold near the granite to the east of the iron range. No deposits that could be mined for pyrite only are to be found in the area mapped, but the Holdsworth pyrite deposit is located on the railway a short distance south of the east end of the range.

HEMATITE DEPOSITS

The Josephine ore is unique in the Michipicoten area in that it is mainly hematite. The oxide ore mined from the old Helen mine was brown ore, mainly goethite, with some turgite. It was formed by the weathering of siderite and pyrite, and it was distinctly secondary ore. The Josephine oxide has also been described by previous writers[1] as brown ore, but this is not a correct classification because some of it carries more than 65 per cent. iron, and the water in some samples is less than 1 per cent. Few of them show as much as 4 per cent. ignition loss. The ore underground is mostly red not brown, and it ranges from dull red to bright red. Much of the ore is very soft and will run when wet. A zone of such ore, more than 25 feet in width, was seen on the 6th level; it is high grade, some of it containing as much as 67 per cent. iron.

That the Josephine hematite was unlike the oxide ore at the Helen mine and was a true hydrothermal deposit was early recognized by the geologist and the engineers of Sherritt Gordon Mines, Limited.[2] Whereas the brown ore at the



Specimen from Parks lake of brecciated agglomerate with cherty fragments surrounded and matrix replaced by red hematite.

Helen resulted from the weathering of siderite and pyrite, the Josephine hematite was introduced by hot solutions rising along the footwall of the banded silica member of the iron formation.

A concealed Algoman magma is believed to have been the source of the solutions depositing the hematite. Just why solutions from this magma should have deposited hematite at the Josephine and pyrite and siderite in so many other ranges in the Michipicoten area is not quite clear. It might be assumed that the hematite is a replacement of carbonate previously deposited in the ore zone and almost completely displaced, but there seems to be little evidence favouring such an assumption. Relatively little pyrite and siderite occur under Parks lake, and it seems unlikely that these would have been so completely replaced by hematite; nothing similar has happened in other parts of this range or in the other ranges.

There is much evidence of faulting under Parks lake, as well as extensive brecciation of the banded silica and pyroclastics (see photograph above), and

[1] W. H. Collins and T. T. Quirke, op. cit., pp. 121-123.

[2] E. L. Brown and W. F. Morrison, "Geology of the Josephine Mine—Hydrothermal Origin of the Hematite," Can. Min. Jour., Jan., 1942, pp. 5-9.

much quartz has been introduced into the ore zone. Such evidence of faulting along a whole ore zone has not been found in the carbonate deposits, although some brecciation of the banded silica has been observed in many places. It is believed that the faulting and accompanying extensive brecciation have been an important factor in conditioning the rock formations for the deposition of the hematite and in controlling its location and that the opening of fractures affected the stability relations between the oxide and carbonate of iron when the ore-depositing solutions were at high temperature, the main factor being a sudden lowering of pressure on the solutions.

The hematite has veined the banded silica and pyroclastics and replaced them to some extent, whereas in the formation of the carbonate deposits the replacement of acid lavas and pyroclastics has been the most important feature in their development. Although the hematite deposits grade into banded silica, pyroclastics, and lavas, they are more distinctly tabular in form than the carbonate deposits. They have the appearance of vein-like bodies that have been formed along fractures and contacts. They range from a foot to 80 feet in thickness.

Some manganese in the form of manganite ($Mn_2O_3 . H_2O$) and a little rhodochrosite ($MnCO_3$) were found in drill cores near the east end of the ore body, although this metal is generally very low in the hematite. A number of specimens were assayed and yielded from 1.5 to 25.5 per cent. manganese. The quantity so far found is not of commercial importance.

The Josephine hematite deposits are unique in size among the known bodies of this type in Canada, but small hydrothermal deposits of vein type have been found in several places in a zone north of Lake Huron. These occur in quartzite and other rocks along fractures, but they are small. The large deposits under Steeprock lake differ from the deposits at the Josephine in that they are associated with limestone. Hydrothermal deposits of hematite have, however, been mined in the United States and other countries.

OPERATIONS AT THE JOSEPHINE MINE

The early history of the Josephine property has already been outlined on pages 37 to 39. Crosscutting and drifting have been carried on since the completion of the shaft, as well as construction of camp buildings. There was formerly a spur from Josephine Junction almost to the position of the present mine, but the steel was removed many years ago. It was relaid on the old grade during the summer of 1945.

The shaft is located on a high hill on the southeast side of Parks lake. Short crosscuts have been driven from the shaft towards the main ore body on the 1st and 3rd levels, and from their faces holes drilled through the ore body. On the 5th and 6th levels, crosscuts about 450 feet long have been driven to the ore and drifts driven in the footwall of the deposit (see Fig. 9).

Mining will be done mainly in unfilled stopes, but some shrinkage stoping may be adopted. The handling of the soft hematite will present some special problems.

The main ore body above the 6th level is vertical, but below this level drilling indicates that it dips steeply toward the shaft (see Fig. 10). Its maximum thickness is 80 feet, and it maintains a thickness of about 60 feet for much of its length. It lies along the footwall of the banded silica, and part of the ore is high in silica. Two grades of ore can be recognized, high-grade lump ore containing more than 60 per cent. iron and low sulphur and silica, and lower-grade ore much higher in silica. The problem was presented of whether an attempt should be made to mine separately about 20 to 25 per cent. of the ore as high-grade

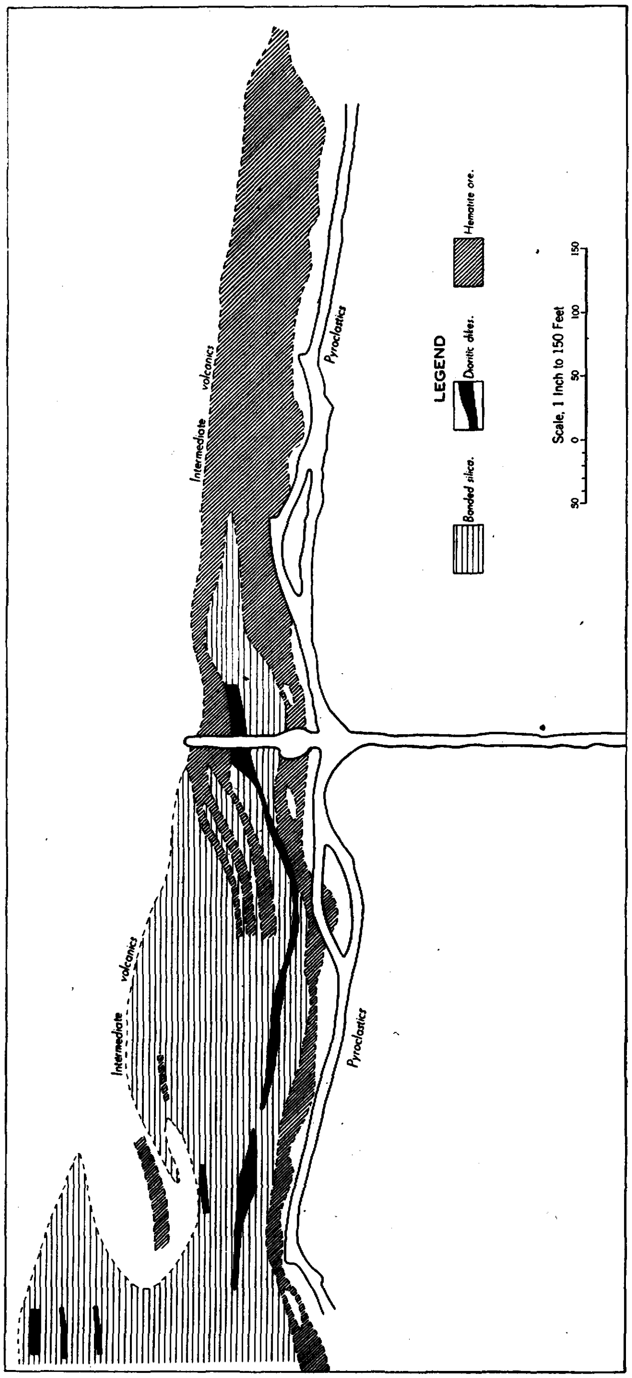


Fig. 9—Plan of the 6th level, Josephine mine. (Geology after W. F. Morrison.)

lump for a premium in price or to mine high- and low-grade together, wash all of it, and produce a product of medium grade.

A mill is now nearing completion,[1] through which all ore will pass. An underground crusher, stationed between the 6th and 7th levels, which was installed during the summer of 1943, breaks the ore to minus 6 inches. It is hoisted to a 500-ton bin and from it conveyed to No. 1 screen, which separates plus 6-inch and minus 2-inch fragments. The minus 6-inch plus 2-inch material is

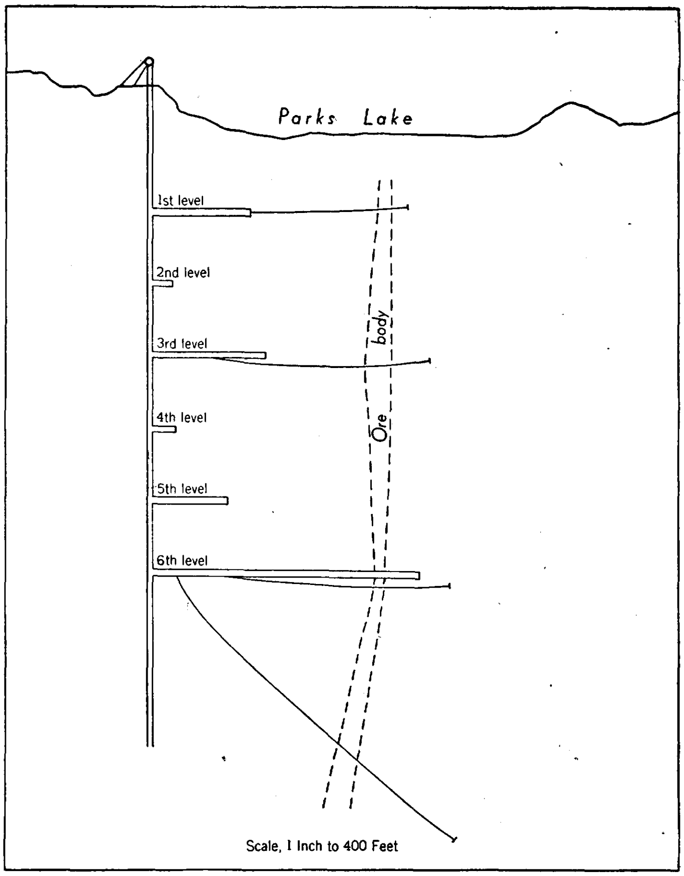


Fig. 10—Section through the shaft and ore body, Josephine mine, showing six levels and some diamond-drill holes from the underground workings. (After E. L. Brown.)

washed and passed to the Hames separator, a machine designed by Charles Hames, metallurgist of the company. This is a sink-float apparatus using water and high-grade hematite sinter, with an iron content near 67 per cent., as a medium. The sinter is crushed to ½-inch size and then ground. After being used, it is pumped back to a classifier and thickened before being sent back to the separator.

The product from the Hames separator is passed over a screen, where it is washed again, and the washings are returned to the circuit. The lump ore goes

[1]The mill was completed and production started in October, 1945. All operations ceased in October, 1946, because of caving in the mine.

to a picking-belt, where the larger fragments containing much sulphide are removed. The remainder goes on to railway cars for shipment as lump ore, and it is expected to constitute 20 to 25 per cent. of the ore mined. It runs about 61 per cent. iron.

Minus 2-inch and plus 6-inch ore, together with material taken from the picking-belt, is conveyed to a 4-foot Symons crusher and reduced to minus 2-inch size. It then goes to a short head crusher, which reduces it to between ½- and ¾-inch size. This product along with tailings from the Hames separator and the product from an Akins classifier pass over a screen that takes off plus ½-inch material. The remainder goes to a 500-ton bin, from which it is fed out on to two strings of 3-cell Wood jigs, which produce three fractions: concentrate, tailings, and a hutch. The hutch is a fine concentrate, which is added to the coarser fraction. The tailings go into the Parks lake basin. The concentrate after being dewatered in a Dorr classifier contains about 60 per cent. iron, 10 per cent. silica, and 1.5 to 2 per cent. sulphur; it will be shipped to Sinterville near Wawa, where it will be sintered in the plant of Algoma Ore Properties.

The mill capacity will be about 1,200 tons of lump and concentrate a day. An agreement was made in 1945 with the Algoma Steel Corporation to purchase the ore from the Josephine.

Ore Reserves

The manager of the company reported, as of January 20, 1943, that the reserves blocked out amounted to 1,271,200 long tons with the following average composition:—

	Per cent.
Fe	51.37
SiO_2	21.19
S	1.507

This ore varied in composition for different levels as follows:—

	Per cent.
Fe	50.71 –57.17
SiO_2	13.70 –21.96
S	.197– 1.760

The above figures for ore reserves were calculated on the drilling and underground work from the 1st level to a depth of 850 feet. By September 1, 1943, the reserves had been increased to 2,134,000 tons. This does not take into account subsidiary bands of ore that have been cut by the drill at various places beneath Parks lake almost to its southwest end. By August, 1945, the reserves had been increased to 3,840,000 tons with the following composition:—

	Per cent.
Fe	51.99
SiO_2	14.99
S	2.119

Treatment of the Ore

A pilot mill was constructed at the mine, and tests were run on the ore. It was found that a satisfactory concentrate could be made by simple jigging. Some of the results obtained are indicated by the following results of two tests:—

Mill feed	Concentrate		Tails	Recovery	Ratio of concentration
Fe	Fe	SiO_2	Fe		
per cent.	per cent.	per cent.	per cent.	per cent.	
46.6	60.2	9.3	27.75	79.6	1.57 to 1
48.9	59.7	9.9	27.2	81.2	1.51 to 1

The company reports that samples of the hematite concentrate from the pilot mill were sent to the experimental plant of the Sintering Corporation of America at Netcong, N.J., and that the analyses of the sinters obtained were as follows:—

Feed	Coarse hematite concentrate	—6 mesh hematite concentrate	Soft ore from hanging-wall ore body, 6th level crosscut
	per cent.	per cent.	per cent.
Fe	64.76	64.28	67.17
SiO_2	6.79	7.35	2.88
S	.010	.014	.012
P	.027	.026	.027
As	.003	nil	nil
Mn	.12	.10	.51
CaO	.06	.08	.04
MgO	.15	.05	.07
Al_2O_3	1.67	1.88	1.66

SIDERITE-PYRITE DEPOSITS

Several bodies of siderite with varying proportions of pyrite are exposed along the south side of the banded silica member of the iron formation in the Bartlett section between the Josephine mine and the east end of the range. Another body has recently been found by drilling on the claims of Algoma Ore Properties, between the Josephine mine and the diabase dike to the west. These deposits are indicated on map No. 1946-8. They are all in contact with the banded silica except two that are situated in claim Y. 453. These are small bodies as far as can be learned from surface indications, and one of them is right out in the tuff and the other at its contact with the acid volcanics. It is very difficult, in many places, to obtain a definite idea of the size of these ore bodies because of the weathering of the outcrops and the debris on the hillsides. A number of trenches have been dug across the ore bodies, but they are all nearly filled in. It is believed, however, that drilling would probably disclose several millions of tons of, for the most part, high-sulphur siderite.

One of these bodies has been drilled by the Algoma Steel Corporation, and it is estimated that it contains 5,000,000 tons, mainly high-sulphur siderite. This body extends along the north side of a pond, and across claims A.C. 293 and 294, along the south contact of the banded silica with the acid volcanics. Collins and Quirke[1] have described this drilling and its results. The band is 2,000 feet long. Hole No. 1 was located at the northeast corner of the pond at a point 90 feet south of the banded silica. It was drilled towards the iron formation at an angle of 55 degrees. No. 2 hole was started on the south side of the pond at 350 feet south of the banded silica and was drilled at an inclination of 50 degrees. The third hole is situated east of the pond and 440 feet south of the iron formation. It had an inclination of 53 degrees toward the formation. The writers located two of these holes but, owing to the growth of vegetation since the work was done, the third was not found. According to Collins and Quirke, all three holes passed through lava and then cut a band of siderite from 42 to 64 feet in true width, and analyses of 10-foot samples indicated that the ore was similar to the Helen siderite. Beyond the siderite, the drills cut leaner pyritic siderite from 24 to 200 feet in thickness. Analyses of 10-foot samples of this material showed 7.17 to 36.06 per cent. of sulphur.

A small body of siderite of fair grade was seen on the west side of Siderite lake on claim A.C. 4,285. Unless it should prove much larger underground than it is at the surface it cannot be regarded as of commercial importance.

[1]W. H. Collins and T. T. Quirke, op. cit., p. 92.

A large body of carbonatized pyroclastics runs along the face of the hill fronting Parks lake on the south side. It is approximately 2,500 feet long and as much as 200 feet in width. It is well exposed just southwest of the mine camp on the road from the railway to the mine. It does not approach ore in composition, and much of the carbonate is ankerite. It weathers to a yellowish-brown colour and in some sections is cut up by small veins and stringers of quartz.

In its spatial relations to the main iron formation, this carbonatized band reminds one somewhat of the band of carbonatized greenstone that is crossed by the railway on the point in Leg lake in the Ruth area. It is, however, in a different rock formation. A thin zone of banded silica is associated with it in some places.

A zone along the footwall of the banded silica member between the Josephine property and the large fault and diabase dike that cuts off the iron formation west of the mine is drift covered. No carbonate ore body was exposed. Recent drilling by Algoma Ore Properties, which controls the claims in this part of the area, has, however, located quite a large body of siderite in this zone. Four holes cut the siderite at levels between 590 and 1,010 feet in depth. The width of the ore ranged from 30 to 130 feet. It assayed as follows:—

	Per cent.
Fe	34.14–40.19
SiO_2	5.8 –12.1
S	1.6 – 6.5
Mn	2.00

The higher assays were obtained from a section of the ore body not more than 30 feet wide that was not far from a diabase dike, which may have caused the alteration of some of the siderite to magnetite.

One lens of siderite with a maximum width of 70 feet was located in the banded silica member. An assay from it ran:—

	Per cent.
Fe	37.77
SiO_2	8.5
S	3.00
Mn	2.4

The lens apparently represents a replacement of a band of tuff in the silica member, which is analagous to the situation in the East ore body at the Helen mine.

This ore deposit is continued in the Ruth range on the west side of the large fault. It is better than average siderite for the Michipicoten area.

CHAPTER IV

THE RUTH IRON RANGE

Introduction

The Ruth iron range is a faulted segment of a long iron range that originally also included the Josephine-Bartlett and Lucy ranges (see Fig. 8 facing page 38). It lies in township 28, range XXIV, Michipicoten district, and is crossed by the Michipicoten branch of the Algoma Central Railway within a mile of Josephine Junction. It has previously been described as the Long Lake range,[1] from the name formerly applied to Cuthbertson lake. Coleman and Willmott[2] also briefly described this range at an earlier date.

History of the Ruth Property

Iron is the only mineral substance of economic interest that has so far been found on the Ruth property. It was discovered by Alois Goetz in 1899, and he and his associates retained control until recently. Many trenches were dug on the main part of the range to expose the carbonate, and an adit was driven into the hill near Leg lake. A small cavern was observed in the hillside facing Cuthbertson lake.[3]

The property seems to have remained idle for more than twenty-five years, until the Bethlehem Steel Corporation took an option in 1930 and began drilling. Eight holes were drilled, and a description of these, accompanied by a sketch map showing their location, has been given in an earlier report by the senior author.[4] Most of these holes were relatively shallow, and the deepest was 677 feet on a dip of 85 degrees. The information supplied by Mr. Goetz showed that the analyses of the ore for iron, mostly on 5-foot samples of core, ranged from 12.08 to 43.48 per cent. The following figures show the variations in percentage of the other constituents in the ore:—

	Per cent.
Mn	0.55 – 2.08
S	.31 –33.65
P	.008– .048
As	.01 – 5.18
SiO_2	2.59 –46.98
CaO	1.22 –14.83
MgO	2.81 – 5.81
Ignition loss	12.07 –34.26

The manganese was usually over 1 per cent. The arsenic exceeded 0.5 per cent. in only a few places; it occurs in arsenopyrite, which in some specimens is quite noticeable in distinct crystals. The high proportion of lime and magnesia, usually between 6 and 11 per cent., is a good feature in this ore because they aid in fluxing the charge in the blast furnace. The sulphur is high, and nearly all of it is in pyrite.

After a short drilling campaign, the Bethlehem Steel Corporation dropped its option, the reasons offered being some disappointment in the amount of ore found and the presence of arsenic.

[1] W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, 1926, pp. 89-91.

[2] A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines, Vol. XI, 1902, p. 173.

[3] Ibid, p. 173.

[4] E. S. Moore, "Goudreau and Michipicoten Gold Areas, District of Algoma," Ont. Dept. Mines, Vol. XL, 1931, pt. 4, pp. 48-50.

The Frobisher Exploration Company, Limited, took an option in 1941 on the Ruth property, which consisted of claims Y. 454 and 455, K.W. 41 and 42, and A.C. 4,287, 4,288, 4,289, 4,290, 4,302, and 4,303. An option was secured on the Josephine property at the same time, and Sherritt Gordon Mines, Limited, an associated company, started a drilling campaign on the Josephine early in 1941 and on the Ruth the following year. About 50,000 feet of drilling was done on the Ruth, and a large amount of ore was blocked out.

Acknowledgments

The writers are greatly indebted to the officials of Michipicoten Iron Mines, Limited, for their co-operation during work on this range. They freely supplied information on their drilling operations and ore reserves, and the information on these subjects contained in this report was received from them.

Topography

The altitude of Goetz lake is 1,106 feet; of Bauldry, 1,110; of Cuthbertson, 1,156; and of Leg lake, 1,208 feet. The surrounding area is quite rugged, but the relief is not as great as that of part of the Goulais River area or areas farther southeast of the Ruth, except for the iron range itself. This stands up as a high, sharp ridge between Cuthbertson and Leg lakes, the highest point being on cross-section LB (see map No. 1946-7), where the ridge stands 240 feet above Cuthbertson lake. It rises from Bauldry lake to 110 feet above it on cross-section KF and continues to rise as far as cross-section KJ, where it is 135 feet above that lake. The surface then drops in a depression but rises again rapidly, and from cross-sections KO to MF the elevation ranges from 85 to 240 feet above Cuthbertson lake, the northeast end of the property standing 150 feet above this lake. The footwall side of the range between the railway and the southwest end of Leg lake drops off very sharply, and in many places the carbonate forms the crest of the ridge along the footwall of the banded silica, with the debris of oxidized carbonate scattered down the slope. In places, there are vertical cliffs of schistose tuff and agglomerate. Near the southeast shore of Cuthbertson lake a very steep cliff of banded silica runs along the lake between cross-sections LL and LV and merges into a steep slope to the northeast.

The banded silica is the main rock forming the ridge along the range. The iron carbonate and the more massive rhyolite stand up well in some places, but where there is much pyrite in the ore it weathers down more rapidly.

Stratigraphy

The formations of the area surrounding the Ruth range are classified as follows:—

CENOZOIC

QUATERNARY:	Glacial drift (Pleistocene) and alluvium (Recent).
	Great unconformity

PRECAMBRIAN

KEWEENAWAN:	Olivine diabase and diabase.
	Intrusive contact
	Porphyritic diabase.
	Intrusive contact
	Quartz diabase.
	Intrusive contact
ALGOMAN:	Carbonatized Keewatin lavas and pyroclastics.
	Siderite and pyrite.
	Lamprophyre, diorite, kersantite, and felsite dikes.

Intrusive contact

KEEWATIN:
- Clastic sediments: conglomerate, arkose, greywacke.
- Banded silica.
- Acid to intermediate volcanics: rhyolite, dacite; sericite-carbonate schist; includes some tuff at Bauldry lake.
- Pyroclastics: acid agglomerate, tuff, and sericite-carbonate schist.
- Basic volcanics, in part ellipsoidal lavas; chlorite schist.

KEEWATIN

Basic Lavas and Schist

Basic lavas, in places ellipsoidal, are believed to be the oldest rocks exposed in the vicinity of the Ruth range. These rocks were named the Gros Cap greenstone by Coleman and Willmott.[1] They cover a considerable area in the southeastern part of the map area. The greenstones in the southern part are highly schisted, and typical chlorite schist is abundant, as it is south of the Josephine-Bartlett range.

The basic lavas have not been nearly as favourable as the acid pyroclastics and lavas for replacement by iron carbonate. There is, however, one zone of greenstone about 1,700 feet long and from 100 to 250 feet wide that is in places highly carbonatized. This extends from the point in Leg lake that is crossed by the railway to the large fault at the northeast end of the Ruth range. The extent of the carbonatization of the greenstone varies greatly. In some places, the material approaches ore quality, but in others the degree of carbonatization is less than 5 per cent.; consequently this band is not of commercial importance. On the southwest side of the railway track, there is a band of greenstone that at first glance appears to be a dike in the carbonatized rock, but it is a band that was almost untouched by the carbonate-depositing solutions. At a distance of 75 feet from the track, however, the carbonatization is again prominent.

Pyroclastics

A formation consisting of tuff and agglomerate ranging in thickness from a few feet to about 650 feet lies above the greenstone and chloritic schist. This formation was early called the Wawa tuff by Coleman and Willmott.[2] The fragments in the agglomerate are mostly small, generally less than 3 inches in length, and they consist mainly of acid to intermediate rock with rhyolite predominating. The pyroclastics have been in part highly schisted, and the large areas of sericite and sericite-carbonate schists were undoubtedly formed from these rocks.

The pyroclastics and, to a much less degree, the acid lavas have been a great factor in the formation of the iron carbonate deposits. The ore-forming solutions have shown a strong selective action in replacing these rocks in preference to others not only in the Ruth range but in all of the Michipicoten ranges in which iron carbonate is abundant. The replacement has, in nearly every instance, taken place along the footwall of the banded silica, which has been a controlling structural feature in the formation of the ore.

Acid to Intermediate Lavas

Lying above the pyroclastics and interbedded with them are lava flows, which range in composition from rhyolite through trachyte to dacite. These rocks cover most of the northwestern part of the area. They are, in places, highly schistose and they have given rise to sericite schists, some of which are quite

[1]A. P. Coleman and A. B. Willmott, op. cit., p. 155.
[2]Ibid.

highly carbonatized. It is sometimes difficult to distinguish these schists from those derived from the acid pyroclastics.

Rhyolite and dacite occur in certain areas in a quite massive condition, and there is a question as to whether some of the rhyolite may not be intrusive but closely related to the rhyolite flows. The most conspicuous example of such a mass of rhyolite may be seen on the southeast side of the banded silica, between cross-sections KD and KR on map No. 1946-7, where this rock forms a high cliff. Here, either the banded silica has been bent around this mass and thinned out by drag during folding or the rhyolite has intruded the silica, thus cutting down its thickness and eliminating it entirely near cross-section KO. Owing to the fact that no definite intrusive relations could be observed, it is believed that the first of these explanations is the better one. Further, this massive body of rhyolite resisted replacement by the carbonate-depositing solutions, and little or no ore was formed where it is in contact with the banded silica.

The acid lavas both underlie and overlie the banded silica and pyroclastics, which indicates alternating explosive and quiet volcanic action.

Banded Silica

The banded silica formation consists almost entirely of fine-grained granular to cryptocrystalline silica. It contains a little iron in most places, but some of it is nearly white. Originally the iron was mostly in the form of introduced siderite and pyrite, but part of it is oxidized, which gives the silica a brownish or yellowish colour. A small amount of iron was deposited with the silica in the form of oxides.

The banded silica cannot be placed at any fixed horizon in its age relations to the pyroclastics and acid lavas, because these occur both above and below it, but it is younger than most of the pyroclastics and older than most of the acid flows. Additional data on this matter will be found later in this report where the structure and ore deposits of the Ruth range are discussed.[1]

Clastic Sediments

Thin bands and short lenses of clastic sediments are interbedded with the acid and intermediate lavas. These were seen on islands in the northern part of Bauldry lake and in rock cuts along the railway between Cuthbertson lake and Josephine. These sediments are regarded as of local derivation and extent and they comprise thin conglomerates, arkoses, and streaks of greywacke. They are similar to the clastic sediments described in the chapter on the Josephine-Bartlett range.[2]

ALGOMAN

A variety of dikes, which are believed to be Algoman in age because they are similar to dikes found to be closely related to the Algoman granite in other parts of the Michipicoten area, occur in the vicinity of the Ruth range. No quartz veins of interest were observed in the area.

The dikes have been identified as felsite, kersantite, diorite, and lamprophyre. Three small felsite dikes occur southwest of the railway between the iron formation and Leg lake. They are fine-grained, pink in colour, and from 2 to 12 feet in width. They are exposed for only short distances and then run under drift.

Another series of dikes, which range in composition from kersantite, or mica diorite, to normal diorite, was found. Several dikes of this type were seen on the islands near the north end of Bauldry lake and two on the west shore. The rock

[1]See pages 66 and 67 to 69.
[2]See pages 45 and 46.

in hand specimen is granular, medium coarse in grain, and grey to greenish or brownish in colour.

Several thin sections from these dikes were examined, and they proved to be mica diorites or kersantites in the modern application of the latter term. The feldspar is mainly albite (Ab, 90–94 per cent.) with a little microcline in one section. Some sections show much brown and green biotite, and in others the biotite has mostly been changed to chlorite. Some thin sections show considerable amounts of serpentine, the source of which is not certain. It may have been partly introduced or it may represent a pyroxene that has been completely altered. Minor accessories are apatite, zircon, rutile in needles, and magnetite. There is much siderite, which replaces the feldspars chiefly, and some of this occurs in relatively large crystals, which indicates that these dikes were probably emplaced before the formation of the siderite. The weathering of this mineral gives the rock a brownish or yellowish colour. Quartz is present in some thin sections, but it is believed that it was mainly introduced when the rock was altered.

Another dike of similar character cuts tuff 100 feet north of the north shore of Leg lake. This dike is highly carbonatized, with about 40 per cent. replacement. As most of the feldspars are broken up, the rock must have been sheared and granulated. Chlorite, after biotite, is plentiful. Patches in this rock, as well as in the next one to be described, resemble leucoxene after ilmenite, although the determination is not very certain. Still another dike, which is 6 feet wide and exposed for 25 feet in the banded silica on cross-section LF, seems to belong with the kersantites. It is rich in chlorite, some of which occurs in large patches. It also contains some sericite, secondary amphibole, and possibly altered ilmenite. The rock is highly carbonatized. A few distinct blades of muscovite cut across the crystals of carbonate, which indicates that this mineral was one of the latest to form. This relationship between siderite and muscovite has been observed in other thin sections from the Michipicoten iron ranges.

Two other dikes, one of which is short and only a couple of feet in width, were seen in the large rock-cut on the railway between Leg and Cuthbertson lakes.

A number of small dikes, classed by W. F. Morrison, geologist of Michipicoten Iron Mines, Limited, as diorite or lamprophyre were cut by the drills in the iron carbonate, banded silica, and tuff on cross-sections LL, LN, LR, LT, LV, LX, LZ, MB, and others. The dikes are mostly less than 5 feet in width, and many of them have several branches (see Fig. 12 facing page 70). In some drill cores, as many as five of these narrow dikes, lying almost parallel to one another and dipping steeply, were found. Most of them are in the tuff or banded silica and along the contact of the carbonate bodies, but some lie right in the carbonate. There is a question regarding the relative age of the dikes and carbonate. Are the dikes younger than the carbonate, or are they older rocks that have not been completely replaced by the carbonate? The impression that one gets from studying the rocks in the Ruth area is that most of the dikes were emplaced before the carbonate bodies because, in thin section, the rocks nearly all show a considerable amount of carbonatization. Some of these dike rocks have not yielded so readily to replacement by carbonate as have the tuff and acid lavas. In any case it is believed that the carbonate and dike rocks had a common origin in an Algoman magma and that they were nearly contemporaneous in age. Some of the dikes may have preceded carbonate formation and some succeeded it, just as some of the lamprophyres in the gold fields in the Canadian shield preceded the deposition of gold and some succeeded it, but they all originated at about the same time. The occurrence of so many of the dikes with the largest carbonate bodies indicates that both dike rocks and carbonate-bearing solutions found structural conditions especially favourable in some parts of the iron range for their entrance into the older rocks.

One lamprophyre, a very dark dike of unusual character, was found on the large island in the northeastern part of Leg lake. This dike, which is about 2 feet wide and exposed above the drift for only a few feet, cuts agglomerate. It is a picrite-lamprophyre, rich in olivine and deep red-brown biotite. Such lamprophyres are not common in the Canadian shield, but several of them have been described from the Michipicoten area.[1] What is apparently a continuation of this dike was cut by a drill-hole on cross-section MB.

This rock has a groundmass composed mainly of augite and biotite, through which are scattered crystals of olivine and numerous blades and plates of deep red-brown biotite. Many of the biotite plates show distinct crystal outlines on

Photomicrograph of picrite-lamprophyre from an island in Leg lake. The bladed crystals are deep-brown biotite. The grains are olivine partially altered to light-green serpentine. (× 15.)

two or three sides. Some of them have a dark core richer in iron, and this may constitute half of the crystal. The olivine is mostly altered to serpentine with the typical alteration pattern developed when this change takes place (see photomicrograph above). Some of the olivine crystals are relatively so large that this rock might also be classified as a picrite porphyry. Frohberg[2] found dikes of this type cutting olivine diabase dikes in the Centennial mine. He places them in the Keweenawan and considers them the latest Precambrian rocks in the Michipicoten area.

KEWEENAWAN

Four varieties of diabase have been recognized in this area; from the oldest to the youngest they are: quartz, porphyritic, normal, and olivine diabases.

[1]T. L. Gledhill, "Michipicoten Gold Area, District of Algoma," Ont. Dept. Mines, Vol. XXXVI, 1927, pt. 2, p. 14.
E. S. Moore, op. cit., p. 12.
M. H. Frohberg, "The Gold Deposits of the Michipicoten Area," Ont. Dept. Mines, Vol. XLIV, 1935, pt. 8, pp. 45-48.
[2]Ibid, p. 46.

These have not all been distinguished from one another in mapping, except for the porphyritic type, which is easily recognized, because it was found that some dikes that were regarded in the field as olivine diabase proved in thin section to contain some quartz and no olivine. The diabases in the Ruth and Josephine-Bartlett ranges are quite deceiving in this respect. In most other areas, there is usually no difficulty in distinguishing the quartz and olivine types in the field. It is probable, therefore, because thin sections were not obtained from all the dikes, that some of the dikes shown on map No. 1946-7 as younger diabase really belong in the older, quartz diabase class.

The most prominent quartz diabase dike is that which extends across the northeast quarter of the area and runs under the northern part of Goetz lake near Josephine. It was not traced much beyond Josephine on the Algoma Central and Hudson Bay railway, but Collins and Quirke indicate on their map[1] that it has a minimum length of about 3 miles. Its maximum width is about 100 feet.

The quartz diabase in some dikes is remarkably fresh and is composed of sodic labradorite and calcic andesine, augite, ilmenite or titaniferous magnetite, and quartz. The quartz is mostly found in graphic intergrowth with a sodic feldspar in the interstices between the augite and plagioclase crystals, and it crystallized late in the solidification of the rock.

Only one dike of the porphyritic diabase, which is so conspicuous in the Goulais River range, was found in the Ruth area. This dike has a maximum width of 140 feet and cuts across the iron range near the southeast end of Cuthbertson lake. It was traced for a distance of more than 4,000 feet, and neither end was found. The rock looks like an ordinary diabase splashed with small and large phenocrysts of white to greenish-white plagioclase. Most of the phenocrysts are roundish or irregular in shape, and many have rather indefinite outlines, but some have distinct crystal faces.

The dike is offset 575 feet along the creek draining Cuthbertson lake, and the ravine followed by this creek has the topographical features characteristic of one developed along a fault. There seems to be no doubt that there is a fault in this ravine, but whether the faulting occurred before or after the dike was intruded is unknown. There is the possibility that when the dike was intruded it was displaced owing to a pre-existing fault. It may have followed the fault and be buried beneath mantle rock in the bottom of the ravine, or it may have been simply deflected by the fault and have broken upward at a point farther west on the south side of the fault. The erratic behaviour of similar porphyritic diabase dikes in the Goulais River range, where they are numerous, indicates that this dike might have behaved in a similar manner. Another feature of interest is the fact that in the Michipicoten area, the large faults were, as far as known, formed in the stage when the earlier, quartz diabase dikes were intruded. No definite evidence, of course, exists in the Ruth area of the relative age of the porphyritic and ordinary quartz diabase, but by analogy with the conditions found in the Goulais River range, where relations were definitely established, the porphyritic dikes are later than those of quartz diabase. A rapid change in the dip of the dike near the creek might also help to account for the displacement on the surface.

PLEISTOCENE

The Pleistocene deposits in the Ruth area present no unusual features. Some large areas are drift-covered, but rock outcrops are so abundant as to make it possible to determine the bed rocks in most of the area with sufficient certainty,

[1]Pub. No. 1972 accompanying Mem. 147, Geol. Surv. Can., 1926.

except under an extensive cedar swamp in the southern part. Near the northeast end of Cuthbertson lake the rocks are largely concealed on the face of the hill just southeast of the shore.

Structural Geology

The major structural features of the area may be recognized by observing the distribution and attitude of the banded silica. This member of the iron formation runs almost continuously across the map area, there being only one break, in the southwestern section. Nearly everywhere the banded silica dips steeply, from 50° N. to vertical, as indicated by the sections obtained by drilling (see Fig. 12 facing page 70). The formation has been tilted along with all of the other Keewatin rocks in the area so that they stand nearly on edge. The banded

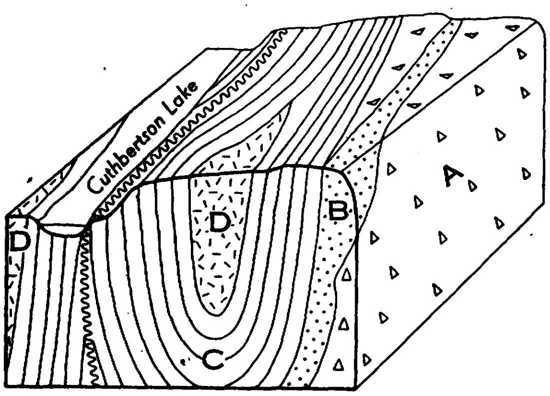


Fig. 11—Block diagram illustrating the folding of the iron formation into a syncline and an anticline, which is cut by a fault, along the southeast shore of Cuthbertson lake, between cross-sections LL and LT, Ruth range. A = pyroclastics; B = siderite; C = banded silica; D = volcanics.

silica has also been folded. The main band, which runs along the top of the ridge, plunges beneath acid lavas between cross-sections LF and LR. Here a syncline comes in from a point near the southwest end of Cuthbertson lake and noses out near cross-section LR. That this is a syncline is proved by the fact that drill-holes passed under the acid lavas on cross-sections LR and LN. The banded silica emerges from beneath the lavas in this syncline to form a closed fold, the axis of which lies along the southeast shore of Cuthbertson lake. This anticline pitches to the southwest, and the silica member disappears beneath the acid lavas near the outlet of the lake (see Fig. 11). It is believed that a fault followed by the creek draining the lake runs along or very close to the axis of this anticline and that considerable movement occurred along this strike fault.

Faulting

The only faults of importance seen in this area are the large one along the quartz diabase dike at the northeast end of the range and the one through Bauldry lake, which separates the Ruth and Lucy ranges. The former caused the separation of the Ruth and Josephine-Bartlett ranges from one another by a horizontal displacement of about half a mile. As far as can be determined, the fault is about vertical and the major part of the displacement was horizontal; but there was apparently some vertical displacement, because the formations at the west end of the Josephine-Bartlett range do not match exactly those at the east end of the Ruth range in thickness and in minor bodies of rock.

For a fault of this magnitude, there was little shattering of the rocks. This suggests that the diabase dike, which apparently followed the fault for its full length, came in immediately after the fracture occurred and lubricated the fracture. As the dike is somewhat sheared, the displacement did not occur after the dike was consolidated.

Economic Geology

THE IRON FORMATION

What is usually considered the iron formation in most of the Michipicoten ranges consists mainly of two members, banded silica and siderite, with varying proportions of pyrite and other sulphides. Interbanded with these two members are large or small quantities of other rocks, such as tuff, lava, and sediments.

Banded Silica Member

The nature and origin of this peculiar banded silica rock has been quite fully discussed earlier in this report.[1] The banded silica in the Ruth and Josephine-Bartlett, and in fact in many of the Michipicoten iron ranges, differs from that in the Goulais River and most other iron ranges in that there is very little original iron in it. In many places, it is nearly white in colour and composed entirely of silica. Where the rock is associated with siderite and pyrite, however, these minerals have later impregnated it, and they occur as disseminated grains and stringers. When they oxidize, the weathered outcrops of the silica take on a yellowish or brownish colour.

The banded silica member forms the backbone of the high ridge constituting the Ruth range. It has a maximum thickness of about 350 feet, but the width of the outcrop is doubled and even trebled by folding in one section of the range, as described under Structural Geology (see Fig. 11 on page 66). In the eastern part of the range, it strikes at N. 70° E., then swings to about N. 30° E. and back to N. 60° E. Near Bauldry lake, at the southwest end of the range, where it has been deformed around a large mass of rhyolite, the strike runs from about N. 20° E. to N. 50° E.

The band is continuous across the Ruth property except where it pinches out at cross-section KO. From this line southwest to the end of the range, the width of the silica increases to about 150 feet, being widest where it is cut off by the north-south fault running down through Bauldry lake. The dip is mostly steep and to the north, as indicated by the drilling; although it ranges from about 50 degrees to vertical, dips of from 80 to 90 degrees are the commonest.

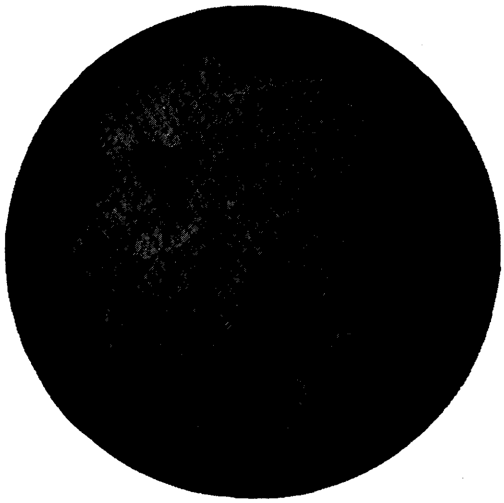
The banded silica is faulted by a strike slip fault, which follows the crest of a closed anticline running along part of Cuthbertson lake, but this fault is not believed to have greatly affected the thickness of the member.

Siderite-Pyrite Deposits

The siderite-pyrite ore deposits constitute the second prominent member of the iron formation. There are several ore bodies, most of which occur along the footwall of the banded silica member. The location of most of the ore in this position is due to structural control and the ease of replacement of acid tuff and

[1]See pages 3 to 6.

lavas. During the folding of the series of interbedded rocks the banded silica, being harder and more brittle, behaved differently from the other rocks. It slipped over the footwall rocks and it brecciated readily in many places. Drilling has shown that it is brecciated in the vicinity of much of the ore. This structure provides channels through which the hot iron-bearing solutions could easily rise from a magma beneath the area and attack the silica, and especially the acid tuffs and lavas of the footwall. Considerable quantities of silica have been replaced by siderite and pyrite, but the tuffs and acid lavas were replaced to a much greater extent. A number of thin sections of the siderite show that in the replacement of the rocks, ferromagnesian minerals, such as biotite and chlorite, are often left, whereas feldspars and even quartz have been replaced. The action of the replacing solutions on silica varies. In some places the silica is definitely replaced, and in others it is not replaced. In some thin sections, there is evidence



Photomicrograph of large crystals of partially oxidized siderite replacing intermediate lava, Ruth range. Outlines of partially altered feldspars (light areas) may still be seen. (× 15.)

of the deposition of silica with carbonate or as veinlets in it. The pyrite is mostly later than the carbonate. The iron-bearing solutions also permeated the banded silica, especially the coarser-grained portions, and deposited siderite and pyrite. These minerals are found in a disseminated state and, where the rock was fractured, in veinlets.

There is no doubt that the ore deposits are due mainly to replacement and that they came in long after the banded silica was formed and after it had been folded and brecciated. Collins and Quirke[1] were the first to recognize clearly that the siderite member is due to replacement of acid tuffs and lavas, and they set forth fully all the evidence indicating such an origin. The present writers, however, differ with their hypothesis that the banded silica, siderite, and pyrite were formed contemporaneously. According to this hypothesis, hot springs deposited the silica in basins of water on the surface, and the same waters ascending from below deposited siderite and pyrite beneath the silica on their way to the surface. Grout[2] was the first to raise objections to this idea, on the basis of these hot spring waters depositing pyrrhotite and metals such as gold and nickel,

[1]W. H. Collins and T. T. Quirke, op. cit., pp. 50-78.
[2]F. F. Grout, "Michipicoten Iron Ranges," review in Econ. Geol., Vol. XXI, 1926, p. 816.

which occur in certain of the iron ranges, along with the low-temperature minerals. The senior author[1] later called attention to the striking space relations of the pyrite deposits and Algoman intrusives and the similarity in the mineral assemblage in the siderite-pyrite deposits and Algoman ore deposits in the Michipicoten and Goudreau areas. Still later, Hawley[2] presented evidence that fully supports the conclusions the present writers have reached from their study of these siderite-pyrite deposits. There is so much evidence of the formation of iron-bearing carbonates and sulphides from the Algoman magmas that there is little doubt about the age of these iron ores. It is not entirely clear why so much siderite should have been formed in the Michipicoten area when it is relatively scarce in other parts of the country nor why hematite was formed at the Josephine mine apparently at about the same time that siderite and pyrite were formed in adjacent areas.

RUTH PROPERTY

Ore Bodies

There are three ore bodies in the Ruth property that carry appreciable quantities of ore, although one of them is much smaller than the other two. They will be designated, for convenience of description, as the East, Central, and West ore bodies from their location on the property.

East Ore Body.—The East ore body begins as a comparatively narrow outcrop at the big fault at the northeast end of the range, extends for about 1,300 feet westward along the footwall of the banded silica, and ends where the strike of this rock swings farther to the south. The exposure at the surface is from about 40 to 100 feet in width, and it dips at angles of 70° N. to 80° S. The drilling presents no evidence that this body connects at depth with the Central ore body, but there is this possibility because it was not bottomed in the drill-holes. It has been drilled on cross-sections MF to LV (see map No. 1946-7), and the following figures show the maximum vertical depth of the holes, together with the minimum and maximum widths of ore cut, including low- and high-silica ore. These figures have been compiled from drill records, which were kindly furnished by Michipicoten Iron Mines.

Cross-section	Maximum vertical depth drilled below outcrop	Minimum width of ore	Maximum width of ore
	feet	feet	feet
MF	700	40	125
MD	700	75	200
MB	1,120	110	230
LZ	1,475	105	215
LX	1,180	80	175
LV	1,040	35	125

The results of drilling show much variation in width of ore, and this variation is not confined to any particular horizon. In some sections, the ore is narrowest at the top and widest at the bottom and in others the reverse. The drilling did not reach the bottom of the ore body on any cross-section, and on several of them the ore was widening at the greatest depth reached by drilling. The high-silica ore is usually on the hanging wall of the low-silica ore and next to the banded silica, with the better ore next to the tuff footwall. The high- and low-silica ore often occur as more or less parallel bands, but high-silica ore may

[1]E. S. Moore, op. cit., pp. 45-47.
[2]J. E. Hawley, "Origin of Some Siderite, Pyrite, Chert Deposits, Michipicoten District, Ontario," Trans. Roy. Soc. Can., Sec. IV, Vol. XXXVI, 1942, pp. 79-87.

also form horses in the low-silica grade, which indicates incomplete replacement of the banded silica. A few bands of ore occur out in the banded silica. In some holes, narrow bands of tuff and slaty rock are interbedded with the ore, and there are several narrow dikes, especially on cross-sections LV, LX, and LZ, which Mr. Morrison, geologist of the company, has classified as diorite or lamprophyre (see Fig. 12 facing this page). These dikes occur in both the ore and the country rocks. They appear to be intrusive into the ore and therefore younger, but the question may be raised as to whether they are older than the ore and have not been replaced, because the carbonate has elsewhere shown aversion to replacement of rocks on the basic side and a preference for acid tuffs. In the Josephine mine, there are dikes in the hematite that are regarded as Algoman in age which have been only partly replaced by the ore.

The East ore body contains the largest tonnage that has been developed on the property, and in some sections it is very high in pyrite. Its tonnage, which has been carefully computed by the engineers of the company, is as follows:—

	Composition			Tons
	Fe	SiO_2	S	
	per cent.	per cent.	per cent.	
Low-silica ore	34.60	6.95	6.352	7,359,000
High-silica ore	31.13	13.84	5.129	12,714,000

In consideration of the size of the siderite deposit where it is cut off by the big fault at the northeast end of the range, it is suggested that a continuation of it should be expected on the footwall of the banded silica at the west end of the Josephine-Bartlett range.[1]

Central Ore Body.—The Central ore body, the second in tonnage, extends for 3,200 feet through the central part of the property between cross-sections LX and KR. It outcrops along the brink of the high ridge and follows the footwall of the banded silica throughout its whole length except where it projects for 300 feet into the pyroclastics at its east end. Its outcrop has a maximum width of about 150 feet, but it is difficult to determine its thickness at the surface because the siderite weathers to fragments and dust of limonitic oxide (goethite).

This ore body has been drilled from end to end, and the following figures, compiled from the company's logs, show the maximum depth of drilling and the maximum and minimum width of low- and high-silica ore on the various cross-sections (see map No. 1946-7).

Cross-section	Maximum vertical depth drilled below outcrop	Minimum width of ore	Maximum width of ore
	feet	feet	feet
LT	1,450	10	165
LR	1,180	10	225
LP	435	80	125
LN	1,350	100	250
LL	900	65	125
LJ	465	25	100
LH	570	45	100
LF	140	....	70
LD	305	....	110
LB	505	10	165
LA	405	....	130
KX	275	....	40
KY	350	10	30
KT	425	35	35

[1]Recent drilling has found this continuation beneath the drift.

On cross-sections LT to LH, inclusive, the bottom of the ore was not reached, and on LT, LR, and LN, the ore was widest at the bottom of the deepest holes. On cross-sections LF to KX the ore in nearly all sections was widest at the outcrop, and it wedged out below at depths of from 130 feet to 380 feet. On cross-section KY it was almost bottomed, whereas on KT the ore body, with high silica in the upper half and low silica in the lower half of that part reached by the drill, maintained an almost constant width to the bottom of the deepest hole. The ore body, as well as the banded silica, pinches out to the southwest to come in again to form the West ore body.

The dip of the Central ore body is approximately vertical on cross-sections LT, LR, and LP. On LN it is about 80° N. near the surface and 65° N. at depth; from this section to the southwest end it ranges from 50° to 83° N., the last dip being in cross-section KT.

The tonnage computed by the company for the Central ore body is as follows:—

	Composition			Tons
	Fe	SiO_2	S	
	per cent.	per cent.	per cent.	
Low-silica ore	34.46–34.60	6.37– 6.95	2.741–6.352	3,791,000
High-silica ore	29.97–31.13	13.84–16.89	2.997–5.129	5,321,000

The ore is cut out by the large porphyritic diabase dike that traverses the range between cross-sections LA and KX, and in several of the sections, such as LL, LN, and LR, there are bands of unreplaced slaty tuff in the ore body. That on cross-section LR is nearly 65 feet wide, and it splits the ore into two bands.

West Ore Body.—The West ore body is quite small and is exposed for only about 100 feet from the fault under Bauldry lake. The outcrop has a maximum width of about 65 feet. The banded silica and siderite are bent around a large mass of rhyolite, and the strike runs from northeast to north to northwest.

The West ore body has been drilled on cross-sections KD to KO, but appreciable quantities of ore were found only on KD and KF. On cross-section KD the deepest hole reached 275 feet vertically beneath the outcrop, and the ore body was 45 feet wide at the surface and 75 feet at the greatest depth drilled. On cross-section KF the deepest hole was 665 feet, and the ore widens from almost nothing in the shallowest hole to about 130 feet near the bottom of the deepest hole, although it is mainly high-silica ore in this section. To the northeast the ore pinches out rapidly.

The tonnage computed by the company for the West ore body is as follows:—

	Composition			Tons
	Fe	SiO_2	S	
	per cent.	per cent.	per cent.	
Low-silica ore	32.76	7.84	1.288	406,000
High-silica ore	28.47	18.08	2.735	1,336,000

Other Ore Bodies.—A few small bodies of siderite and pyrite occur near the southeast side of Cuthbertson lake. Around the nose of the syncline, near cross-sections LR and LP, there are showings of these minerals, but nothing of importance has so far been found. Nearer the shore of the lake, considerable amounts of pyrite occur in several places near the fault and the crest of the anticline that runs along near the lake.

A band of highly carbonatized greenstone occurs near the contact with pyroclastics and extends from a point just southwest of the railway track where it crosses the large point in Leg lake northeastward to the fault near the east side of the Ruth property. It is weathered yellowish-brown and at a glance appears to be ore, but most of it runs only from 12 to 15 per cent. iron. It seems to occupy much the same position with respect to the iron formation as the large carbonatized band in the pyroclastics on the south side of the road from the railway to the Josephine mine does with respect to the iron formation under Parks lake.

Ore Reserves

The total ore reserves computed by Michipicoten Iron Mines from the results of drilling were 30,927,000 long tons, of which 11,556,000 long tons was low-silica ore and 19,371,000 tons high-silica ore. The average composition is as follows:[1]—

	Low-silica ore	High-silica ore
	per cent.	per cent.
Fe	34.54	30.92
SiO_2	6.97	14.19
S	6.107	5.129
P	.014	.013
As	.165	.190
Mn	1.83	1.81
CaO	3.55	3.79
MgO	4.32	4.34
Al_2O_3	.57	.85
Loss on ignition	26.54	25.48

[1]From a report by Eldon L. Brown, general manager, Michipicoten Iron Mines, Limited.

In classifying the low-silica ore reserves, 7 per cent. silica was taken as the maximum; the tonnage was calculated on the basis of 10 cubic feet of ore to the long ton. For the gross tonnage, including low- and high-silica ore, 11 cubic feet was used.

Treatment of the Ore

The sulphur averages much higher in this ore than it does in the Helen mine and the abandoned Magpie mine, and the arsenic is high for iron ore. The company, however, had tests on the ore run in a plant of the Sintering Corporation of America, and both the sulphur and arsenic were reduced in the sinter to a satisfactory level. In the modern sintering machine, a small percentage of sulphur in the form of pyrite proves to be helpful in reducing the amount of fuel required and, therefore, the cost of sintering. The composition of the sinter obtained from 100 per cent. of Ruth ore is given by Mr. Brown as:—

	Per cent.
Fe	52.23
SiO_2	8.92
S	.033
As	.08
P	.020
Mn	2.82
CaO	4.95
MgO	6.09
Al_2O_3	1.26

It will be observed that in sintering, the iron, silica, phosphorus, manganese, lime, magnesia, and alumina all increase: the iron greatly and the other constituents in a much smaller proportion. The phosphorus seems to remain with the iron or the lime. The increase in manganese, lime, magnesia, and alumina is a favourable feature because of the fluxing properties of the three last substances in the blast furnace and the value of manganese in steel-making.

The high-silica ore will require treatment to reduce the silica below 9 per cent. This may be easily and quite cheaply accomplished by applying a sink-float process and using ferrosilicon as the medium of separation.

Michipicoten Iron Mines has considered the possibility of sintering Ruth carbonate and Josephine hematite together. This would provide a higher-grade sinter and effect a great saving in cost over handling the products of the two mines separately. It would appear that the most economical scheme would be to have the sintering plant on the Ruth property and to mix the ores from the two mines to obtain a much higher-grade sinter than could be obtained from the Ruth ore alone. Sinter made from the Josephine ore alone would, of course, have a much higher grade than that from Ruth ore alone, but considering the much greater tonnage that it is expected will ultimately be produced from the Ruth property, it would appear better in the long run to make a product of average grade.

Transportation facilities are very good because the Michipicoten branch of the Algoma Central and Hudson Bay Railway crosses the property within about 20 miles of Michipicoten Harbour on Lake Superior and about 6 miles of Hawk Junction on the main line of the railway.

CHAPTER V

THE LUCY IRON RANGE

Introduction

The Lucy iron range comprises the third and western segment of what was originally one range, 6½ miles long, which also included what are now called the Josephine-Bartlett and Ruth ranges. This long range has been broken into three sections by two transverse faults, and the Lucy range is separated from the Ruth by a fault running under Bauldry lake (see Fig. 8 facing page 38).

The range was discovered near the close of the last century when most of the other Michipicoten ranges were found. It was formerly known as the Brooks Lake range from the lake of that name on the south side of the range.[1] It is not nearly as well known as the other large Michipicoten ranges, mainly because of its inaccessibility. It is isolated from the railway and in very rough country. The hills are high, the bed rock is covered in many places with a heavy mantle of drift, the ore bodies are mostly concealed, and the woods are very difficult to travel through. The spruce bud-worm has killed all the balsam, and many claims are so covered with a tangle of fallen trees that it is almost impossible to examine the outcrops.

Much surface work was done on the range in 1908 by Alois Goetz, discoverer and part owner of the claims. Trenches were dug all over the range, and much effort was wasted in trenching barren silica, tuff, and other rocks. The trenches are now filled in, but Mr. Goetz prepared a rather elaborate map of the area where work was done, which has been found very useful in outlining some of the siderite bodies. No drilling was done.

In 1941, the Frobisher Exploration Company, Limited, obtained control of the Lucy claims, K.W. 32 to 40, covering the whole of the iron range, from Alois Goetz and associates, at the same time that the Josephine and Ruth properties were acquired. Later a few additional claims were staked, comprising a row along the south side of the string obtained from Goetz and a few on open ground on the north side. This property is now controlled by Michipicoten Iron Mines, Limited.

Another group of claims, S.S.M. 1,699 to 1,706, which are sometimes called the Arnott-Wilkes claims, is situated to the north of the iron range. They are recorded as surveyed, but it was impossible to find surveyor's lines or posts for most of them, although they were surveyed considerably later than the K.W. claims, the lines and posts of which could be found with few exceptions. It is said that these claims were staked with the mistaken idea that there was another iron range in that area.

Location

The Lucy iron range is 2 miles long and extends from a small lake on the creek draining Loonskin lake into Bauldry lake southwest almost to Mildred lake. The northeast end of the range lies in township 28, range XXIV, and the rest in township 29. The northeast end of the range is 1 mile southwest of the Michipicoten branch of the Algoma Central and Hudson Bay Railway at Leg lake and may be reached from the railway by canoe by crossing Goetz and Bauldry lakes, but the best canoe route is from the railway at mile 10½ near Blueberry lake to

[1]A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines, Vol. XI, 1902, p. 161-162.

W. H. Collins and T. T. Quirke, "The Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, 1926, pp. 88-89.

the north end of Mildred lake over a portage 33 chains long. This portage may be broken by paddling across a small lake, which is about 14 chains long and skirted by the trail. The southwest end of the range is east of the railway and may be reached by a 2-mile trip up the creek that drains Mildred lake to the southwest.

Topography

The area is very rugged and the iron formation forms, near its centre, a high ridge running about northeast-southwest and dropping down near lake level towards the ends. It is estimated that where the township line crosses the range, it is 250 feet above Bauldry lake. Some of the hills on the east side of the north half of Mildred lake are, according to barometric reading, as much as 210 feet above the lake, and the ridge north of the east arm of the lake has about the same elevation. The area around the south end of the lake is comparatively low and heavily drift-covered on the east side of the lake.

Stratigraphy

The formations in the Lucy area are in many respects similar to those in the Ruth and Josephine-Bartlett areas. One formation present, which was not definitely recognized in the other areas but is abundant in the Helen map area, is an intrusive greenstone, which is regarded as probably Haileyburian in age.

The rocks may be classified as follows:—

CENOZOIC	
QUATERNARY:	Glacial drift (Pleistocene) and alluvium (Recent).
	Great unconformity
PRECAMBRIAN	
KEWEENAWAN:	Diabase and quartz diabase, partly porphyritic.
	Intrusive contact
ALGOMAN:	Siderite and pyrite. Quartz veins. Kersantite (mica diorite).
	Intrusive contact
HAILEYBURIAN(?):	Mica peridotite. Gabbro and diabase; metadiorite.
	Intrusive contact
TIMISKAMING:	Doré conglomerate containing abundant granite pebbles and boulders.
	Unconformity(?)
KEEWATIN:	Acid to intermediate volcanics: rhyolite; sericite-carbonate schist; includes acid tuffs largely converted to sericite-carbonate schist. Interbedded band of clastic sediments including conglomerate, arkose, greywacke, and slate, some of which may be Doré. Basic volcanics: in part ellipsoidal andesite and basalt; chlorite schist. Banded silica. Acid to intermediate volcanics: rhyolite; sericite-carbonate schist. Includes acid tuffs largely converted to sericite-carbonate schist. Basic volcanics: in part ellipsoidal andesite and basalt; chlorite schist.

KEEWATIN

Basic Volcanics

Basic lavas, in part ellipsoidal, occur both north and south of the banded silica. In the area mapped, more basic lava lies above the banded silica than below it, but the acid rocks predominate in both zones. In places, the andesite and basalt are coarse-grained and difficult to distinguish from the intrusive greenstone. Elsewhere, as on the west boundary of claim K.W. 37, the basic lava is fine-grained and chloritic.

Acid to Intermediate Volcanics

Most of the acid and intermediate types, which occur both north and south of the banded silica, are represented by sericite-carbonate schists, which makes it very difficult or even impossible to distinguish between acid lava and acid tuffs. Moreover, where the two types can be distinguished they are intimately interbedded. This close relationship increases the difficulty of correct interpretation where they have been converted into schists.

The dominant rock appears to be an acid tuff, which has been derived by the blowing to powder of rhyolite and related rocks. It is, for the most part, sheared to sericite schist, which contains from small to large proportions of iron carbonate. A green chrome mica occurs in part of the schists. These pyroclastics may be correlated with the Wawa tuffs of the Helen range.

Clastic Sediments

A band of sediments lies about 2,000 feet north of the iron range and parallel to it. The rocks composing this band are conglomerate, arkose, and greywacke with some slaty bands. The conglomerate contains numerous pebbles of quartz and chert; some of banded silica, greenstone, and acid lavas; and a few of slate. Most of the pebbles are small, but some of the silica pebbles are as much as 3 inches in diameter. No granite pebbles were found.

The matrix of the conglomerate consists of very small, partially rounded pebbles of quartz, grains of quartz and feldspar showing some evidence of water wear, much sericite, and some carbonate. In places the matrix is distinctly slaty.

The arkose is fine-grained and composed of grains of feldspar and quartz. The quartz grains predominate, and their nearly uniform size would appear to indicate some water-sorting of the materials.

Part of this band of sediments is shown on Collin's map of the Michipicoten area.[1] It proved to be much more extensive than indicated on that map, and it was traced from the south end of Bauldry lake to the east shore of Mildred lake. Near Mildred lake, it swings southward, just as the iron formation does, and this is believed to be due to the drag along the east side of a large fault under Mildred lake. The sediments retain a fairly uniform width of 400 feet across the area except on the shore of Mildred lake, where they curve southward and the strike and dip vary from point to point and the width is increased to 800 feet by duplication of the beds.

The age of these sediments is uncertain. Collins and Quirke[2] assigned them to the post-Dorean schists as minor bands in the rocks that are classified as Keewatin in this report. The conglomerate is, however, more prominent than that usually found as minor occurrences in the Keewatin. The abundance of quartz pebbles and their size indicate a considerable hiatus in the deposition of the Keewatin rocks. The absence of granite pebbles is a factor against calling them Timiskaming, although a longer search might possibly reveal their presence and show that this band of sediments should be correlated with the Doré at the south end of Mildred lake.

Banded Silica

The prominent member of the iron formation is the white, grey, yellow, or brown banded silica. This forms a ridge which, in the vicinity of the boundary between townships 28 and 29, dominates the area. The ridge becomes lower to the southwest, and the silica disappears under a relatively low drift-covered area

[1]Pub. No. 1972 accompanying Mem. 147, Geol. Surv. Can., 1926.
[2]Ibid.

near Mildred lake. It apparently ends before reaching the Mildred Lake fault (see section on Structural Geology on page 80). In most places, the rock is a granular silica, which contains little jasper or magnetite but is impregnated with varying percentages of siderite and pyrite. The contacts of the banded silica are exposed in few places, but the thickness for most of its length is believed to be between 200 and 400 feet. The maximum width of the outcrop, 600 feet, is reached on claims K.W. 38 and 39, where the banded silica is highly disturbed and beds are duplicated by folding, which indicates that this large figure does not represent the true thickness of the member. The dip is generally between 75° N.W. and vertical. The dip of the pillow lavas is also to the northwest.

The banded silica is brecciated in places but not nearly as much so as the silica at the Josephine mine or on parts of the Helen range. All siderite bodies lie along the footwall, as in the other ranges containing siderite, and they have been formed by replacement of acid tuff. They are geologically much younger than the banded silica. A discussion of the origin of the banded silica may be found on pages 3 to 6 of this report and further information regarding the iron formation on pages 81 and 82.

TIMISKAMING

A large outcrop of the Doré conglomerate, which is typical of the Timiskaming elsewhere, occurs at the south end of Mildred lake. This formation strikes N. 60° E., and there is a possibility that the conglomerate on the east side of the lake, and the Mildred Lake fault, is of the same age as this Doré conglomerate, the two formations being separated a distance of 3,500 feet by the faulting. The Doré, however, contains abundant granite pebbles, some as much as 15 inches in length, whereas the formation on the east side of the fault lacks boulders of this rock. The age relations of the two formations are, therefore, uncertain.

HAILEYBURIAN(?)

A number of bodies of coarse greenstone that occur south of the Lucy iron range are regarded as intrusive and probably equivalent in age to the numerous intrusions of gabbro and metadiorite in the Helen area. They are mostly roughly tabular in form and may, therefore, be sills that follow the trend of the older pyroclastics and lavas. No definite evidence of their age exists in the Lucy area, but in the Helen area they are later than the Keewatin and older than the Algoman and are, therefore, considered as probably Haileyburian.

An intrusion of very basic rock occurs on an island in the north end of Mildred lake, along the north shore of part of the east arm, and on the large peninsula projecting into this part of the lake. The rock is very dark grey to almost black in colour. It weathers with cups and prongs, which gives it a very harsh, rough surface, and when broken it presents many large glistening cleavage surfaces. Several specimens were studied in thin section, and they showed the rock to be rich in olivine, which amounted to about 70 per cent. in one specimen. In some specimens there is much fresh olivine, and in others this mineral is nearly all altered to serpentine with the typical pattern of serpentine derived from olivine. Veinlets of serpentine run through the rock. Augite is fresh to much altered to serpentine. A little enstatite is present. In some thin sections the biotite is a deep red-brown in colour and is present in considerable amounts; in others much of it is bleached in colour or changed to chlorite. In a specimen from the peninsula in the east arm of Mildred lake, the biotite is in a peculiar condition. The colour is golden-brown to deep brown with brown to yellowish-brown pleochroism, but when examined under high magnification it appears to be composed of a flocculent mass of flakes resembling limonite. This material has the characteristic outlines of the iron-rich biotite in the other specimens, but it lacks some of the characteristic optical properties of biotite. Magnetite has the same distribution in both varieties of biotite.

Magnetite is so abundant in the rock that a small magnet readily picks up small fragments of it. It is arranged along crystallographic planes in augite, olivine, and biotite and also disseminated in these minerals. It remains in the serpentine, chlorite, and the peculiar golden-brown weathered product of biotite, with a similar distribution. No feldspar was found.

This rock is a mica peridotite, variety wehrlite. It shows a certain resemblance to the picrite-lamprophyre at Leg lake in the Ruth range[1] and may, therefore, be Keweenawan in age; Frohberg[2] considered these olivine lamprophyres as later than but related to the Keweenawan diabases. The picrite-lamprophyre contains much more of the red-brown biotite than the rock on Mildred lake.

A large body of pyroxenite-peridotite occurs on the Lakemount property,[3] which is located around Sunrise lake, 2½ miles southeast of Mildred lake. It is cut by granite regarded as Algoman, and this would point to a Haileyburian age for that intrusion. The Haileyburian is notable in other parts of the Canadian shield for basic intrusives, and whether all these very basic rocks should be placed in that system cannot be decided from the field evidence at present available.

ALGOMAN

Few rocks of Algoman age are exposed in the Lucy area. The siderite-pyrite deposits are regarded as having formed in that period by replacement of Keewatin rocks. A few irregular barren quartz veins are also regarded as of Algoman age; the largest of these is in the hill north of the east arm of Mildred lake. A little green chrome mica occurs with the quartz.

A dike of mica diorite or kersantite outcrops west of Bauldry lake and extends northeast for 2,200 feet to the west shore of Bauldry lake in the Ruth map area, where it reaches a width of 30 feet. This kersantite dike is similar to those described under the Ruth range. It contains plagioclase, from albite to andesine, and in places a little orthoclase. Brown biotite is abundant, and some of it has been bleached or altered to chlorite. Hornblende in small crystals is present, and apatite occurs in numerous small prisms embedded in the other minerals. These rocks have been highly carbonatized in some parts, and considerable amounts of quartz occur with the ferruginous carbonate, apparently introduced with it. The carbonate shows here, as in the Ruth range, a strong tendency to replace the feldspar in preference to the biotite, hornblende, or chlorite. The rock weathers brown because of the presence of so much ferruginous carbonate.

Another dike, only 5 feet wide, crosses the small island on the south side of the entrance to the east arm of Mildred lake. It has been carbonatized to about 50 per cent. of its volume, but it is also believed to be kersantite from what remains of original minerals.

KEWEENAWAN

Only two dikes of Keweenawan diabase were observed in this area. One of these is a dike of quartz diabase about 100 feet wide, which was traced northwest from a point just east of Brooks lake across the iron range to a point beyond the end of the east arm of Mildred lake. The rock of this dike is very similar to that

[1] See page 64.

[2] M. H. Frohberg, "The Gold Deposits of the Michipicoten Area," Ont. Dept. Mines, Vol. XLIV, 1935, pt. 8, p. 45.

[3] See Appendix, pages 119 to 121.

in many of the other quartz diabases of the Michipicoten area. The ophitic texture is distinct, and the feldspars are remarkably fresh and are andesine to labradorite in composition. Part of the augite is fresh and part is uralitized, and most of the titaniferous magnetite shows little alteration. The quartz, which is in small quantity, occurs both as individual grains and in myrmekitic intergrowth with feldspar.

The second dike is much narrower. It runs almost parallel to the first about 500 feet to the east. Very little is known about this dike because of the lack of outcrops.

Structural Geology

Folding

The Lucy range area has been highly folded, and the formations have been sheared and so tightly compressed in most places that they stand nearly vertical with a monoclinal dip to the northwest. The rapid alternations of pyroclastics and lavas, acid and basic, make it impossible to find reliable stratigraphical horizons that can be used to distinguish anticlinal and synclinal structures and therefore individual folds. The dip of the banded silica, the one most uniform and continuous formation across the area, is very steep, mostly between 70 and 90 degrees. Many low dips may be found where the formation is crumpled into minor folds, as in the wider part of the range. The silica is a great tabular mass standing almost on edge.

The band of sediments north of the iron range is also a continuous and parallel stratigraphical unit, but the rocks in most places are sheared and the schistosity has a nearly vertical dip. Exceptions to this are found near the shore of Mildred lake where the structure is complex. The difficulty about using the sediments in working out the major structure of the area is that it is not certain whether they are interbedded with the Keewatin rocks or are Timiskaming and lie in a closely folded and sheared syncline in the Keewatin.

Such pillows as occur in the basic lavas always indicate a northwesterly dip. They are not, however, sufficiently numerous or distributed in such a manner as to throw much light on the question of whether the sediments are in a syncline.

The acid lavas and proclastics have been for the most part altered to sericite schist, much of which is more or less replaced by carbonate, and they have thus lost their individual characteristics. The basic lavas in many places have been changed to chlorite schist.

Faulting

It has been mentioned that the Josephine-Bartlett, Ruth, and Lucy ranges are segments of one continuous range of iron formation separated by large transverse faults. Such faults strike either north or nearly northwest, and they are a prominent feature of the structure of the Michipicoten area. A fault of this type running under Walbank lake offsets the Helen iron range near its east end. This fault and the one separating the Josephine-Bartlett from the Ruth range strike roughly northwest and are followed by large Keweenawan diabase dikes. It is generally assumed that the faulting occurred at the time of the injection of these dikes, and this is probably a correct assumption, although it must be considered a possibility that the dikes followed faults developed long before they were injected. The fault separating the Josephine-Bartlett from the Ruth range has a horizontal displacement of 2,600 feet, with an indefinite amount of vertical displacement. The fault under Bauldry lake strikes north-south, is not followed by a dike, and separates the Ruth and Lucy ranges by 2,100 feet horizontally.

Whether there is appreciable vertical displacement or not cannot be determined, but if there is the amount is believed to be small.

The Walbank Lake fault strikes nearly northwest and is followed by a diabase dike; its horizontal displacement is about 1,800 feet.

In all the faults mentioned, the block on the east side of the fault has been pushed to the north, and this seems to be the rule for nearly all the large faults in the Michipicoten area.

Work on the Lucy range showed that there is another large fault in the area running under Mildred lake. It strikes nearly north under the lake and nearly northwest-southeast beyond the ends of the lake. It is not, so far as known, followed by a diabase dike anywhere near Mildred lake, but it is near Lena lake. The surmise that such a fault existed arose in the first place from the existence of truncated spurs or high ridges that are cut off abruptly along the east shore of the lake and the manner in which the banded silica and the band of sediments north of the iron range are curved sharply to the south owing to drag as these formations approach the lake. It was thought that possibly the iron formation, which runs under drift, was cut off at the lake by a fault. It became evident, however, that the banded silica dies out before reaching the lake.

Convincing evidence of the Mildred Lake fault was found in the aerial photographs of the sections between Mildred and Lena lakes and to the northwest around Blueberry lake. The fault is so evident from these photographs that its existence cannot be questioned. It extends southward beyond Lena lake to Wawa lake, offsetting the Eleanor iron formation south of Lena lake. The fault branches under the lake. One branch runs to the southeast and is followed by a diabase dike; the other strikes nearly due south to Wawa lake. The displacement on the southeast branch has not been determined because the segment of iron formation displaced has not been located. This branch, which may be the main part of the Mildred Lake fault, has a diabase dike along at least part of its course. The displacement on the south branch where it cuts the iron formation is about 600 feet. The south branch splits again, and the second branch again offsets the iron formation about 600 feet. The relative movement on the last two faults in each case is to the north on the east side of the fault.

The displacement under Mildred lake is not known. The block on the east side of the fault undoubtedly pushed north as the blocks did in the Eleanor range. The movement tended to drag all the formations near the fault along the east shore of the lake down to the south. If the conglomerate at the south end of the lake is the same formation as that on the east shore, the displacement must have been of the order of 3,000 to 3,500 feet. There are no other definite horizon markers that can be used to determine the amount of offset. The sharp truncated spurs mentioned above cannot be explained as simply due to being the crag left on the lee side of the hills during glaciation because the glacial striations on the islands in the lake strike N. 10° E. This shows that the ice moved almost parallel to this basin.

The presence of this large fault is well shown in the aerial photographs along the east shore of Blueberry lake, which lies north-northwest of Mildred lake, and far beyond the lake.

The Bauldry Lake fault extends southwestward along Loonskin lake, and it is considered probable that it joins the Mildred Lake fault south of Lena lake. North of the iron range, it is very difficult to match the formations on the opposite sides of the fault on Bauldry lake. The band of sediments to the west of the fault could not be located on the east side. The volcanic formations alternate so frequently that correlation over considerable distances is difficult.

The banded silica is the only dependable formation for correlation in most places, and it is distinctly offset by the fault.

Economic Geology

The only deposits of economic interest found in the Lucy area are those of siderite in the iron range. There are a few bodies of quartz, the largest seen being in the hill north of the east arm of Mildred lake. It is practically barren but has a little green chrome mica, mariposite or fuchsite, associated with it. An old pit full of indigo-blue water was found on the west boundary of claim No. 4,291 at the foot of a ledge of conglomerate. It had been sunk in nearly black slaty rock highly impregnated with pyrite. The deposit did not show anything of economic interest. Collins and Quirke[1] mention a shaft and an adit just south of the sediments near the northwest corner of claim S.S.M. 1,704. As the corner of that claim is in Mildred lake and no sediments are shown in the southwest corner of the claim on the map accompanying the report, it is evident that the shaft was placed in the wrong claim. It is possible that the pit described above is the shaft to which reference was made, but the description does not properly fit it either.

SIDERITE-PYRITE DEPOSITS

Very few good exposures of siderite could be found in 1944. The numerous trenches that were dug across the range in 1908 by Alois Goetz were nearly all filled in. The presence of siderite below the surface in many places could be assumed from the characteristic yellow-brown soil and fragments of iron oxide, but the outlines of the siderite bodies could not be traced. No drilling had been done on the range.

A good section of the siderite was measured in a trench across the iron formation north of No. 2 post of claim K.W. 33, where it has a width of 200 feet. The carbonate is very dense and fine-grained, some of the grains measuring from 0.008 mm. to 0.025 mm. in diameter. It is cut by veinlets of quartz and contains pyrite, which increases in proportion as the footwall of the banded silica is approached. In part of the siderite there are distinct prisms of arsenopyrite as much as half an inch in length and one-twentieth to one-tenth of an inch in diameter. The siderite resembles that in the other carbonate deposits of the Michipicoten area. An excellent example was found in this ore of feldspar crystals partly replaced by siderite, and this again demonstrates that the siderite replaces the acid tuffs.

Three partial analyses of the ore from the Lucy range were found among the records of the late Alois Goetz. They are as follows:—

	No. 1	No. 2	No. 3
	per cent.	per cent.	per cent.
Fe	35.40	29.40	18.40
SiO_2	3.00	Not given	37.00
CaO	4.20	3.85	....
MgO	3.60	2.52	....
P	.010	.010	....

Sample No. 1—Siderite described above.
Sample No. 2—Siderite near the centre of claim K.W. 38.
Sample No. 3—Cherty magnetite at the contact of the diabase dike near the southwest corner of claim K.W. 36.

These analyses show that the best siderite here runs about the same in iron as the Helen siderite. The lime, magnesia, and phosphorus are also similar.

[1]W. H. Collins and T. T. Quirke, op. cit., p. 89.

W. M. Goodwin examined the Lucy deposits in 1911 for the Algoma Steel Corporation. This was but a short time after the range had been extensively trenched, and it was possible to see the siderite bodies in some detail. The results of this examination are quoted by Collins and Quirke:[1]—

> A lens of siderite 100 feet wide and 500 feet long . . . crosses the line between K.W. 32 and 33. A second lens commences in K.W. 33, 350 feet from its eastern boundary, and extends eastward into K.W. 34 for a total length of 950 feet. It is 30 feet wide at the west end, 160 feet wide on the line between K.W. 33 and 34, 105 feet wide at 100 feet east of this line, and 30 feet wide for the last 300 feet at the east. One hundred feet east of this lens is a third one, 1,050 feet long and 60 feet wide, that extends for 300 feet into K.W. 35, where it merges into sideritized volcanics. Near the southeast corner of K.W. 35 is a fourth lens, about 50 feet wide, which is cut across by the diabase dikes shown on the map. On the east boundary of K.W. 39 the banded silica is followed by 140 feet of rather lean sideritic rock, and then by drift.

Diamond-drilling is the only means of determining whether there are ore bodies of sufficient depth to be mined profitably. It is also probable that there are some hidden bodies of siderite. At the west end of the Ruth range there is a considerable band of siderite, but the east end of the Lucy range is drift-covered. If there were much vertical displacement on the Bauldry Lake fault, there might be an ore body in the Ruth range on the east side of the fault and no corresponding body in the Lucy range on the west side. Differential erosion on opposite sides of the fault might remove the ore on the west side. On the other hand it might be at greater depth than on the Ruth. Drilling has recently shown that the siderite that was found on the footwall side of the banded silica on the Ruth property occurs under the drift on the other side of the fault that separates the Ruth and Josephine-Bartlett ranges.

[1]W. H. Collins and T. T. Quirke, op. cit., p. 89.

CHAPTER VI

THE ELEANOR IRON RANGE

Introduction

The Eleanor iron range is located in township 29, range XXIV, about three-quarters of a mile north of the east end of Wawa lake and just south of Lena lake. A trail between these lakes crosses sand plain and drift before reaching the range, which forms a rugged ridge, in places about 200 feet high.

The range was discovered and staked very early in the exploration of the Michipicoten area because of its marked relief and rusty appearance. It is,

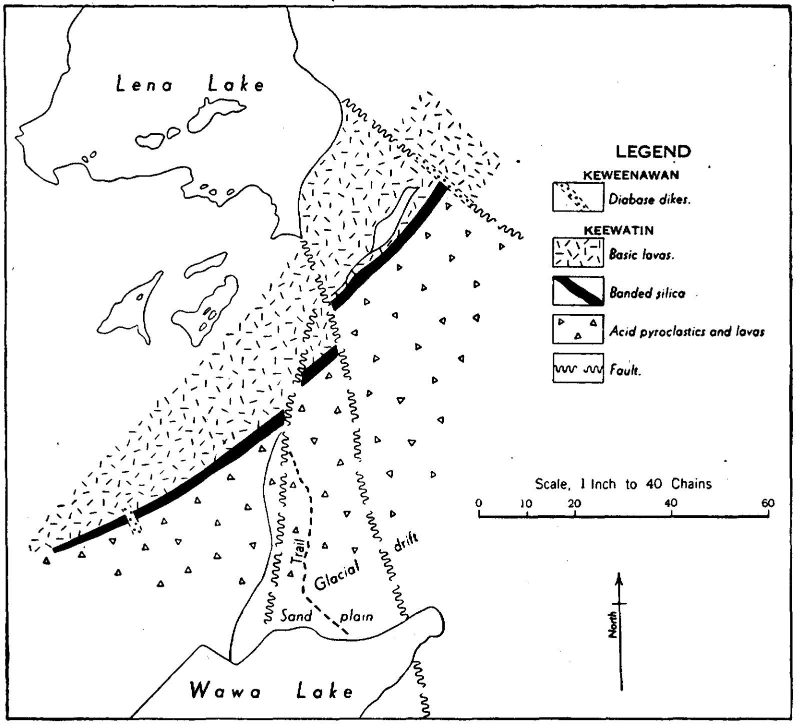


Fig. 13—Geological sketch map of the Eleanor iron range.

however, little known because of the rugged nature of the terrain and the fact that it is partly drift-covered and heavily forested. It is also a long way from the railway and off the travelled routes.

The junior author, assisted by R. L. Alexander, spent a short time in the autumn of 1944 on the range and worked out its geology.

Coleman and Willmott[1] described this range and stated that not far from its southwest end the iron formation strikes nearly north and south. No evidence of this was found, and it is believed that this mistaken direction was due to the magnetic effect of a porphyritic diabase dike in the vicinity, which deflects the compass very strongly.

[1]A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines, Vol. XI, 1902, p. 160.

The accompanying map (Fig. 13) shows the position of the iron formation and its relation to the associated rocks.

Algoma Ore Properties, Limited, controls the patented claims on this range.

General Geology

Banded silica, broken by three faults, was traced for 7,500 feet along the strike, which averages nearly northeast-southwest. It is overlain on the northwest or hanging-wall side by basic lavas, andesites and basalts, which contain pillows, and underlain on the southeast side by acid tuff, agglomerate, and acid lavas. This relation is similar to that at the Helen mine, and these rocks are all regarded as Keewatin in age. No dioritic or gabbroic intrusives, however, were found in the vicinity of this range as they have been in some of the other ranges, nor were any dacitic lavas identified.

It is impossible to obtain exact measurements of the dip of the formations because on the north side of the ridge there is much drift and on the south side the formations are carbonatized and broken. It is, however, steep and to the north like that of the Lucy, Ruth, and Bartlett ranges.

Two Keweenawan diabase dikes cut the iron formation. One of these is 75 feet in width and of the porphyritic type. It crosses the iron formation, without displacing it, at right angles a quarter of a mile from the southwest end. As already noted, there is a strong deflection of the compass near this dike.

The other dike, which is of the common quartz diabase variety and at least 40 feet wide, follows a fault and is exposed on the east side of a gully. The iron formation is cut off sharply at the dike, which strikes at N. 37° W. Basic lavas lie opposite the banded silica across the dike.

It is probable that exploratory work would reveal other diabase dikes in this range because many fragments of this type of rock were found in a depression above the swamp lying south of the southwest section of the range. No diabase, however, was found there in place.

Faulting

At least three faults occur in the area (see Fig. 13). They are distinctly recognized in the field by the offsetting of the banded silica, by the presence of deep gullies along their courses, and in the topography as seen on aerial photographs. They are all branches of the Mildred Lake fault,[1] which splits into two branches under Lena lake. What is probably the main branch runs off at S. 37° E. and is followed by the quartz diabase dike described above. It cuts off the banded silica at its northeast end. As the displaced portion of the range has not been located, it is impossible to determine the direction or extent of the horizontal displacement. The fact that basic lavas lie opposite the banded silica on the northeast side of the fault and on the hanging-wall side of the silica southwest of the fault suggests a displacement of the right-hand side to the southeast. Such a displacement would mean that a continuation of the iron range should be found in that direction rather than to the northwest, nearer Lena lake. In view of the fact that all the other faults along diabase dikes have the right-hand block pushed to the northwest, it seems probable that the same relative movement has occurred here and that the basic lavas northeast of the fault have been pushed up to their present position from the southeast, from a band of greenstone lying south of the acid pyroclastics and volcanics that form the footwall of the banded silica. Such bands of greenstone occur south of the iron formation in the other

[1]See page 80.

ranges. If this supposition is correct, it would point to a large horizontal displacement along the fault and account for the great displacement at Mildred lake.

The second branch of the Mildred Lake fault runs from Lena lake southward, with a strike of about S. 15° E., across the east end of Wawa lake. Its course is marked by a gully with steep cliffs, and it has displaced the iron formation about 600 feet, with the east side moved relatively to the north.

A third fault branches off from the second just north of the iron range and strikes at about S. 20° W. toward Wawa lake. The offset of the iron formation is here, as on the second fault, about 600 feet, making a total displacement of the northeastern from the southwestern section of the range of approximately 1,200 feet. This fault is followed by a small creek draining a small lake on the north side of the iron range and by the portage from Wawa lake to Lena lake. It is also marked by prominent cliffs in the banded silica and acid pyroclastics.

Economic Geology

So far as can be seen in the field under present conditions, there is no siderite body of commercial importance exposed in the Eleanor range. Trenching would expose the siderite, but diamond-drilling will be necessary to determine finally whether bodies of commerical importance exist.

THE IRON FORMATION

The iron formation of the Eleanor range may be conveniently described under three sections, the Southwest, the Centre, and the Northeast.

Southwest Section

The Southwest is the longest of the sections, being more than 4,000 feet in length. It forms a prominent ridge made up of a series of elongated, short knolls arranged *en échelon* at a small angle to the strike of the banded silica member of the iron formation. There is a steep slope to the north where the banded silica underlies the surface and a gentler slope to the south where siderite, followed by acidic pyroclastics, occurs. Basic lavas lie to the north of the banded silica and underlie the valley on that side of the ridge. The ridge rises steeply from the flat and partly swampy land between it and Wawa lake.

In general, the iron formation strikes from N. 50° E. to N. 65° E. The banded silica for most of its length is about 100 feet in width, but toward the southwest end it first narrows to between 50 and 75 feet and then gradually dies out. This range certainly does not link up with the Helen range, more than half a mile to the west, as has often been suggested. The silica member fingers out into acid schists and pyroclastics, which are followed by a highly ferruginous zone of agglomerate with light-coloured fragments in a chocolate matrix, the colour being due to the weathering of carbonate.

The section terminates at its east end in a low, narrow, steep-sided ridge at the valley followed by the portage trail. It gradually increases in height towards the southwest until the top of the ridge is attained at a point about 650 feet from the trail.

The Southwest section is the only part of the range in which a definite siderite deposit was found. The greatest width observed was 25 feet on the footwall of the banded silica, 600 feet from the northeast end of the section. A composite sample containing disseminated pyrite was taken from the outcrop and analysed by E. Lahaye, of Algoma Ore Properties, Limited, at Sinterville. It ran: iron, 37.4 per cent.; and silica, 3.44 per cent. The analysis shows that it is siderite of good quality for the Michipicoten area.

This siderite member was observed at a number of places along the footwall of the banded silica throughout a length of almost 3,000 feet, but it appeared to be lenticular and some of the lenses contained lenticles of unreplaced schist.

Centre Section

The Centre section of iron formation is about 800 feet long, and it is offset from the other two sections by two faults, each with a displacement of about 600 feet. It trends about N. 56° E. and forms a low, narrow, steep-sided ridge. In the southwestern part of the section, which could be examined closely, the width of the banded silica is about 90 or 100 feet, increasing to the east to 125 feet. No siderite was found in this section. The banded silica is somewhat brecciated and rusty at some points.

Eastern Section

The iron formation in the Eastern section is 2,450 feet in length and stands up as a high ridge trending at N. 45° E. It outcrops at its southwest end as a vertical rusty mass in a very steep cliff, which is part of a fault scarp and lines up with a cliff of basic lavas to the north and another of acid rocks to the south.

The ridge has a steep north-facing slope down to the narrow lake lying on its northwest side. It ends to the northeast in a high cliff rising above a gully that follows a diabase dike and a fault. It was not possible to obtain data on the thickness of the iron formation along most of its length. At its southwest end, however, it is exposed in an almost inaccessible position in the cliff, where the thickness was estimated at 100 feet, the south 10 feet of which is composed of rusty rock, which weathers in a blocky manner somewhat like pyritic siderite. Although the lower part of the iron formation is rusty, no siderite was found. Coleman and Willmott,[1] however, mention about 25 feet of siderite in this section of the range.

[1]A. P. Coleman and A. B. Willmott, op. cit., p. 160.

CHAPTER VII

THE HELEN IRON RANGE

Introduction

The Helen is the best known and most important of the iron ranges that have been found in Algoma. Discovered in 1898, it was largely responsible for the great interest shown for many years in the Michipicoten area and for the discovery of most of the other iron ranges and of gold deposits as well. Oxide ore of iron in the Helen range was the feature of greatest interest because in the early days little attention was paid to the siderite.

In fact, the siderite in Helen hill was not at first recognized as iron ore. Some of it resembles felsite, rhyolite, or quartz porphyry so much that it is difficult for persons inexperienced with the ore to distinguish it in drill cores from one of these rocks, and it is not surprising that it was overlooked.

Mining of brown ore began in 1900 and continued until 1918, and the "Old Helen" was for many years the most important iron mine in Canada. When the oxide ore was exhausted, mining on the range ceased until 1939, when mining and sintering of siderite began. This operation has been actively carried on to the present time by Algoma Ore Properties, Limited, a wholly owned subsidiary of the Algoma Steel Corporation, Limited.

The senior author visited Helen Mine for a short time in September, 1943, collecting samples and data on the ore deposits. In 1944, most of the summer was spent by the authors, assisted by Ralph L. Alexander, in mapping the range and adjacent areas. A further visit was made to the property in August, 1945, by the senior author to check up on certain features and to see the results of work on the East (or Victoria) ore body.

Most of the mapping was done by plane table on a scale of 100 feet to the inch, but this method could not be employed in the areas thickly covered with green timber. In these, the standard method of traversing by compass and pacing was used. In the plane-table mapping, the topography as well as the geology was placed on the maps.

The publications relating to the various iron ranges of the Michipicoten area may be found on pages 2 and 3 of this report. In addition to those listed, there are a considerable number of articles dealing particularly with the mining operations and the production and utilization of the ore of the old Helen mine. These are found in all the annual reports of the Ontario Bureau of Mines for the years 1900 to 1919, inclusive.

Acknowledgments

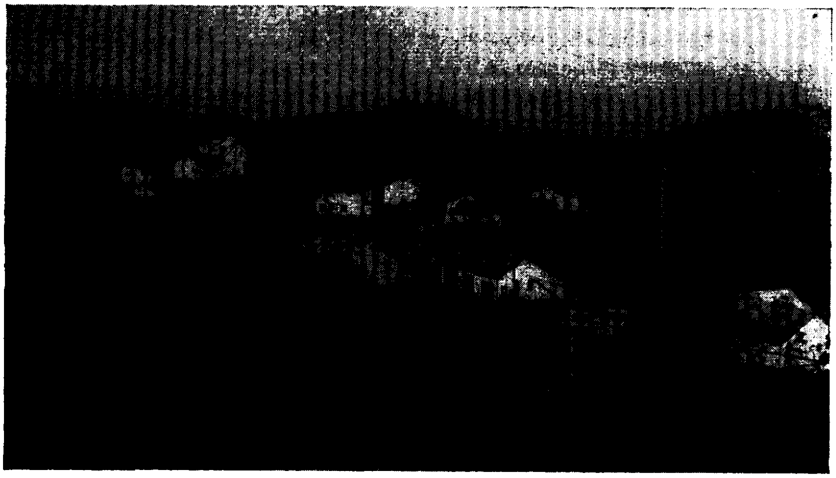
During the work on the Helen range, the writers' party enjoyed unstinted hospitality at the mine and very generous help from the staff of Algoma Ore Properties. Maps and data of all kinds were frequently placed at their disposal, and sincere thanks for their many courtesies are expressed to S. J. Kidder, manager of the Helen mine; Carl Beck, superintendent; G. C. McCartney, geologist; J. McConnell, superintendent of the sintering plant; the members of the Engineering department; and others.

Location and Transportation Facilities

The Helen range is situated in the southern part of township 29, range XXIV, district of Algoma. It extends 2¼ miles east from Talbot lake on the

Michipicoten branch of the Algoma Central and Hudson Bay Railway, and the mine is near the centre of the range. Helen Mine is 11 miles by railway from Michipicoten Harbour on Lake Superior. A spur, 1¾ miles long, runs from Helen Junction on the Michipicoten branch, 9¼ miles from the harbour, to the old mine on Boyer lake at the foot of Helen hill. This spur served for the transport of the ore from the old mine but is now used only occasionally for coal and heavy machinery. Heavy freight is hauled up to the mine level from Boyer lake on cable cars running on an incline, just as supplies were lifted to the level of the camp at the old mine.

There is no passenger railway service to the mine. Passengers detrain at Wawa station, from which a good highway about 3¾ miles long, with a very steep grade, climbs up to the mine. A regular bus service is maintained between Wawa and the mine.



Helen Mine village at the foot of Helen hill, with agglomerate hills in the background.

Wawa village, which is the main settlement in the area outside of Helen Mine, has a beautiful situation on a large sand plain around the end of Wawa lake. Helen Mine and Sinterville, which is near Wawa, are two attractive villages newly built for the employees of the mining company.

A motor road runs from Wawa to Michipicoten Mission on Lake Superior near the mouths of the Michipicoten and Magpie rivers. There is, however, no road extending beyond the area.

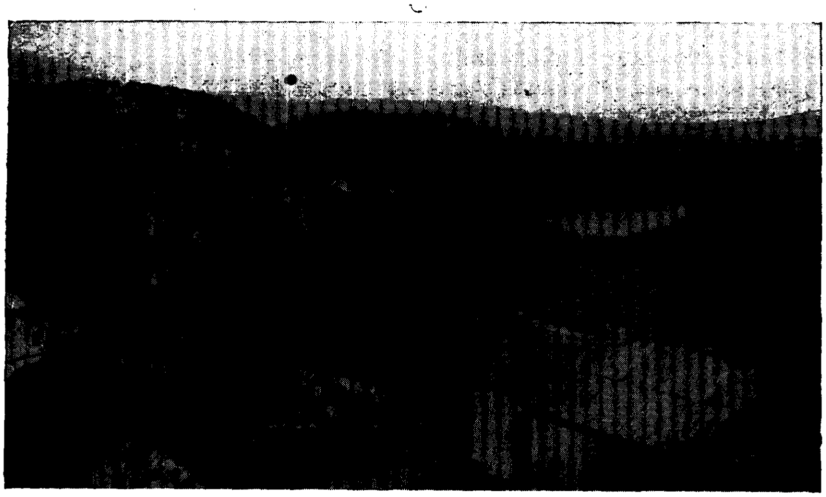
The ore from the mine is carried by an aerial tramway, about 3 miles long, to Sinterville, where it is sintered. The sinter is transported by rail to Michipicoten Harbour and then moved by water to the blast furnaces around the Great Lakes.

Topography

The region along the northeast shore of Lake Superior is one of the most rugged in Ontario, and the Helen iron range forms one of its high ridges. Lake Superior has an altitude of 602 feet and Helen hill of 1,725 feet, a relief of 1,123 feet in 7 miles direct line. The altitude of Wawa station is 961 feet, and that of the camp at Helen Mine, 1,420 feet.

The iron range lies between the Magpie and Michipicoten rivers, but all the drainage from the area is toward the Magpie, which flows around the range only a few miles north and also west of Helen Mine.

Wawa lake, which has an altitude of about 955 feet, is a large body of water surrounded by rugged hills except at the southwest end. It has a length of 5 miles and maximum width of 1 mile. Numerous other lakes are found in the map area, and some of considerable size, such as Talbot, Lagarde, and Walbank, are situated close to the iron range. Boyer lake lies in a deep depression in the iron formation at the foot of Helen hill. Its altitude is 1,244 feet, and the hill just east of it rises to 1,725 feet. Sayer lake, almost immediately west of Boyer, is also in the iron formation and is deep for its size. The water is about 100 feet deep, and attempts to penetrate the drift in the bottom of the lake by drilling from the ice were not successful. It is believed to be quite thick. Boyer lake was almost dewatered when the old mine was working, and it is about 130 feet



View from Helen Mine of the agglomerate hill south of Boyer lake. A band of conglomerate grading into agglomerate runs through the right side of the hill.

deep at the deepest point a little west of the centre. These two lakes have much the appearance of glacial cirques, especially Boyer lake. They owe their position and depth mainly to the ease of weathering of pyrite and carbonate in the iron formation and its resulting deep erosion by water and ice action.

The banded silica of the iron formation is the main ridge-forming rock of the area. The range begins at the west end of Talbot lake, which has an elevation of 1,091 feet and gradually rises to a maximum altitude of 1,725 feet in Helen hill. The ridge here descends to the north in a number of cliffs to a comparatively low area of greenstone and pyroclastics lying at approximately 1,400 feet altitude and cut by ravines bordered by steep cliffs. There is a further steep drop into a depression running east from Talbot lake. On the south side of the range there is a rapid descent into the large valley occupied by Spud and Wishbone lakes, the former at an altitude of 1,421 feet and the latter at 1,380 feet.

East of the ore deposits, which occur in the highest part of Helen hill, the range descends a little towards the Walbank Lake fault, where it is offset 1,800 feet to the northwest. Walbank lake has an altitude of only 1,149 feet, and to the east of it the iron formation does not form a conspicuous ridge. A great gully follows the Walbank Lake fault and the diabase dike along the fault between Walbank and Wawa lakes. This gully is not very prominent at the south end of

Walbank lake, but it gradually deepens and steep cliffs appear, with a deep canyon in some sections. Walbank lake, however, drains westward.

In addition to the iron formation, the agglomerate and rhyolite form conspicuous hills. The high hill on the south side of Boyer and Sayer lakes is composed of agglomerate with a local band of conglomerate. The conspicuous hills seen south of the highway between Wawa and the mine, 2,000 feet southeast of Moran lake, are composed mainly of rhyolite. These hills rise 240 feet above the deep valley lying between them and the highway and in places end in high cliffs on their south edges.

Stratigraphy

The formations of the Helen area have been classified in various ways by the geologists who have worked on it. Only a few examples of previous classifications will be given. Coleman and Willmott[1] mapped all the granite in the region as Laurentian; the Doré conglomerate as Upper Huronian; and the Eleanor slate, Helen iron formation, Wawa tuffs, and Gros Cap greenstone as Lower Horunian. Twenty-four years later, Collins and Quirke[2] mapped the conglomerate as Doré, some of the lavas and pyroclastics and some granite as pre-Dorean, and some of the lavas and pyroclastics and the iron formation as post-Dorean. They also showed later granite and gneiss and the Keweenawan diabases. Later workers in this region have assumed that the lavas, pyroclastics, and iron formation are Keewatin; the Doré, Timiskaming; and the exposed granites, Algoman. The granite boulders in the Doré conglomerate must have come from an older granite, which is usually called Laurentian, the term originally used by Coleman and Willmott, although they also included the younger granite in the Laurentian.

No large bodies of granite occur in the area covered by this report, but there is one on Gull lake half a mile north of Walbank lake; there is no Doré conglomerate. The classification adopted for this report is as follows:—

CENOZOIC	
QUATERNARY:	Glacial drift (Pleistocene) and alluvium (Recent).
	Great unconformity
PRECAMBRIAN	
KEWEENAWAN:	Diabase, including some quartz diabase.
	Intrusive contact
	Porphyritic diabase.
	Intrusive contact
	Quartz diabase.
	Intrusive contact
ALGOMAN:	Siderite and pyrite.
	Lamprophyre dikes; dioritic dikes, including kersantite and related ottrelite rocks; feldspar porphyry.
	Intrusive contact
HAILEYBURIAN:	Gabbro and diabase; metadiorite.
	Intrusive contact
KEEWATIN:	Quartz porphyry, ottrelitized.
	Intrusive contact
	Pyroclastics (Wawa tuffs): acid agglomerate and tuff, and sericite-carbonate schist derived therefrom.
	Basic volcanics: partly ellipsoidal lava, some basic tuff, chlorite schists derived therefrom.
	Helen iron formation: banded silica member.
	Pyroclastics (Wawa tuffs): acid agglomerate and tuff, sericite-carbonate schist, and ottrelite schist; local bands of conglomerate.
	Acid lavas: rhyolite and felsite, and ottrelite-carbonate-sericite schist derived therefrom.

[1]A. P. Coleman and A. B. Willmott, "The Michipicoten Iron Region," Ont. Bur. Mines, Vol. XI, 1902, accompanying map(11a).

[2]W. H. Collins and T. T. Quirke, "Michipicoten Iron Ranges," Geol. Surv. Can., Mem. 147, pt. 1, 1926, map No. 1972.

KEEWATIN

The Helen area is predominantly underlain by acid rocks of the Keewatin type: pyroclastics, rhyolite, and felsite. The occurrence of acid agglomerate and tuff is the most conspicuous yet found by the writers in any one area in the Canadian shield. Coarse agglomerate is particularly prominent, especially south of the iron range; the abundance of ottrelite in the rocks of the area, especially in the acid rocks, is another unusual feature. A considerable area of basic lava lies north of and stratigraphically above the iron formation.

Large areas of intrusive greenstone were found. This rock has previously been lumped by geologists working in the region with the Keewatin greenstones, along with the lavas, but its later age and intrusive relations have been so definitely proved that there is no doubt that it is a stratigraphical unit and should be separated from the Keewatin greenstones, which are dominantly extrusive.

Basic Lavas

An area of basic lava, about 2,000 feet wide, extends north from the banded silica in Helen hill. Rocks formed previous to the deposition of the silica were almost entirely acid in composition. Following the formation of the silica and a cessation of violent volcanic activity, vulcanism was renewed on a grand scale, but instead of acid lavas and pyroclastics the extrusions were for a time almost entirely basic in character. These lavas immediately overlie the silica in an area between Talbot and Walbank lakes. They are much like the andesites and basalts constituting the Keewatin greenstones of other areas. Pillows are numerous and there is much amygdaloidal lava. The pillows have their tops to the north, showing that the lavas face in that direction. A good locality in which to see the pillows and amygdaloids is just north of Boyer lake beyond the ridge of banded silica.

Extrusions of basic composition gradually gave way to those of more acid character. Along the north border of the greenstone area, acid pyroclastics are interbedded with basic pillow lavas and some basic tuff, and they become dominant to the north. They are similar to those underlying the banded silica south of the range.

In a few places, the basic lavas give evidence of being more acid than the average greenstone. In the valley, 700 feet north of the outlet of Sayer lake, a patch of light-coloured lava occurs in the greenstone. It appears to grade into the typical basic lava and it contains small pillows, more like those sometimes seen in rhyolite and trachyte than the larger ones typical of andesite.

In thin section, this rock is seen to contain much quartz, some hornblende, biotite, and untwinned feldspar. Iron carbonate, pyrite, and magnetite are present. The feldspar grains and the matrix are sericitized, and the exact composition of the feldspar can not be determined. The lightest-coloured portion of the rock has the appearance of rhyolite, but it is difficult to determine whether it was originally a rhyolite or whether it is an acidified andesite, since the pyrite, carbonate, and magnetite have apparently been introduced into the rock and this makes it possible for much of the quartz also to have been introduced. Small and irregular injections of granitic rock cut the basic lavas not far from this rock.

Another occurrence of apparently quite acidic rock grading into the basic lava was observed farther east near the foot of the large waste dump from the pit on the West ore body.

Pyroclastics

Tuff and agglomerate, which are widely distributed in the area, are very acid in character. The tuff is composed mainly of quartz grains, with grains of feldspar and numerous scales of sericite making up most of the rest of the rock. Much of the tuff has been sheared to a yellow or greenish-yellow, fissile sericite schist. Most of the tuff contains some ottrelite, and part of it a great deal of this mineral. The tuff is fine-grained to coarse, grading into agglomerate. In places, narrow bands of arkose occur in the tuff.

Agglomerate constitutes an unusually large proportion of the pyroclastics in many sections of the map area. It contains small to large fragments, which are almost all composed of rhyolite, others being felsite and quartz porphyry, with a few of greenstone. The fragments have a maximum length of 6 feet and vary from sharply angular to nearly round. The acid agglomerate weathers white, creamy white, or greenish-white, and some of the hills of the rock stand up as conspicuous white masses (see photograph on page 89).

Very little basic tuff or agglomerate occurs in this area. A small amount is found near the top of the series of basic flows lying north of the iron range and represents a renewal of the explosive type of volcanic activity that produced so much of the acid tuff and agglomerate that is found north of the basic lavas.

Immediately south of the southern zone of banded silica, which lies along the south side of the ore bodies in the eastern part of the ore zone, there are irregular bands of what appear in the field to be basic tuff and agglomerate. It is mostly a dark, white-spotted rock, with white fragments in a dark-brown matrix. In thin section the white bodies, which are angular to round, are found to be composed of quartz. Many of them consist of a group of intergrown quartz grains. The matrix contains much introduced ferruginous carbonate, now largely oxidized. Considerable quantities of grünerite are also present, and this mineral and the iron oxide from the carbonate account for the dark-coloured matrix and give the rock the deceiving appearance of being more basic than it is.

The term "Wawa tuffs" was suggested more than forty years ago by Coleman and Willmott[1] for the acid pyroclastics near Wawa lake. This term is now considered to be properly used in a lithological sense rather than stratigraphically because the rocks formed both early and late in the Keewatin period. The later ones are separated in the central section of the area by the banded silica and a thick series of basic lavas. Where they occur north of and stratigraphically above the iron formation, they are similar to those on its south side and below it.

Large areas of rhyolite occur in this region, and a number of flows are interbedded with the pyroclastics. Where the rhyolite is highly schisted, it is not always possible to distinguish it in the field from acid tuff because they both give rise to ottrelite-carbonate-sericite schist. Large bodies of rhyolite occur in the prominent hills south of the highway and 2,000 feet southeast of Moran lake. It may be assumed that this region was largely underlain by rhyolite before so much of it was broken up by volcanic explosions to form the large quantity of tuff and agglomerate. *Lithophysae* were observed in some of the flows.

Quartz Porphyry

Several bodies of typical quartz porphyry occur in the area. One of these is found on the south edge of the west end of the pit on the West ore body in Helen hill. It extends from the top of the hill down almost to the road leading from the village up to the mine. Another forms a prominent knoll at the northwest corner of Spud lake. The third area in which this rock is well exposed contains several

[1]A. P. Coleman and A. B. Willmott, op. cit., p. 155.

separate intrusions. At the southwest corner of the map area, 400 feet east of the highway, there is a prominent hill of this rock. Other bodies outcrop conspicuously along the valley to the northwest, beginning about 800 feet from the one last mentioned.

The quartz porphyry intrusions have the form of plugs and long narrow bodies following the trend of the formations they intrude. They are slightly schisted, and some of them weather white, so that they stand out conspicuously. The rock near the mine is stained yellowish-brown from oxidized carbonate. All the outcrops show phenocrysts of quartz and some a few of feldspar; ottrelite is commonly present.

Thin sections of this rock show numerous phenocrysts of quartz, some of them with imperfect crystal outlines and others with the edges absorbed by the matrix. Many of these are cracked and displaced because of shearing. Some specimens contain small phenocrysts of orthoclase, some of which are much sericitized. Distinct blades of muscovite are seen in some sections. The groundmass is fine-grained and highly sericitized. Almost no ferromagnesian material is present except ottrelite, which is fairly abundant in some specimens and shows, by its occurrence along fracture lines, evidence of having been introduced into the rock.

The quartz porphyry was at first regarded as younger than the pyroclastics and probably Algoman because such rock is often found associated with Algoman granite in many other regions. It is definitely intrusive in the tuffs and agglomerates surrounding it, but it is also distinctly cut, in one locality at least, by the basic intrusives that are regarded as Haileyburian. It is now considered to be genetically related to the Keewatin rhyolite but intrusive in nature.

Helen Iron Formation

The Helen iron range is not so long as some of the other ranges in the Michipicoten area, being only about 2½ miles as compared with the original range of which the Lucy, Ruth, and Josephine-Bartlett ranges are segments and which was more than 6 miles long. The other ranges are, however, not as wide.

The banded silica member comprises by far the larger part of the iron formation, in fact all of it, except where the siderite-pyrite bodies occur near the mine. The rock is similar to that in the other Michipicoten ranges carrying siderite-pyrite deposits. Little of it is jasper, as is the case in so many iron ranges in other regions. It consists of granular silica, which, owing to metamorphism, has crystallized as small grains about 0.07 to 1.25 mm. in diameter from the cryptocrystalline state in which individual grains of silica could not be recognized by the naked eye. It is believed to have crystallized from colloidal silica in the form of a gel. For a discussion of the origin of the silica, see pages 3 to 6.

The enormous quantity of silica, originally so comparatively free from iron, in the Michipicoten ranges is attributed to the unusually large quantity of acid tuff available to supply silica. The large proportion of acid tuff in this region, as compared with that in many other iron range areas, is a striking feature; and in most ranges where much iron was originally deposited with the silica, basic rocks underlie the banded silica. It is distinctly banded, with bands ranging in thickness from a small fraction of an inch to more than an inch. Originally the rock was composed of little but silica, but siderite and pyrite have been introduced into much of it, so that on weathering it turns reddish, yellowish, or brownish through the alteration of these minerals to iron oxides. Many bands are greenish or brownish due to the presence of amphiboles, such as hornblende, actinolite, and grünerite, or to chlorite. These minerals have been developed from small quantities of iron, alumina, lime, and magnesia deposited along with the silica when it was precipitated from solution.

On the knoll in Helen hill near the most westerly of the two large diabase dikes, a considerable variety is found in the banded silica in an area only a few feet in diameter. Four specimens were selected. One is a bluish-grey massive rock full of needles of amphibole. Another is a rather dense, light-grey silica with numerous specks of brown iron oxide. The third is dark-brown and full of amphibole needles. The fourth is distinctly banded, one half being granular silica and the other a massive bluish-grey rock with many needles of amphibole. Under the microscope the first specimen and half of the fourth are found to consist mainly of grünerite. The second and third are chiefly fine-grained silica, with siderite, iron oxide, grünerite, and disseminated magnetite. More magnetite is found in the vicinity of these diabase dikes than was observed elsewhere in the range. Some

Brecciated banded silica between Talbot and Sayer lakes.

of this may have been formed from carbonate by the action of heat from the dikes, but it is believed that most of it resulted from the great deformation of the iron formation in this section of the range, because the rocks are severely folded near the dikes.

The banded silica in some places is greatly brecciated, and the fragments of the broken bands are surrounded by pyrite and siderite, or one or the other of these minerals. The most remarkable illustration of brecciation seen was found near the west end of the range. Along the railway spur from the outlet of Sayer lake to Talbot lake, the rock is tremendously broken up (see photograph above) because of compression and twisting of the formation. In some places the rock is highly folded into small complex folds, but it is not folded to anything like the extent that many of the jasper formations are folded in other areas, such, for example, as the Goulais River range.

The silica in most places is so hard and so resistant to weathering that it stands up as a great ridge in Helen hill. It is a long tabular mass standing almost vertically, except at its west end where the bed is folded and split into two bands. The dip for most of the range is from 70° to 80° S., but in places it is vertical. As the silica band faces north, folding caused it and the adjacent rocks to be overturned from 10 to 20 degrees.

The structure at the west end of the range, at Talbot lake, is confusing. The silica splits into two bands, one wide and the other narrow, the wider one ending abruptly, as shown on map No. 1946-5a. These bands are separated by a considerable area of acid agglomerate, and whether the agglomerate was deposited in that position near the border of the basin in which the silica was being deposited or whether it has been squeezed up from below into the silica bed; thus splitting it apart, is not clear. The extreme brecciation of the silica in this section of the range and the deviation of the strike of the formations from the general trend in some places leads to the conclusion that the split is due to deformation and that the mass of agglomerate has been folded up beneath the silica. Elsewhere the silica member retains an almost regular homoclinal attitude.

The iron formation fingers out at the east end of the range along the shore of a small lake. Between its end and Walbank lake, it has a thickness of between 70 and 130 feet, and it is narrow near the shore of the lake. Beneath the lake it is offset 1,800 feet to the northwest by a large fault followed by a diabase dike. It is evident that there was vertical as well as horizontal displacement on the fault because on the southwest side of the dike the banded silica is believed to be about 500 feet wide. No precise measurement of width could be taken because of the heavy drift and talus overburden and the forest cover. The formation widens a little to the west, and across the East ore body,[1] in Helen hill, the following section was measured from north to south: main banded silica zone, 260 feet; siderite, 85 feet; banded silica ("D" zone), 65 feet; siderite, 140 feet; and banded silica, 12 feet; total, 562 feet. These figures are for actual thickness and not width of outcrop and apply to only one section. The thickness of other sections would vary considerably from the figures given, the siderite being wider in some places and narrower in others.

A section across the West ore body toward the west end of the pit shows the following thickness for the iron formation from north to south: main banded silica zone, 600 feet; siderite, 210 feet; banded silica, 8 feet; total, 818 feet. At the west end of Boyer lake, the banded silica is about 965 feet thick, and on Sayer lake more than 1,000 feet. In the latter section the silica is twisted about a great deal, and an exact measurement of the thickness is not obtainable.

It should be observed that the figures given above are for thickness and not width of outcrop, which in most places would be higher. Marked changes in thickness are found within short distances.

No ore has been found in the range except in Helen hill and a little at the east end of the range. The siderite occurs beneath the banded silica, as it was originally formed, although the ore is really on the footwall of the silica in most places, owing to the slight overturning of the formations to the north. The relations here are similar to those in all the other Michipicoten ranges which contain carbonate ore and in which banded silica is present. A zone richer in pyrite usually lies between the best siderite ore and the banded silica. The position of the ore bodies is explained as being due largely to structural control during the formation of the ore.

Although no commercial ore bodies occur outside of Helen hill, a considerable amount of siderite is scattered along the south side of the banded silica throughout most of its length. Pyrite also occurs, in some places almost in commercial quantities. Between Boyer and Sayer lakes and along the south side of Sayer, there is a large amount of pyrite. This has been tested by an adit on the south shore and by pits in other places. Considerable quantities of this mineral

[1]This is now known as the Victoria ore body.

also occur in the brecciated silica near the outlet of Sayer lake. Pyrite in some amount is present in all parts of the range.

The banded silica is not entirely free from interbedded rock. On the northwest shore of Boyer lake, a lens of agglomerate occurs in the silica, and in the East ore body there is a zone of ottrelite schist within the siderite that has not been completely replaced by carbonate.

The Josephine-Bartlett area has several thin iron formations below the main range. No such zones of banded silica occur with the Ruth or Lucy ranges. None were found with the Helen range except for thin bands almost immediately below the siderite, the main silica zone being above the siderite. A narrow zone of banded silica runs along the south side of the ore bodies in Helen hill. That along the West ore body is from 5 to 12 feet wide, and in places it is in contact with the siderite and forms the hanging wall. That along the East ore body is a little wider. Then there is what is known as the "D" zone within the ore body. The relations of these bands of silica to the siderite are due to the fact that before the main silica deposit was formed, thin layers of banded silica were laid down. These were each overlain by thick beds of acid tuff, and they in turn by the main deposit of banded silica. The siderite and pyrite replaced these beds of tuff, leaving the beds of silica almost unreplaced. That the siderite was formed by replacement of tuff has long been accepted, and the remnants of tuff found in the East ore body strongly support this conclusion.

Evidence that a little banded silica was formed even before the bands mentioned above lies in the fact that a few fragments of this rock were found in the conglomerate under the warehouse at the mine. The rock was evidently broken up by the volcanic eruptions that produced the tuff and agglomerate.

Clastic Sediments

Bands of conglomerate were found in two places. The most conspicuous occurrence may be seen beneath the warehouse at the mine on the south side of the iron formation. It contains pebbles of rhyolite, chert, and quartz, and a few of banded silica.

Traces of this rock were found east of the warehouse, as, for example, near the water tower, but it extends westward as an irregular zone in the agglomerate composing the large hill lying just south of Boyer lake. It grades into the agglomerate in such an irregular way that in many places it is only a matter of opinion as to whether the rock in some places should be classed as conglomerate or agglomerate. It is composed mainly of waterworn fragments of the agglomerate and is therefore mapped with the Keewatin pyroclastics.

Another narrow band of similar conglomerate occurs in the agglomerate just south of the subsidiary band of silica that lies on the south side of the East ore body in Helen hill. These bands of conglomerate are the result of water action in the area, and their presence is thought to have foreshadowed the coming of the water deposition of the large body of banded silica. The silica was undoubtedly deposited in a large basin of water, which must have existed in the region for a considerable time. It represents a period during which volcanic activity had almost ceased, to be renewed later after the banded silica had been deposited.

HAILEYBURIAN(?)

Many large and small bodies of intrusive greenstone outcrop in the Helen area. Previous writers have included these with the Keewatin lavas. They are, however, definitely intrusive in form and in contact relations to the adjacent rocks; and as they are all very similar in composition, they seem to constitute a unit. They are, therefore, considered a separate formation. Their age, however, is somewhat indefinite. They intrude the Keewatin formations and are intruded by the dioritic dikes, which are considered Algoman. Because of the abundance of basic rocks in the Haileyburian in other areas and of the stratigraphical position of the above rocks in this area, they are tentatively classified as Haileyburian or early Algoman.

These rocks are mostly medium- to coarse-grained and brown, green, or grey in colour. They tend to weather brown because of the oxidation of ferruginous carbonate, which is abundant in most places. Some specimens are quite chloritic and some have a mottled appearance on the fresh surface.

Thin sections indicate that most of the original rock was gabbro and diabase now altered to metadiorite. In some sections the feldspars are almost completely replaced by carbonate. In others they are fresh enough to be identified as andesine and labradorite. The pyroxene is mostly altered to serpentine and chlorite. Part of the titaniferous magnetite and ilmenite is altered to leucoxene and part to brownish-yellow titanite, which occurs in groups of small crystals. Much quartz is scattered through some thin sections, apparently introduced with the ferruginous carbonate and pyrite, which are often present. Some sections contain ottrelite, and some show blades of muscovite, which were formed at a late stage because they cut indiscriminately across various minerals. Cordierite was found in specimens taken from the prong of greenstone that cuts into the West ore body.

The intrusive greenstone is of much importance in the Helen mine, because a large prong of one of the intrusions projected across the West ore body and cut out a large quantity of ore. It was intruded from south to north through the tuff and into the banded silica, and when the siderite ore was formed it failed to replace this basic rock as it did the tuff. The basic rock is highly carbonatized, but no appreciable quantity of basic rock has anywhere in the area been sufficiently replaced to make ore. Throughout the Michipicoten area, the siderite-depositing solutions had a distinct preference for replacing the acid rocks.

Several small and later dikes cut this greenstone in the mine.

Basic intrusives, similar to those described, occur south of the Lucy iron range, and it is probable that an ancient diabase intrusion in the bottom of Parks lake at Josephine may be of the same age.

OTTRELITE ROCKS

The abundance of ottrelite is one of the most conspicuous features of the Helen area, and it is probable that no other area contains so much of it. This mineral has been mentioned previously in the discussion of the Josephine-Bartlett range, but it is much more abundant here.

Ottrelite and chloritoid have not been fully distinguished by the mineralogists, and there is a great opportunity for some mineralogist to make a thorough study of the ottrelite in the Michipicoten area. Chloritoid is generally regarded as a hydrogen-iron-magnesium-aluminium silicate, and ottrelite as similar in composition but with manganese replacing the magnesium. None of the descriptions found satisfactorily fit the mineral that is so abundant in the Michipicoten area. Further, these minerals are always described in the textbooks as occurring in metamorphosed sediments, whereas the ottrelite in the Michipicoten area occurs in a variety of rocks, acid and basic, and relatively little of it is in sedimentary rocks. It is found in acid tuff and agglomerate, quartz porphyry, rhyolite, and greenstone. In most places it is definitely not, as suggested by Collins and Quirke,[1] a primary mineral. It has formed along cracks in some

[1] W. H. Collins and T. T. Quirke, op. cit., p. 30.

rocks, and the crystals have no orientation in schisted rocks, showing that they developed after the schisting had occurred. It is most abundant in the acid tuff and in many places constitutes a large percentage of the rock, giving it a greenish to bluish to dark-grey colour. It shows considerable evidence of selective replacement in that some bands of tuff are largely replaced and others very little, and it is not always evident why this should be so because no appreciable difference in the bands can be observed in thin sections.

The colour of the ottrelite varies greatly, yellowish-green, blue-green, greyish-blue, and plum-blue shades being common. The pleochroism is weak to strong, blue-green or greenish-blue and yellowish-green being the most frequent shades. The colour is not uniformly distributed in many crystals. The central portion may be blue and the border zone greenish-blue, green, or yellowish-green. In one specimen an hour-glass structure was observed. The colour may also be patchy in distribution.

The ottrelite crystals may be distinct columns, which are often needle-like and arranged in rosettes or sheaves, or rectangular in outline and either long or short. Many have ragged borders. An imperfect cleavage, or fracture, perpendicular to the long axis and polysynthetic twinning are two of the most characteristic features of the crystals. In a few specimens there is good cleavage parallel to the long axis.

In the vicinity of the Helen mine, the ottrelite is most abundant along the south side of the iron range. It is mainly confined to the formations that are stratigraphically below the iron formation. Its position in them is thus similar to that of the iron carbonate. Bands of ottrelite-rich tuffs and dikes may be found in this section of the area. The dark, greyish-brown intrusions in front of the warehouse are full of the mineral. In the low hill south of the highway where it leaves the staff-houses, a massive tuff has unusually large crystals of ottrelite. In the field it resembles an intrusive igneous rock. Streaks of ottrelite-rich, only partly replaced tuff occur in the ore bodies.

The abundance of ottrelite in the rocks in some places together with the occurrence of a group of peculiar dikes near the mine have presented difficulties in the field. It is almost impossible sometimes to be sure whether a dark rock is an intrusion or a narrow ottrelite-rich band of tuff that has been deformed in folding.

In the large hill of tuff southeast of the highway, opposite the staff-houses, there is a very irregular body of medium-grained, dark-grey rock weathering brown. It is from 2 to 20 feet wide and it branches. In the field it strongly resembles an irregular intrusion, but in thin section the rock is found to consist mainly of quartz, ferruginous carbonate, and ottrelite and it strongly resembles some of the tuff. In the field this rock is similar to the dark-grey rock in front of the warehouse.

In the East ore body, near the centre of the southern ore zone, is another irregular band a few feet wide. In some places it is a distinct coarse ottrelite tuff with much pyrite and some chalcopyrite, but in others it has the appearance of a dike. Its form and its relations to the adjacent rocks strongly point to there being an intrusion in that zone. Some of this dark rock has a groundmass of quartz and sericite with disseminated magnetite, a little pyrite and carbonate, and much ottrelite. The presence of a considerable amount of magnetite with much ottrelite is characteristic of some of the smaller dikes to be described later. In the hand specimen the rock is medium-grained and dark-grey, and it shows glistening faces as if it were full of chlorite.

The cause of the formation of so much ottrelite in this area and its source are interesting problems. It occurs in all the rocks that have been regarded as older than the Algoman dikes, except the basic lavas, and in a few intrusions that are probably early Algoman. The latter appear to be related to intrusions that have been found in the other iron ranges described in this report and regarded as Algoman. The ottrelite is older than the siderite because the latter is found partially replacing crystals of ottrelite. Its abundance in some dikes and in an area where siderite is almost universally present suggests that the mineral was introduced into the area in early Algoman time. Further, it is evident that its existence is in some way genetically related to the igneous activity that produced the unusual group of dikes and the uncommonly large quantity of iron carbonate.

ALGOMAN

The siderite ore bodies, the small veins of carbonate, the quartz-carbonate veins in which the carbonate is mainly ankerite, the small quartz veins, and a group of dikes and other small intrusions are regarded as of Algoman age. The siderite deposits and quartz veins will be described in the section on Economic Geology.[1] No large bodies of granite or other acid intrusive rocks occur in this area. The nearest large masses of granite are on Gull lake half a mile north of Walbank lake and on the southeast side of Wawa lake. A few small irregular injections of granite and orthoclase porphyry occur in the Keewatin greenstone on the north edge of a hill about 1,200 feet north of Boyer lake. Farther east, in the valley on the north side of Helen hill and about 800 feet north of the west end of the West ore body, an intrusion of feldspar porphyry occurs in the basic lavas. This rock is quite fresh in appearance and fairly coarse grained, and it contains numerous phenocrysts of orthoclase and albite. The groundmass consists of sericite, quartz, and feldspar. In thin section the feldspars are seen to be partly sericitized.

Basic to Intermediate Dikes

A group of peculiar dikes occur in this area. They mostly fall in the diorite family of rocks, and some of them are difficult to classify satisfactorily.

A dike running almost parallel to the large diabase dikes cutting through Helen hill between the ore bodies is from 4 to 9 feet wide. It cuts through Helen hill at the constriction in the West ore body caused by the greenstone intrusion. It was traced for more than 3,000 feet. The rock is dark-grey, fine-grained, and dense and in places is spotted with pyrite. Thin sections show that in some places the dike contains much primary hornblende and in others much chlorite, apparently derived from biotite. Little feldspar occurs and what is present is untwinned, but considerable quantities of disseminated magnetite and some carbonate and quartz are found, the last two minerals being introduced. The rock apparently belongs in the diorite-syenite group of rocks.

Several other dikes cut the formations in Helen hill. About 200 feet east of the one described above and south of the East ore body, is a large dike, which is as much as 80 to 100 feet wide in one section but pinches down to about 10 feet in other sections. It has several branches, and some of them also pinch and swell in an abnormal way. The rock in these dikes weathers to a soft, yellowish-brown or red-brown material owing to oxidation of ferruginous carbonate, which is abundant in the rock. On the fresh surface, the rock is light- to dark-grey with small phenocrysts of feldspar showing in some specimens. Thin sections show the feldspar to be albite to oligoclase in composition. Some sections show much hornblende, and others many patches of chlorite, evidently derived from biotite. Considerable quantities of quartz occur in the rock, but it may

[1]Pages 108 to 113.

have been introduced along with the carbonate. These dikes are regarded as kersantite, a variety of mica diorite.

A 20-inch dike in the south wall of the pit on the West ore body is dense, fine-grained, and dark-grey in colour. It has been largely replaced by siderite and quartz but contains much chlorite and preserves the outlines of crystals that appear to have been hornblende. Other small dikes from 2 to 4 feet wide cut through the greenstone prong that projects into the West ore body. These are composed of fine-grained, massive, dark-coloured rock. Thin sections mostly show the rock to be highly altered, carbonatized, and silicified. They all contain much magnetite, which occurs in grains, rods, and needles. This mineral cuts through siderite grains as if it were later than the siderite, but it is regarded as a primary constituent of the rock and it is probable that the siderite failed to replace it. Some thin sections show much chlorite, apparently derived from biotite, and others much serpentine and some epidote. In some sections, feldspar, near andesine in composition, can be recognized, but others show little or no feldspar. These dikes were considered as lamprophyres containing much biotite or hornblende.

Another lamprophyre dike has been exposed in the pit on the East ore body near the entrance. This dike cuts transversely across the ore body. It is from 2 to 4 feet wide, very dark grey, fine-grained, and somewhat schisted. In thin section it is found to consist of a mat of chlorite, with some sericite, aggregates of leucoxene and sphene, and a few grains of quartz and brownish tourmaline. No ottrelite was found in any of the dikes described.

A dike, 4 feet wide, related to some of those described above, outcrops at the west end of Spud lake. It outcrops for only a short distance, but a similar dike was found in the hill to the north. It is a dark-grey, brown-weathering rock, medium-grained and full of crystals of magnetite. So much of this mineral is present that a magnet readily picks up small chips of the rock. A thin section shows much hornblende and large grains of magnetite scattered throughout, which are believed to be primary in origin. No feldspar is present, but extensive carbonatization may have replaced any of this mineral that was originally present. Fine-grained quartz was probably introduced with the carbonate. A few grains of ottrelite are present.

Reference was made in the discussion of ottrelite rocks to the peculiar ottrelite-rich rocks near the staff-houses and the warehouse and in the East ore body. The difficulty in their determination as true igneous intrusions was mentioned. These rocks, however, seem to be members of the group of unusual dikes described above.

The rock in front of the warehouse shows considerable variation in character. It is medium- to fine-grained and grey-brown to very dark brown on the weathered surface. Some specimens have a distinct sheen, and some of the rock breaks up into very irregular and angular fragments. Several thin sections show that one specimen is composed mainly of a dirty-green hornblende, ottrelite and magnetite, and some quartz. The ottrelite is mainly in very striking rosettes and sheaves of long narrow crystals. The magnetite is most abundant in these. Similar ottrelite is found in the adjacent tuffs near the head of the stairway leading down to Boyer lake. Some of this ottrelite tuff is so dark and massive that it is almost impossible to distinguish it from the igneous rock.

KEWEENAWAN

A number of Keweenawan diabase dikes occur in the area, and some are of large size. Many of these dikes are deceiving in the field, as similar dikes are in other parts of the district of Algoma. In most areas in the Canadian shield the olivine diabase is readily distinguished from the quartz and normal varieties by its weathering to a brown granular product compared with the greener and less granular product from the other diabases. For example, the large dike that crosses the basin of Boyer lake has the appearance of an olivine diabase and it was formerly mapped[1] with the younger dikes, but a thin section shows that it does not contain olivine; it is a quartz diabase. It is at least slightly younger than the large porphyritic dike and the parallel diabase dike that cross Helen hill between the two ore bodies because it cuts both of them. It also cuts the normal diabase dike that is crossed by the highway and by the tramway 2,500 feet southeast of its terminus. The latter dike has a uniform dip of 60° E., whereas the dike in Helen hill dips southeastward at the same angle.

The west diabase dike of the pair crossing Helen hill is from 30 to 50 feet wide and maintains a nearly uniform width and a uniform strike northwest across the area. There is little faulting along this dike. It is porphyritic in places and contains prominent white phenocrysts of plagioclase with a maximum diameter of 1 inch. It does not contain any quartz and thus differs from some other dikes of this type.

The east dike of the two parallel dikes is from 30 to 40 feet wide and it, like its companion, has been traced most of the way across the map area. It is, however, very different in appearance. It is not porphyritic, it is much finer grained, and instead of brownish-green it is in many places almost light-grey in colour. It is also much more altered than the porphyritic diabase. Instead of fresh labradorite plagioclase in distinct ophitic texture, the feldspar is practically all saussuritized to secondary albite and the ophitic texture is not prominent. The pyroxene has been changed to blue-green hornblende and uralite. A little biotite remains, but there is chlorite apparently derived from biotite. Leucoxene and magnetite are dispersed through the thin sections, as well as apatite, quartz, and pyrite. Epidote, especially in small stringers, is abundant in some parts of the dike.

This dike has always been called diabase, but it differs so much in so many ways from all the other diabases in the area that doubt arose regarding its identification. It seemed possible that it might belong to the Algoman mica diorite family of rocks. The thin sections were submitted to W. W. Moorhouse for an impartial opinion, and he considered it a saussuritized diabase. Further, this dike was later found cutting a small porphyritic diabase dike in the northern part of the area. The small dike is similar in composition to the large porphyritic diabase dike running through Helen hill. This suggests that the east dike may be younger than the west; why it is so much more altered is a problem.

The largest diabase dike in the area is that which runs from Wawa lake through Walbank lake and off to the northwest. It has a width of about 70 feet and a nearly uniform strike between N. 30° W. and N. 40° W. It thus nearly parallels the dike through Helen hill and other large quartz diabase dikes in the Michipicoten area. It follows a large fault that displaces the iron formation 1,800 feet near and under Walbank lake. Faulting with the quartz diabases, but not with the normal and olivine diabases, is also a characteristic feature in the Michipicoten area.

The diabases in this area range from very fresh to much altered. The ophitic texture is prominent in most of them, and the feldspars are andesine and labradorite. The augite in some is altered to secondary amphibole, and the ilmenite may or may not be largely altered to leucoxene. The diabase mentioned above

[1]W. H. Collins and T. T. Quirke, op. cit., Fig. 10 facing p. 84.

as crossed by the tramway and highway contains an unusual quantity of magnetite. No olivine diabase was found in the area.

In view of the fact that the quartz diabases cut the quartzless varieties and that no olivine diabase was found, it seems best to regard all the diabase dikes in the area as belonging to one period of igneous activity, during which intrusions of the different varieties of diabase occurred not far apart, the quartzless variety being a little older than the quartz-bearing rock.

PLEISTOCENE

Abundant evidence of the glaciation of the Michipicoten area in Pleistocene time exists, although some writers have suggested that it may have been bypassed by the ice. The drift in the area as a whole is not thick, and rock exposures are very numerous. It seems probable that the ice over the higher hills may not

Deep glacial grooving in a narrow diabase dike on the tractor road between the highway and Moran lake.

have been of great thickness because the direction of the striations on the polished rocks varies considerably within short distances. This suggests that the higher hills exert quite an influence on the course of the ice. The direction of most of the striations measured indicates that the general direction of movement was near S. 30° W., but in some places the direction was as much as S. 50° W. Two sets of striations were generally found together, one near S. 30° W. and the other between S. 10° W. and S. 15° W. Deep grooving of rocks is evident in some places (see photograph above).

There has been considerable speculation as to why the glacier did not remove the oxidized ore at the Helen mine. This ore was unquestionably mostly formed before the Pleistocene because such a quantity of oxide could not have been developed since that time. The explanation for it being left in place is that it was protected by Helen hill behind and a diabase dike in front and the glacier was too heavily loaded with drift to remove such a great thickness of ore. As it extended when mining began to a depth of about 700 feet, it is not surprising that much of it remained in place. Large quantities of ore, however, were removed, because many large blocks of it may be seen in the drift south of the mine.

Structural Geology

Folding

In its broader aspects, the structure of the Helen area is comparatively simple. The whole system of Keewatin rocks, lavas, pyroclastics, minor quantities of clastic sediments, and the banded silica, was folded up so that it stands almost vertically. As there is no evidence of repetition on a large scale of the main formations, the whole assemblage of rocks in the map area represents one limb of a tightly compressed anticline that has been slightly overturned to the north. The dip is, therefore, south in most places, and the most frequent angle is 80 degrees. There are southerly dips as low as 60 degrees, and 70 degrees is a common one. In many places also the dip is vertical; and in a few, it is north.

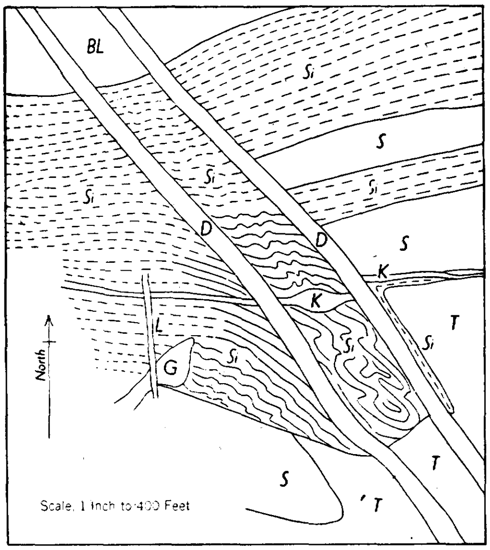


Fig. 14—Diagram showing the folding between the diabase dikes in Helen hill. BL= basic lavas; D= diabase; G= intrusive greenstone; K= kersantite; L= lamprophyre; Si= banded silica; S= siderite; and T= tuff and agglomerate.

On the whole, however, the structure is nearly a great monocline, that is, a structure with dip mainly in one direction. That the top of the Keewatin system is to the north is demonstrated by the pillows in the basic lavas and by analogy with the situation in other areas.

Some minor folds are found in the area, and these are best seen in the banded silica where any deformation of the beds stands out clearly. Many local folds probably occur in the other rocks, but they are not evident because most of these rocks show little difference in character from point to point within a formation.

On the north side of Sayer and Boyer lakes, many local disturbances are found in the banded silica, but the most important deformation is between the West and East ore bodies in Helen hill. On the highest point in this locality the iron formation follows an almost circular course. The formations swing off to the north in a fold nearly the shape of a reversed Z (see Fig. 14). There is only a little faulting on the east diabase dike since about 30 feet displacement is indicated in the small kersantite dike; the offset between the two ore bodies is due almost entirely to folding. It is believed that the folding occurred prior to the formation of the ore; this accounts for the break in continuity between the two ore bodies. The agglomerate wall on the south side of the West ore body was moved about 300 feet northward to its present position on the south side of the East ore body by this fold, but the north border of the main banded silica member was displaced much less. Much crumpling and duplication of the beds and some upward thrusting during the folding must have occurred to explain this state of affairs. The interbedding of the banded silica, which is found as subsidiary zones, and the tuff were, of course, not exactly the same in the East and West ore zones before the siderite came in and replaced the tuff.

This large fold in Helen hill was a zone of weakness, which accounts for the presence of the two large diabase dikes that cut the zone.

Much shearing accompanied the severe folding of the whole area. All the Keewatin rocks were subjected to shearing, and the acid tuff was in many places

Scarp of the fault cutting across the West ore body on the 1,500-foot level of the Helen mine.

mashed into fissile sericite schist. Extraordinary brecciation of the more brittle banded silica member also took place. It is nearly everywhere somewhat brecciated, but between Sayer and Talbot lakes it looks as if it had been put through a crusher and then recemented with siderite, pyrite, and silica.

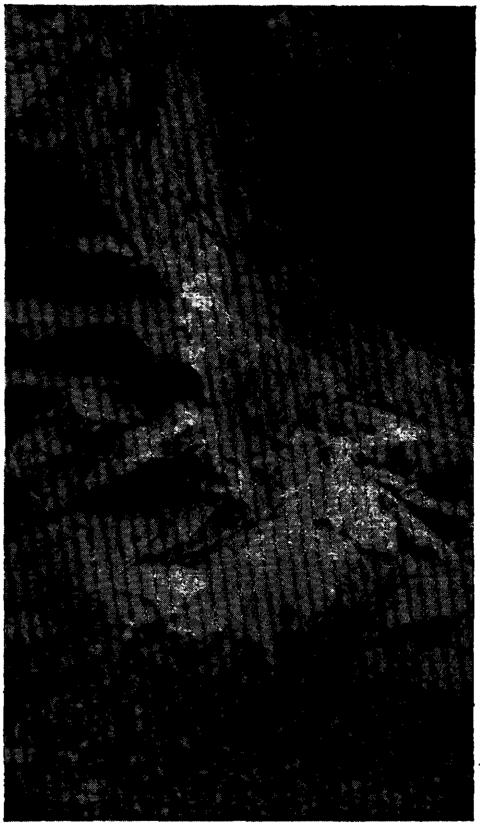
Faulting

Few large faults were found, but some faulting not now evident may have occurred within some of the formations. The largest fault is the Walbank Lake fault, which runs under that lake and offsets the iron formation about 1,800 feet horizontally. This fault is followed by a quartz diabase dike, and a canyon has developed along it in places between Wawa and Walbank lakes.

At least six faults have been located in the West ore body by G. C. McCartney, geologist of Algoma Ore Properties, Limited. These are transverse faults nearly parallel in direction. Three strike N. 20° E., one N. 27° E., and the other two almost north-south. The ore and the banded silica are displaced from 15 to 120 feet on these faults, in most cases between 25 and 35 feet. They are post-ore in age.

A transverse fault near the centre of the East ore body lies along a dike and offsets the beds 30 feet or more. A curved strike fault has been encountered in the

East ore body. It was well exposed in the west face of the pit at the 5,900-foot co-ordinate line in August, 1945 (see Fig. 15). This fault strikes nearly parallel to the "D" zone of banded silica in the centre of the ore body and dips 37° S. At the top of the pit, the "D" zone is offset about 40 feet, or its own width. The slip curves down to the bottom of the pit, which is about 80 feet deep, on the south side and runs nearly parallel to the ore zone along the bottom of the pit for some distance then curves up along the south wall of the pit.



Curved fault fracture in the West ore body on the 1,500-foot level of the Helen mine.

A displacement of about 30 feet is seen in the small kersantite dike cut by the east diabase dike between the two ore bodies. Most of the displacement of the iron formation near these dikes, however, is due to folding.

Economic Geology

Iron is the only product of economic importance so far found in this area. Gold has been mined in a number of places in the Michipicoten area, but in the Helen range area the quartz veins are small, irregular, and unpromising in appearance. A number of these occur in the large hill south of Boyer and Sayer lakes, east of Moran lake, and about 1,200 feet directly south from the village of Helen Mine.

The Helen mine has been to the present time the most important producer of iron ore in Canada. Two types of ore have been mined: brown oxide and siderite. The oxide ore in the "Old Helen" mine was exhausted in 1918, and only siderite is now being mined in the "New Helen."

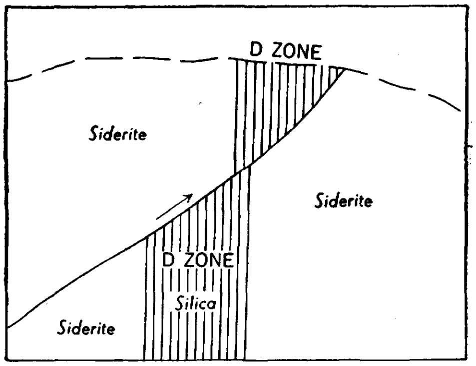


Fig. 15—Diagram of the fault in the face of the open pit in the East ore body of the Helen mine. The displacement is about 40 feet.

OXIDE ORE

The Helen range was discovered by Alois Goetz in 1898, and mining of brown ore by the Algoma Steel Corporation started with the close of the century. By 1918, when the ore was exhausted, 2,823,369 tons of iron ore and 51,930 tons of pyrite had been produced from the old Helen mine.

View of the Helen mine showing the waste dump at the east end of Boyer lake and the pinnacles of siliceous iron oxide near the water that were left when the old mine was worked.

The brown ore was commonly called hematite and limonite, but it was mainly goethite ($Fe_2O_3 . H_2O$) with a little hydrous hematite and other hydrous oxides. These were the result mainly of oxidation of the large body of siderite ($FeCO_3$) in Helen hill, and the oxide ore lay on the west face of this hill. Pyrite contributed some of the iron oxide, because it is abundant in the siderite and the mine waters were high in sulphuric acid. Much quite unaltered pyrite sand was, however, found in the mine and on the bottom of Boyer lake. The oxide ore was unquestionably a supergene deposit, the result of the oxidation of siderite and pyrite by surface waters. It was distinctly different from the Josephine ore, which is a red hematite with little water and was formed as a primary deposit from hot solutions.

The oxide ore was mined by open pit and two shafts to a depth of about 650 feet, although some oxide extended to more than 700 feet. Great difficulties were encountered in mining because of the weak, porous, and cavernous nature of the ore and the presence of large pockets of loose pyrite and silica sand. The production of more than 51,000 tons of pyrite sand from the ore body was an anamolous feature. There was no gradation of oxide to pyrite in most places, thus indicating that most of the adjacent oxide was not due to oxidation of pyrite. Blocks of good iron oxide as much as 2 feet in diameter were found within one of the bodies of pyrite sand. A good description of the largest body of pyrite sand is given by Coleman and Willmott.[1] This deposit was seen in the open pit, and it was 45 feet long by 8 feet wide and was cut off at both ends and below by oxide ore. It was reported that at the surface the deposit began as a chimney of quartz sand about 30 feet in diameter. As it was followed downward the silica sand gradually gave place to pyrite sand, which near the bottom was almost pure pyrite, with only small stringers of pure white, fine sand running through it. The presence of these pockets of sand in the oxide ore can only be accounted for by assuming that they were formed underground in channels and caverns in the siderite and from a concentration of grains of quartz and pyrite originally in the banded silica and siderite. These grains were set free when the siderite was changed to oxide. The great elevation of Helen hill furnished a good head for the downward circulation of the surface waters that carried oxygen to the siderite and pyrite and caused such deep oxidation.

Thirty years ago the pyrite in the mine was of such importance for the manufacture of sulphuric acid that in the later years of operation of the mine a concentrator was build to recover it.

The large diabase dike that crosses Boyer lake near the foot of Helen hill no doubt played a part in the concentration of the oxide ore. Most of the ore was impounded between it and the steep slope of the hill, but some occurred on the west side of it. This dike underground was almost completely decomposed in places to a soft kaolin, which has been fully described by Parsons[2] and Keele.[3] As kaolin forms under acid conditions, the alteration of such basic rock to a white kaolin was apparently due to the high percentage of sulphuric acid in the mine waters. It is reported that the ore was often steaming, and this would be due to the reaction between the sulphuric acid and moisture. The acid was formed by the oxidation of pyrite.

Analyses of the oxide ore averaged as follows:—

	Per cent.
Fe	56 –58
SiO_2	5.5 – 8.0
S	.05– .4
P	.07– .115
H_2O	4.0 –16.3

There was less than 1 per cent. of alumina and less than one-half of 1 per cent. each of lime, magnesia, and manganese. This indicates that the last group of

[1] A. P. Coleman and A. B. Willmott, op. cit., p. 170.

[2] A. L. Parsons, "The Productive Area of the Michipicoten Iron Ranges," Ont. Bur. Mines, Vol. XXIV, 1915, pt. 1, pp. 192-194.

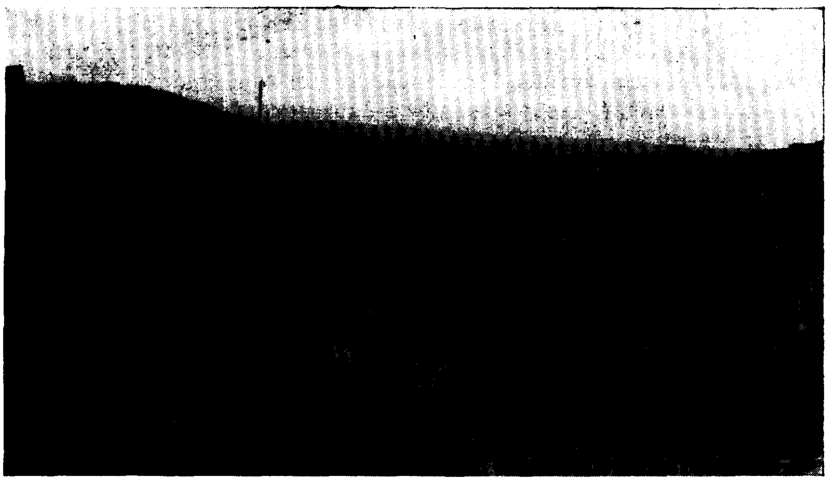
[3] J. Keele, ibid, appendix, pp. 214-215.

substances, which form about 12 per cent. of the siderite ore, had been nearly leached out. The ore was non-Bessemer, a matter of importance in the days when Bessemer ore was regarded as much more important than it is to-day. It was all shipped by rail to Michipicoten Harbour, where there were ore docks, and from there by boat to the Algoma Steel Corporation's blast furnaces in Sault Ste. Marie.

IRON CARBONATE DEPOSITS

The siderite deposits in the Helen range are the largest bodies of iron carbonate of such purity known on the continent and among the largest known in the world. The carbonate deposits at Bilbao, Spain, were originally larger.

The two major ore bodies in Helen hill are known as the West and the East[1] ore bodies. They lie along the south side of the main zone of banded silica and between it and the pyroclastics to the south. As they dip steeply from 65° S.



Photograph taken in 1943 from the east end of the open pit on the West ore body of the Helen mine. The mass of rock in the left foreground is greenstone, which extended across the ore body and caused a narrows in the pit. Boyer lake is seen in the background.

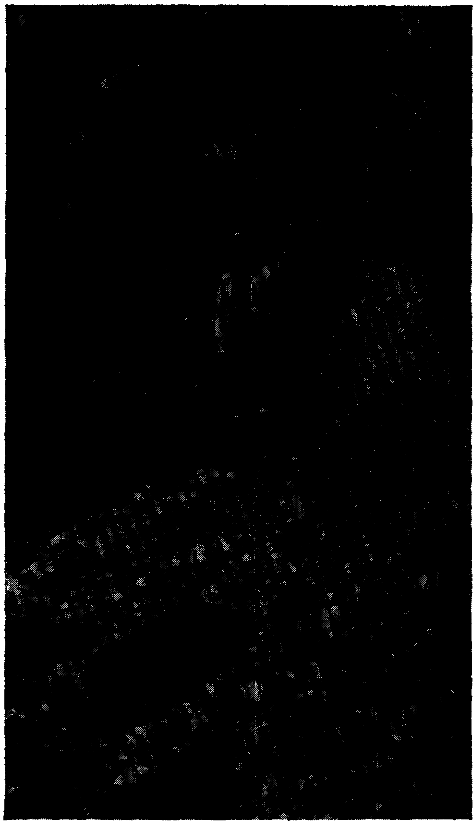
to vertical, owing to slight overturning in folding, the silica forms the footwall of the ore, although it is younger than the rocks that the ore replaced. Thin bands of banded silica occur along the south side of both ore bodies, and a thick zone known as the "D" zone lies within the East ore body. These deposits of silica were apparently formed some time previous to the main body of silica and buried by acid tuff, which was later replaced by siderite, leaving the silica bands in place. The northern part of the ore zone in both ore bodies is rich in pyrite. This pyrite zone varies greatly in thickness and in the proportion of the pyrite it carries. The pyrite grades into the siderite and occurs as disseminated grains in most of it. In the West ore body the siderite runs right up to the banded silica and not enough pyrite is present in most places to raise the sulphur in the ore, when mixed with low-sulphur ore, beyond that which may be removed in sintering. In the East ore body there is a zone of high-sulphur rock from 20 to 25 feet wide next to the banded silica, and a high-sulphur band is found in most places in the range next to the banded silica. In some sections it carries as much

[1]Since this report was written, the ore body has become known as the "Victoria mine."

as 28 per cent. sulphur. A narrow graphitic band also occurs along the base of the banded silica. This material is soft, contains pyrite grains, and soils the fingers.

West Ore Body

The West ore body is a large lens of siderite striking nearly east-west and dipping from 70° S. to vertical, which has been mined in an open pit to a maximum depth of 275 feet below the highest point in Helen hill. The length of the ore from the east end, where it pinches out, to the west end of the pit 205 feet above Boyer lake is 1,400 feet. As it is known to extend beneath the eastern



Contact of siderite and banded silica (right) in the open pit on the West ore body of the Helen mine.

part of Boyer lake, its total length is about 2,500 feet. Some carbonate and much pyrite occur under the western part of the lake, but between this lake and Sayer lake the banded silica comes into contact with the agglomerate lying to the south. Here, a pyrite zone with no siderite ore occurs along the contact. Drilling under the western section of Boyer lake failed to disclose siderite in minable quantity.

The maximum width of the West ore body is 210 feet near the west end of the pit. It narrows to about 150 feet in the section that was overlain by the oxide ore before it was mined.

The ore body narrows toward the east to the section where a prong of greenstone projected across its strike. Here the siderite-depositing waters failed to replace this basic rock, which completely cut off the ore at the top of the pit for a short distance, and this accounts for the narrows in the pit. It is an interesting feature, however, that this greenstone tongue retreats with depth, and at the 1,200-foot elevation drilling shows that it does not extend into the ore body, which is about full width at that level. Beyond the narrows, the ore body widens out again and then begins to taper towards its east end. It ends in a blunt point consisting of high-silica ore.

To the end of July, 1945, 3,772,261 gross tons of ore was mined from the open pit on the West ore body, and about 1,000,000 tons of waste rock was removed, mainly in "wasting" the walls of the pit for safety. The quantity of waste has run about one ton of waste to two tons of ore. The average composition of the ore from the pit was as follows:—

	West half	East half
	per cent.	per cent.
Fe	37.0	35.7
SiO_2	5.8	5.8
S	3.75	1.68

A narrow band of the banded silica formation from 5 to 12 feet wide lies along part of the south side of the ore body and in places forms the hanging wall of the ore. It has been broken by faulting and is much disturbed where the greenstone intruded the ore zone from the south side.

At least six transverse faults cut the ore with horizontal displacements of from 15 to 120 feet. Almost always more offset occurs on the south side than on the north side of the ore body. This suggests that there has been some differential movement vertically as well as horizontal displacement. These are post-ore faults. The ore body is also cut by a number of small dikes.

East Ore Body

The East ore body is almost completely separated from the West ore body, although there is a little ore between the two big dikes that lie between them. Drag-folding has pushed the formations to the north in the vicinity of these dikes and greatly deformed them, and there is no extensive and little distinct faulting.

The situation in the East ore body differs from that in the West ore body. The stratigraphical conditions differed before the siderite was formed in that a wide zone of banded silica, known as the "D" zone, occurs near the centre of the deposit.

A zone of banded silica, which is from 10 feet to 25 feet wide and similar to that along the West ore body, occurs along the south contact of the siderite. This is followed by a body of siderite, which is interrupted to the west by the large diabase dike. At this point the siderite is 125 feet wide. At 350 feet to the east it is 175 feet thick, but its thickness quickly thins to 100 feet and it pinches out at 1,000 feet east of the dike. The "D" zone of banded silica lies to the north of this first siderite zone. It is about the same length as the siderite body and pinches out to the east with it; it is 90 feet thick at the dike at the west end, 50 feet half way to the east end, and from 40 to 50 feet between the middle and the east end of the zone.

A second siderite zone, lying between the "D" zone and the main banded silica member to the north, is 1,700 feet long. The east 400 feet contains only lean ore. This body of siderite is 90 feet thick at the dike, 50 feet at 600 feet to the east, and from 90 to 100 feet thick almost to the east end, where it rapidly pinches out and the main banded silica member and the acid pyroclastics come together. Ore has been found by drilling between the two large dikes, but the quantity there that can be mined is problematical.

The deposits dip from 70° S. to vertical. Several bands of silica, one of ottrelite schist, and some dikes that occur within the deposit will require the removal of considerable waste (see insert facing page 110). The percentage of silica in the different bands of siderite thus separated from one another varies greatly.

The total width of the ore body including the silica bands within it is considered to be about 273 feet. Only the north member of the siderite deposit will average as high in iron as the West ore body. The average composition of the East ore body is about as follows:—

	Per cent.
Fe	33.73
SiO_2	10.4
S	2.03

The iron is lower and the silica higher on the average than in the West ore body. The sulphur averages higher than in the east half of the West ore body but lower than in the west half. This substance is almost completely removed in sintering.

Nature and Origin of the Siderite

The siderite is grey, brown, yellowish, and in a few places, as near the east end of the West ore body and in part of the southern ore zone of the East ore body, nearly black. It is mostly dense and felsitic in appearance and resembles, in the unweathered specimen, felsite or fine-grained quartz porphyry because it is so massive and quartz "eyes" are often seen. It is not surprising that it was at first regarded as a felsite, and it is quite difficult sometimes for the inexperienced person to recognize it in drill cores, where it occurs with fine-grained acid rock. The specific gravity of the siderite, about 3.00, compared with that of an acid volcanic rock immediately attracts attention.

The siderite, when examined in thin section, is mostly fine-grained, some of the grains in the densest material being as small as 0.007 mm. in diameter. They grade from this up to much larger sizes, and in some veinlets of siderite and quartz there are rhombs more than an inch in diameter. Many veinlets of crystalline siderite cut through the dense, fine-grained ore. Some ankerite occurs in the ore, and it is more abundant towards the east end of the East ore body. Numerous small veins, some of which are ankerite, occur outside of the ore bodies.

The nearly black siderite mentioned as occurring near the east end of the West ore body is rather puzzling. It lies near the north side of the ore body and at first glance would scarcely be regarded as ore. It is, however, good siderite, which appears to be graphitic. No graphite could be detected under the microscope, however, but each grain of carbonate has a thin, dark film around its border. This seems to be iron oxide and is apparently the result of slight weathering of the grains in a zone where the ore has been somewhat disturbed, permitting air to penetrate it.

The very dark coloured siderite near the east end of the southern zone of the East ore body forms a band about 15 feet wide. It lies along the south side of the ottrelite tuff and a small dike previously described.[1] It breaks differently from the normal siderite ore and lacks the blocky fracture. It is a little higher in sulphides and silica than the normal ore and under the microscope shows many undigested grains of quartz. Films of chalcopyrite and pyrite are found on frac-

[1]Page 100.

ture faces in hand specimens, and under the microscope exceedingly thin films of sulphide are seen between the siderite grains. These are believed to account for the very dark colour of the ore.

Some magnetite occurs in the siderite, particularly near the small dikes, which are themselves rich in magnetite, near the big dikes cutting Helen hill, and near the greenstone in the West ore body. Some of this magnetite may be unreplaced material that was in the rocks that were almost completely replaced by siderite, some of it has been developed in the iron formation where it is highly folded and compressed, and some has been developed from carbonate by the heat from the dikes. Some of the dikes that cross the ore bodies are pre-ore and are highly carbonatized, but the large diabase dikes and some of the lamprophyric dikes are later.

The solutions that deposited the siderite selectively replaced the minerals and rock. The acid pyroclastics were most readily replaced, especially the feldspar in them. Some of the quartz "eyes" in the siderite appear to be remnants of quartz from the replaced tuff and rhyolite, but some quartz was introduced with the siderite and also after some of it was deposited.

The quartz in the siderite is in small bodies composed of two or more grains grown together. Some of these bodies have mutual boundaries with the carbonate, some show signs of partial replacement, and still others are so arranged that they appear like disconnected parts of veinlets of silica. Veinlets of silica occur in some places. It appears that the quartz, except that remaining from replacement of the tuff, is about the same age as the siderite.

Remnants of feldspar, chlorite, and ottrelite are found in some thin sections. The siderite does not seem to have readily replaced chlorite. Blades of muscovite that formed after the siderite and are a late phase of mineralization, like the sericite in many gold-quartz veins, are seen in some of the thin sections.

Pyrite in small grains is widely disseminated in the carbonate, and there is a gradation in many places from nearly pure siderite to pyrite with an inconspicuous amount of pyrrhotite. These minerals may be contemporaneous in some places, but generally the pyrite replaces siderite. The siderite and pyrite replace the banded silica to some extent, but this rock is quite granular, with grains from 0.02 to 1.25 mm. in diameter, and so highly brecciated in some places near the ore bodies that these minerals have penetrated the pores and the interstices between the fragments. They have not replaced the silica in anything like the proportions by which they have replaced the acid pyroclastics, although they occur in most of the banded silica.

Chalcopyrite has been mentioned as occurring in the East ore body as thin films in the siderite. Traces of lead and zinc have also been seen.

The ore deposits originated by replacement, mainly of acid pyroclastics and some quartz porphyry and rhyolite. Siderite has partly replaced some intrusive greenstone and dioritic dikes. In fact, all rocks in the area except those that are distinctly post-ore in age show some carbonatization.

The siderite is distinctly younger than the banded silica. The constant relation of siderite and silica throughout the Michipicoten area resulted from structural control and an intimate stratigraphical relation between the silica and the acid pyroclastics and lavas. In all the carbonate deposits in the Michipicoten area, except the Magpie, there is banded silica with siderite beneath it stratigraphically. The silica was laid down on acid rocks, and when great folding occurred these rocks were tipped up on edge and, at the Helen mine, overturned. Extensive brecciation of the iron formation accompanied folding or followed it in many places. The granular nature of the silica and its brecciation produced a very favourable condition along the base of the silica member for the iron-bearing solutions to circulate and attack the acid rocks along the contact. The structural and chemical conditions thus combined in producing the ore deposits where they are now found.

The presence of so many siderite deposits, some of such large size, in the Michipicoten area and their scarcity elsewhere in Canada presents a problem. It is believed that there must be some genetic connection between the siderite and the type of magma that produced the group of Algoman dioritic dikes, which include the kersantites. These are not common in other iron ranges, but they occur in the Helen, Lucy, and Ruth ranges and are numerous in the first and last of these, where the largest bodies of siderite occur. The "mica dike" at the Magpie is apparently another member of this group of uncommon rocks.

The occurrence of primary hematite at the Josephine mine instead of siderite, which is the typical ore of all the other ranges in the Michipicoten area, presents another problem. It is explained as due to a delicately balanced relation between physical and chemical conditions at the time the iron-bearing solutions were precipitating the iron minerals. Evidence of faulting and intense brecciation at the time the hematite was deposited is found at the Josephine mine. Change in pressure on the solutions when at high temperature (probably about 500° C) upset the relations between the iron and carbon dioxide, allowing the oxide to form instead of the carbonate.

Ore Reserves

In 1917, C. K. Leith prepared a report on the Helen siderite deposits for the Algoma Steel Corporation. He advised driving an adit into Helen hill on the north side at a level 324 feet below the top of the ore. He then estimated the ore reserves as follows, with the statement that they might well reach 100,000,000 tons:—

	Tons
Above adit level	10,968,000
Below adit level	55,450,000
Small subsidiary body	1,022,000
Total	67,440,000

These figures make provision for loss in mining and waste rock in the ore, amounting to 20 or 25 per cent. of the volume of the ore deposits. This was assuming that the ore would be mined underground. The figures are based on information obtained from a large number of diamond-drill holes and trenches across the ore bodies. The results of mining to the present time show Leith's estimates to be in keeping with the ore recovered.

The drill-holes show varying conditions at depth. In some drill sections the ore widens, and in others it pinches out around 500 feet in vertical depth. Only two holes, according to Dr. McCartney, have exceeded 800 feet in vertical depth below the collar, and their collars are about 125 feet below the top of Helen hill. One of these reached a vertical depth of 1,750 feet and the other, 1,910 feet. Siderite of good grade was encountered in these holes, which indicated that the ore extends downward for a distance greater than one-half the length of the deposit at the surface.

OPERATIONS AT THE HELEN MINE

The Algoma Steel Corporation found the oxide ore at the Helen mine approaching exhaustion and in 1913 began a serious investigation of the siderite deposits. During the next four years the ore bodies were extensively trenched and drilled, more than 17,000 feet of drilling being done. The holes ranged in depth from about 500 to 2,444 feet. Leith then prepared his report and advised driving an adit into the north side of Helen hill to tap the ore body. This was started in October, 1917, and finished one year later. Three drifts were run east and west from the adit, one in the banded silica member and two in the ore. The workings were so laid out as to handle a large tonnage of ore lying above them. The adit was started in a valley at an altitude of 1,380 feet, 345 feet below the highest point on the hill. A few years later, a forest-fire destroyed all the buildings and machinery that had been used during the operation. No use has been made of these workings because another plan for working the mine was adopted.

Construction work started in 1937, and the mining of siderite began in 1939 and has been actively prosecuted since that date. An attractive village was built near Helen hill, a good highway was constructed from Wawa to the mine, a

Churn drill at work on the 1,600-foot level of the West ore body of the Helen mine, September, 1943.

sintering plant and residences for employees were built at Sinterville on the Magpie river near Wawa station, and an aerial tramway was erected from the mine to the sintering plant.

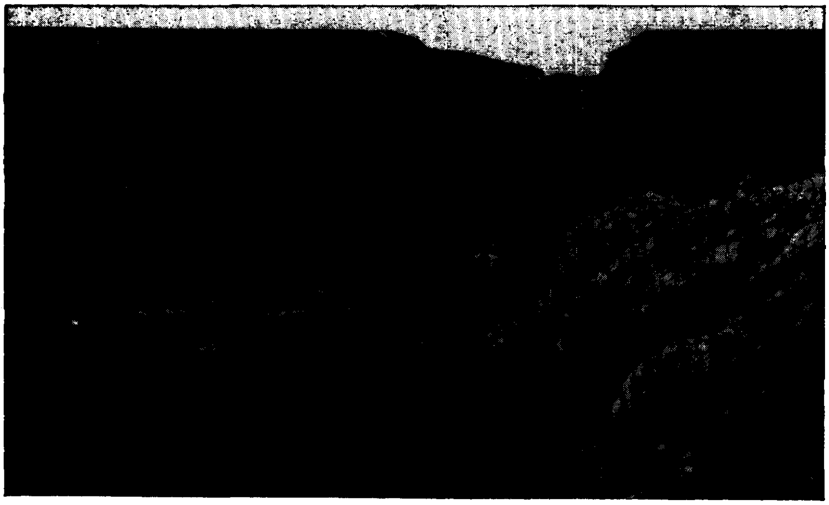
Mining Methods

As nearly all the work is done by machinery in open pits and few men are required, the method of mining is simple and cheap. The ore is worked in benches, using churn drills for drilling holes the depth of the benches and electric shovels for handling ore and waste. These are dumped into Athey wagons of 14-ton capacity hauled by tractors. The ore goes to an ore pass and down to a large crusher, where it is broken to minus 4 inches and passes to a conveyer belt leading to the terminus of the aerial tramway. The waste is dumped over the edge of the hill or down into Boyer lake, there being ample room for its disposal.

The first level was from 90 to 120 feet deep, and below that the levels are each 50 feet, there being four levels in the pit in the West ore body at 1,600-, 1,550-, 1,500-, and 1,450-foot elevations. The first level was carried from the west face of Helen hill almost to the east end of the ore. A considerable quantity of high-silica ore remains to be recovered from the east end of the ore body. On account of the great height of this level, much rock had to be removed from the sides of the pit before it could be carried much deeper because large slabs tended to slough off the walls. The second level was started at the west end of the ore body and carried through to the east end of the pit. The third ended at the narrows; and the fourth, which is still being worked, has not yet reached the narrows. This pit produced 3,772,261 tons of ore to the end of July, 1945, and about 1,000,000 tons of waste.

It is not feasible to carry the pit much below the 1,450-foot elevation (275 feet below the top of the hill) because this level is below the ore pass to the crusher station and the ore has to be hauled up-grade. Because of the situation in this pit, the East ore body was opened up in 1945.

In 1943, a move was made to start underground mining in the West ore body. It was planned to sink a small shaft to a depth of 800 feet between the ore body and Spud lake. The ore was to be raised to the shaft on a series of conveyer belts.



Photograph showing ore being loaded with an electric shovel on the 1,550-foot level of the West ore body of the Helen mine, September, 1943. A tractor and an Athey wagon are seen in the left foreground.

This project, however, was left in abeyance, after the shaft had been sunk to 270 feet, in favour of open-pit work on the East ore body, because this is a cheaper type of mining. Underground mining, however, will have to be undertaken in the near future.

A road was built around Helen hill to the East ore body in order to start operations near the east end of the deposit. This is said to be the highest motor road in Ontario; it enters the pit on the level at an altitude of 1,585 feet.

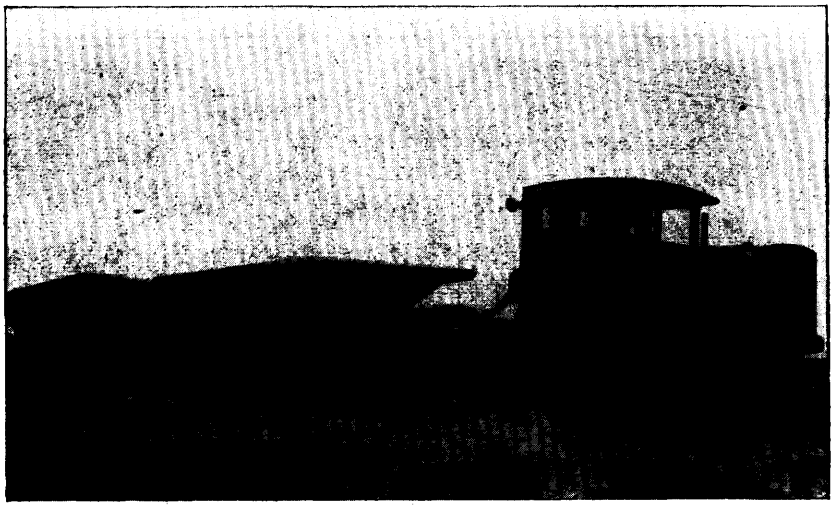
Open-pit operations were started in May, 1945, and by the middle of August, 200,000 tons of ore had been produced. The output runs about 3,000 tons a day, but when high-silica ore is encountered, ore is drawn from the West pit for mixing. The ore is hauled from the pit to the crusher at the aerial tram terminal, a distance of about 4,500 feet, in 15-ton Euclid trucks powered with Diesel engines. They make a round trip in about nine minutes.

The pit started with a face 15 feet high, which was increased to about 85 feet. It is intended to work the ore body in three benches, the first at 1,585 feet and the third at 1,450 feet.

Mining is carried on for about ten months of the year. The ore is stored at the sintering plant during the winter season when the boats are not running on the lakes, except in January and February when no mining is done and men are employed in road construction, repairing equipment, and other non-mining jobs.

Aerial Tramway

The aerial tramway from the mine to the sintering plant is about 3 miles long. It carries 138 buckets, each holding 0.9 ton of ore. At first it delivered a bucket of ore every 29 seconds, but its delivery rate has been increased to one every 25 seconds. Almost every operation of the tram is automatic. Such a means of transportation of iron ore has the one objection that its capacity cannot be increased beyond a certain limit, whereas a railway is more elastic in this respect.



Photograph showing a tractor and two Athey wagons that are used for hauling ore in the open pit in the West ore body, Helen mine.

Treatment of the Ore

Sink-Float Treatment.—The ore so far mined has been sent directly to the sintering plant over the aerial tramway after crushing to minus 4 inches. A considerable part of the ore in the East ore body and a lesser proportion of that in the West ore body, however, will require beneficiation before sintering. For this purpose a sink-float plant is being constructed near the crusher at the mine. All ore averaging more than 10 per cent. silica will go through this plant, in which ferrosilicon will be the medium. The minus 4-inch ore from the large crusher will pass to another crusher, which will reduce it to ¾-inch size, nearly the same size as that to which the unbeneficiated ore is crushed at the sintering plant.

Experiments have shown that good results may be obtained with the Helen type of ore. In fact ore with as much as 27 per cent. silica and only 27 per cent. iron produced a product with only about 8 per cent. silica and about 36 per cent. iron.

Sintering.—After the minus 4-inch ore arrives at the sintering plant at Sinterville, about 3 miles by aerial tramway from the mine, it is crushed in a 5½-foot Symons standard crusher set at 1 inch and then ground in 72- by 18-inch Traylor rolls so that 75 per cent. is minus ¼-inch size. This product is fed on to three oil-fired Dwight-Lloyd sintering furnaces, each 77 feet long and 66 inches wide. These are rated at a capacity of about 1,100 tons a day, but the three of them have handled as high as 3,800 tons in a day. The maximum sinter output for a year was 481,000 tons.

Photograph showing the aerial tramway and its terminal building, Helen mine. The office, cookery, and dormitories are seen in the foreground.

Powdered coke is mixed with the ore, the percentage varying with the sulphur content. With ore carrying up to about 3 per cent. sulphur, 2 per cent. coke is used, and with that containing 6 per cent. sulphur no coke is required. It is difficult to remove all the sulphur by sintering when the content in the ore reaches 6 per cent.

Sintering plant at Sinterville.

The composition of the sinter runs about as follows:—

	Per cent.
Fe	52
SiO_2	9.5
S	0.04–0.05

An effort is made to keep the silica below 9.30 per cent. and the sulphur below 0.1 per cent. at all times, but during the war when iron was in such great demand sinter was sometimes used that carried as much as 10.25 per cent. silica.

The sinter from the Helen mine is excellent material for a blast-furnace charge because of its open texture and a content of several per cent. of lime, magnesia, and alumina. It is partly self-fluxing and makes a free-running slag. About 40 per cent. of the carbonate sinter is used in the furnaces of the Algoma Steel Corporation at Sault Ste. Marie, Ont., the remainder being shipped to the United States for mixing with other ores. The sinter is also in great demand because of its manganese content, which improves the iron.

The sinter is all shipped by rail to Michipicoten Harbour, where it is loaded on boats by a large ore bridge and conveyer belts.

Loading dock for sinter and ore at Michipicoten Harbour.

The sintering plant has a greater capacity than the mine, and during part of the winter season, when navigation is closed, ore is mined and stored at the sintering plant. The stock-pile so built up in winter months is drawn on during the summer, and it also serves as security against any accidents to the tram line or delays in mine production.

The bonus on beneficiated domestic ore provided by an Act of the Ontario Legislature was paid for a few years on the production of ore from the Helen mine, but this has been discontinued.

Just about one-third of the weight of ore sintered escapes from the flue in the form of carbon-dioxide and sulphur-dioxide gases. The sulphur fumes drift up the valley, killing most of the trees and shrubs. At times the wind carries the fumes over Helen hill, and garden flowers and vegetables around Helen Mine are seriously affected. It is hard on blueberry plants, but grass does not seem to be much affected.

APPENDIX

Lakemount Property, Township 28, Range XXIV

By E. S. Moore

Introduction

The Lakemount property is located around Sunrise lake in the northwestern part of township 28, range XXIV, district of Algoma (see map facing page 120). The camp is reached by a motor road from Hawk Junction to the old Regnery mine and a jumper road from there to the camp. Lakemount Mines, Limited, acquired part of the property from the Lakemount Prospecting Syndicate and part from Corinth Mines, Limited, which succeeded the Engineers Holdings Contributors Syndicate. The company also staked some additional claims around Sunrise lake and some on Loonskin lake.

The Engineers Holdings Company, Limited (from whom the property was bought by the last-named syndicate) had done a considerable amount of trenching on a number of copper and some lead-zinc showings on their property and had dug two long trenches near the contact of a basic intrusion with greenstone near Elbow lake. These were visited by the writer in 1942, and some chalcopyrite-pyrrhotite mineralization with traces of lead and zinc were observed.

Lakemount Mines, Limited, began drilling in 1943 on the basic intrusion mentioned above with the hope of finding copper, nickel, and platinum in commercial quantities. About 10,000 feet of drilling had been done and a geophysical survey made by Hans Lundberg, when N. A. Timmins Explorations (Ontario), Limited, took an option on the property for a year and continued drilling. At the time of the writer's second visit to the area in August, 1944, the Timmins company had completed about 4,000 feet more of diamond-drilling. John Armstrong was in charge of the operations, and the writer is greatly indebted to him for his hospitality and for information generously supplied.

General Geology

The Basic Irruptive

The feature of greatest geological interest on this property is a large, very basic intrusion which underlies much of Sunrise and Elbow lakes and extends beyond their shores (see map facing page 120). The general geology of this area is outlined on a map published in 1923 by the Geological Survey of Canada.[1] This basic intrusion is not, however, shown as distinct from the Keewatin lavas, and a body of granite appears on an island in Sunrise lake and another on its southwest shore where no granite could be found by the writer.

This irruptive is at least 6,000 feet long, and it has a maximum width of 1,700 feet at the east end of Sunrise lake. Its extension to the west was not accurately fixed because part of it lies under drift. It may be a sill with the greenstone on the south side forming the hanging wall. Mr. Armstrong said that the mineralized zone cut with the drill dips 43° S. The form of the intrusion cannot be definitely determined because its contacts with the older rocks are almost everywhere concealed by drift. A contact with the greenstone may be seen in the trenches near the camp on the south border of the intrusive.

The rock is very basic, being originally pyroxenite and peridotite, now

[1] Pub. No. 1972, accompanying Mem. 147, "Michipicoten Iron Ranges," 1926.

altered to serpentine and amphibolite. It is coarse-grained and weathers to a harsh, brownish surface. A patch of peridotite on the north side of Sunrise lake near its east end weathers to a rough knobby and cupped surface. When freshly broken, most of the rock is brownish-grey in colour and has large cleavage surfaces, which are apparently due to the pyroxene originally present.

Thin sections show the absence of feldspar and the presence of brown and green hornblende, magnetite, and brown biotite; a little olivine remains in one section. Secondary minerals are serpentine, in some sections with the typical olivine-serpentine pattern, much uralite and tremolite after pyroxene, chlorite after biotite, and magnetite set free by the alteration of olivine to serpentine. Scapolite in small quantity was found in one thin section. Some of the thin sections also show pyrrhotite and chalcopyrite.

The geological age of this intrusive is not definitely fixed. The rock is very similar to that composing the very basic intrusive found on the north shore of Mildred lake, 2 miles to the northwest, which was tentatively placed as Haileyburian. The Sunrise lake intrusion is cut on the north shore of the lake by granite classed as Algoman, and it is believed to be cut by quartz porphyry dikes of similar age, but the contacts of these acid dikes are obscured by drift.

Other Formations

Basic Keewatin lavas occupy most of the area. These are cut by a number of quartz porphyry dikes and other small intrusions. None of these were actually found cutting the basic intrusive because drift obscures the contacts, but their relations in one place indicate the probability of their doing so. Algoman granite cuts the peridotite-pyroxenite body on the north shore of Sunrise lake and occupies all the western part of that shore.

A narrow dike, 8 feet wide, cuts the basic intrusive along a cliff running north from the northeast bay of Elbow lake. It consists of a fine-grained, grey rock, which in thin section shows green hornblende and brown biotite with small grains of quartz and feldspar. The rock may be considered a quartz-hornblende-biotite diorite with granitic affinities. It is like adamellite, which is closely related to tonalite, but it is nearer the diorite class than tonalite. It recalls the kersantites that are numerous in the Ruth, Lucy, and Helen iron range areas. There is some mineralization associated with this dike on the surface and in drill cores.

Economic Geology

The main interest in this property recently has been centred on the chalcopyrite-pyrrhotite mineralization in the vicinity of Elbow lake. Little mineralization of this type was seen elsewhere in the basic intrusion. The mineralization is also pronounced along the south contact with the Keewatin greenstone near the camp and on the north side of and beneath Elbow lake.

The only surface work of any account was done on two long rock trenches near the greenstone contact, which were made by the Engineers Holdings Company about 1934. They are shown on the accompanying map as trenches Nos. 1 and 2. No. 1 is 50 feet long and is dug in highly altered rock, which contains no primary minerals except some green hornblende and brown biotite. The rock is composed mainly of serpentine and tremolite with a little scapolite. A section 36 feet wide shows some chalcopyrite-pyrrhotite mineralization, and chips were taken to make a composite sample for assay. The assays from this and other specimens to be described were made by D. A. Moddle, acting provincial assayer. This specimen gave the following: copper, 0.27 per cent.; nickel, 0.30 per cent.; platinum, none.

Trench No. 2 is 160 feet nearly west of No. 1. It is 100 feet long and extends for a considerable distance into the Keewatin greenstone. Up the hill from the northwest end of the trench an irregular patch of amphibolite 10 feet long and from 5 to 6 feet wide is highly mineralized with pyrrhotite and chalcopyrite, there being much more pyrrhotite than is found in No. 1 trench. The basic intrusive extends up the hill for 65 feet to the contact with finer-grained Keewatin greenstone. At 83 feet there is an irregular injection of quartz porphyry, 2 feet wide, in the greenstone. Except for the patch near the lower end of the trench the basic rock is not highly mineralized. The sulphides impregnate the greenstone for a few feet from the contact.

A sample consisting of chips from the highly mineralized and poorly mineralized portions of the basic rock was taken over a width of 65 feet in this trench and assayed. The results were as follows: copper, 0.16 per cent.; nickel, 1.33 per cent.; platinum, none.

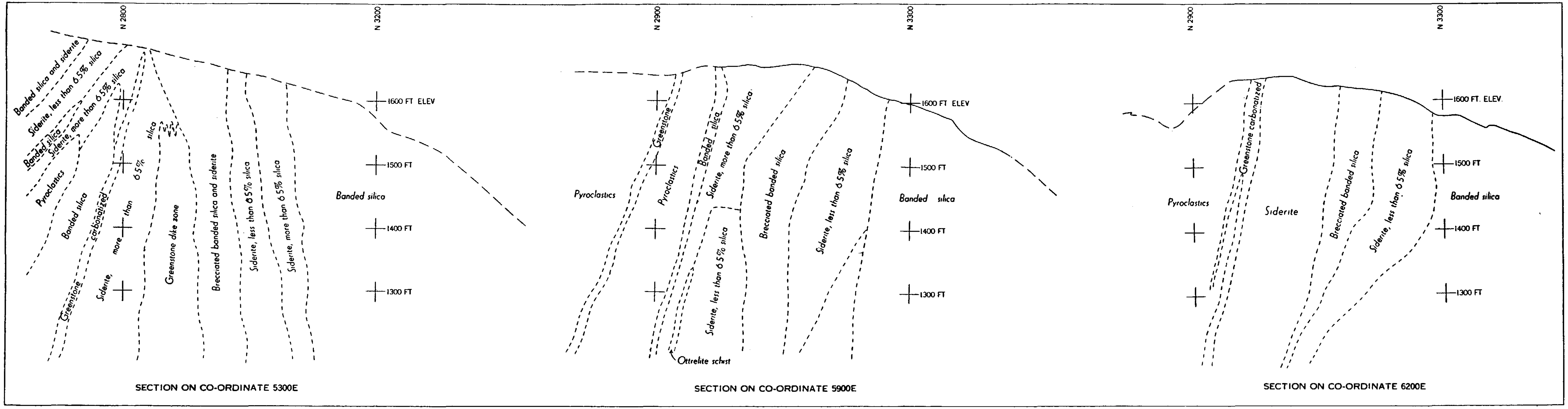
The diamond-drilling showed that there is a mineralized zone on the north side of and under Elbow lake in the general vicinity of the adamellite dike described above. It carries pyrrhotite and chalcopyrite disseminated in the basic rock. Mr. Armstrong stated that this zone was as much as 150 feet thick in some holes but mineralization of possible economic interest was usually confined to a width of from 20 to 25 feet. This zone dips from 40° to 45° S. Stringers of calcite occur with the sulphides in some places. An assay was made of a small section of drill core, from a vertical depth of 150 feet, that showed some of the best mineralization, and it gave: copper, 0.20 per cent.; nickel, 0.65 per cent.; platinum, gold, and silver, none.

The above figures indicate the presence in the basic irruptive of considerable amounts of nickel and copper, but the values are low and very irregularly distributed, making it impossible to mine the rock profitably under present conditions. The Timmins company ceased drilling on the property in the spring of 1945.

The sulphides appear to have been introduced into the basic rock rather than having originated as magmatic segregations.

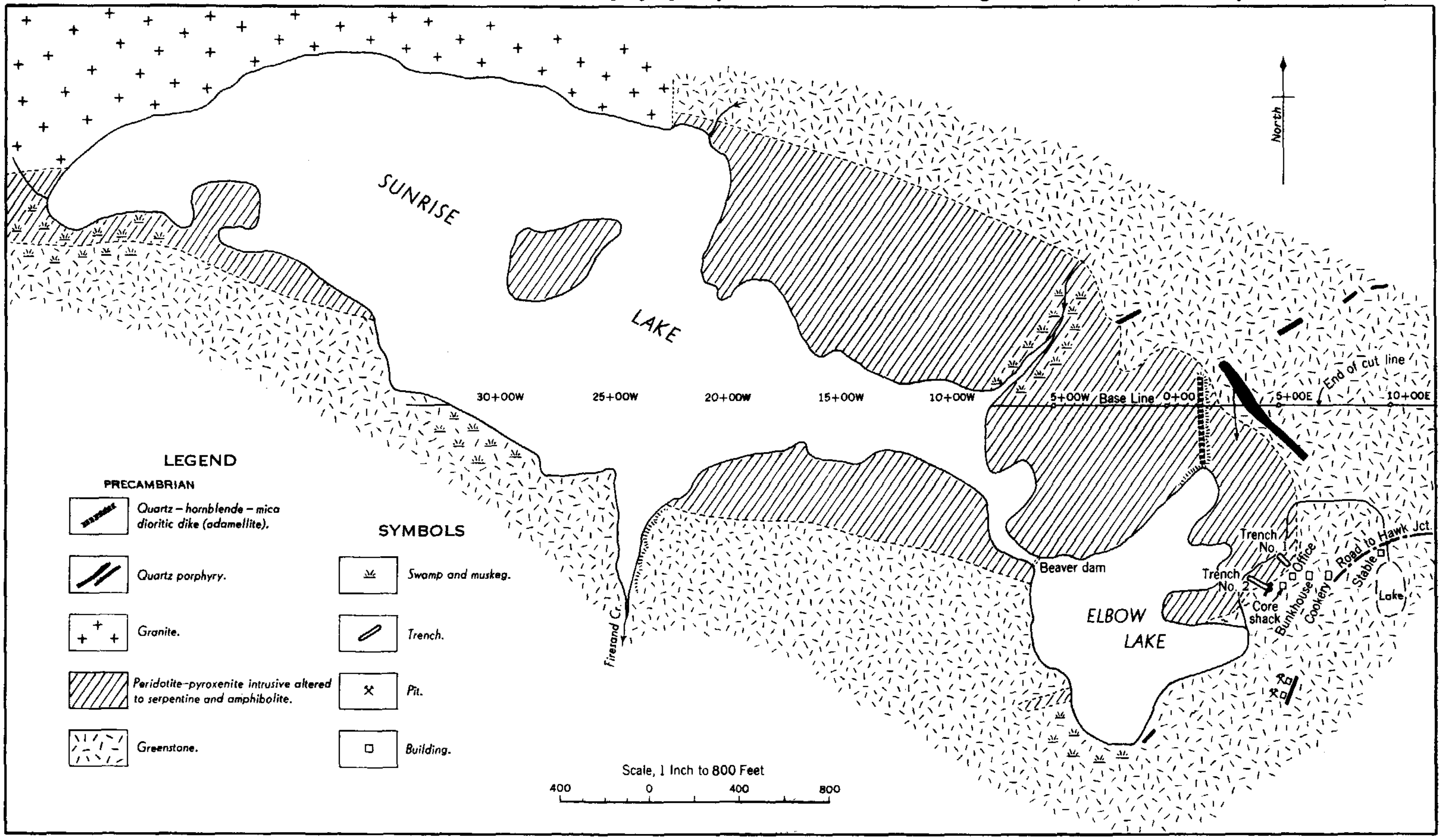
INDEX, PART IV

To accompany report by E. S. Moore and H. S. Armstrong in Vol. LV, Part 4, Ontario Department of Mines, 1946.



SECTIONS THROUGH EAST ORE BODY, FROM DRILL LOGS. (By courtesy of Dr. G. C. McCartney, geologist, Algoma Ore Properties Limited)

To accompany report by E. S. Moore and H. S. Armstrong in Vol. LV, Part 4, Ontario Department of Mines, 1946.



LAKEMOUNT PROPERTY, TOWNSHIP 28, RANGE 24, DISTRICT OF ALGOMA.

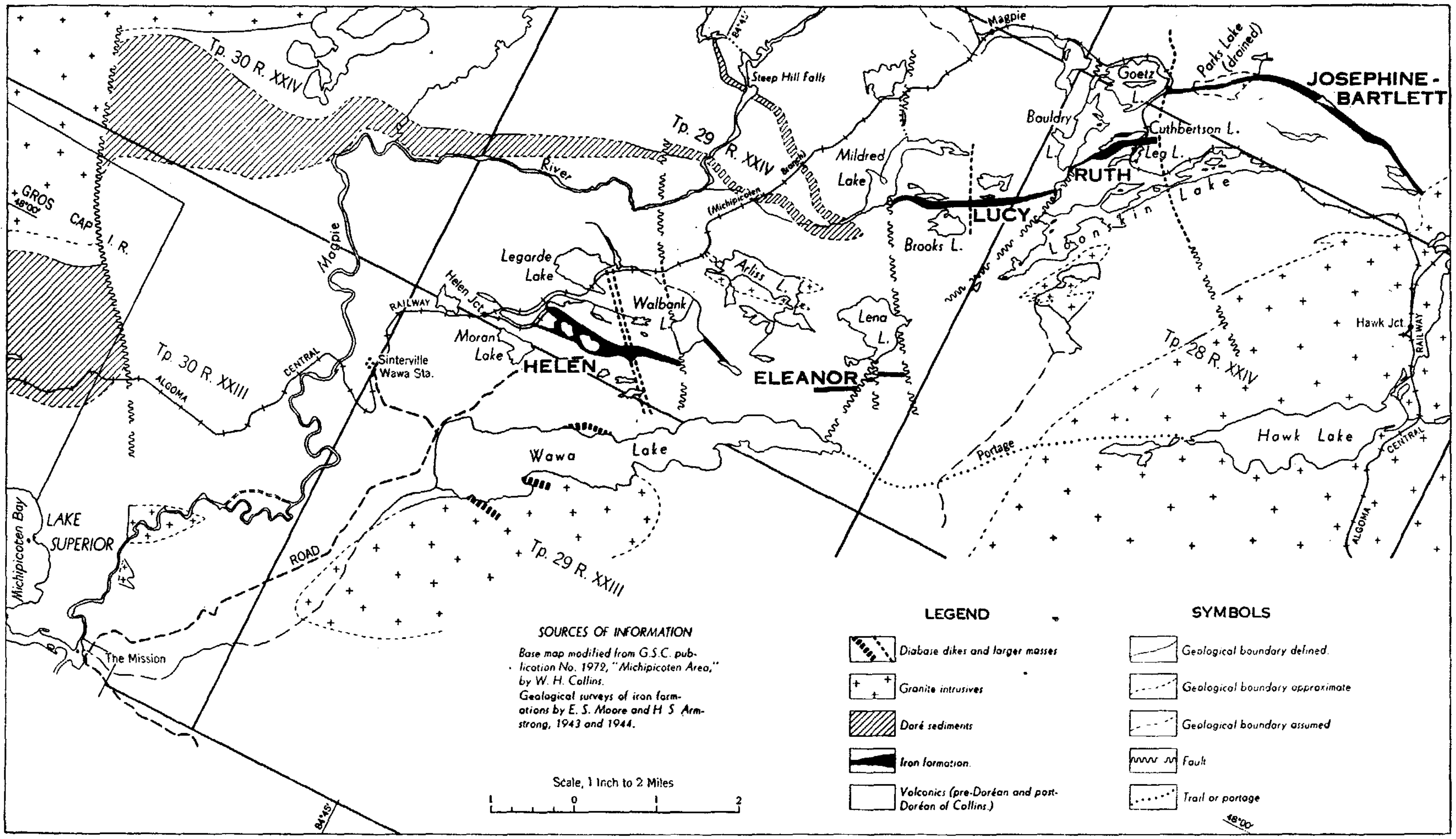


Fig. 8—Geological Sketch Map Showing the Relations of the Josephine-Bartlett, Ruth, Lucy, Eleanor, and Helen Iron Ranges.

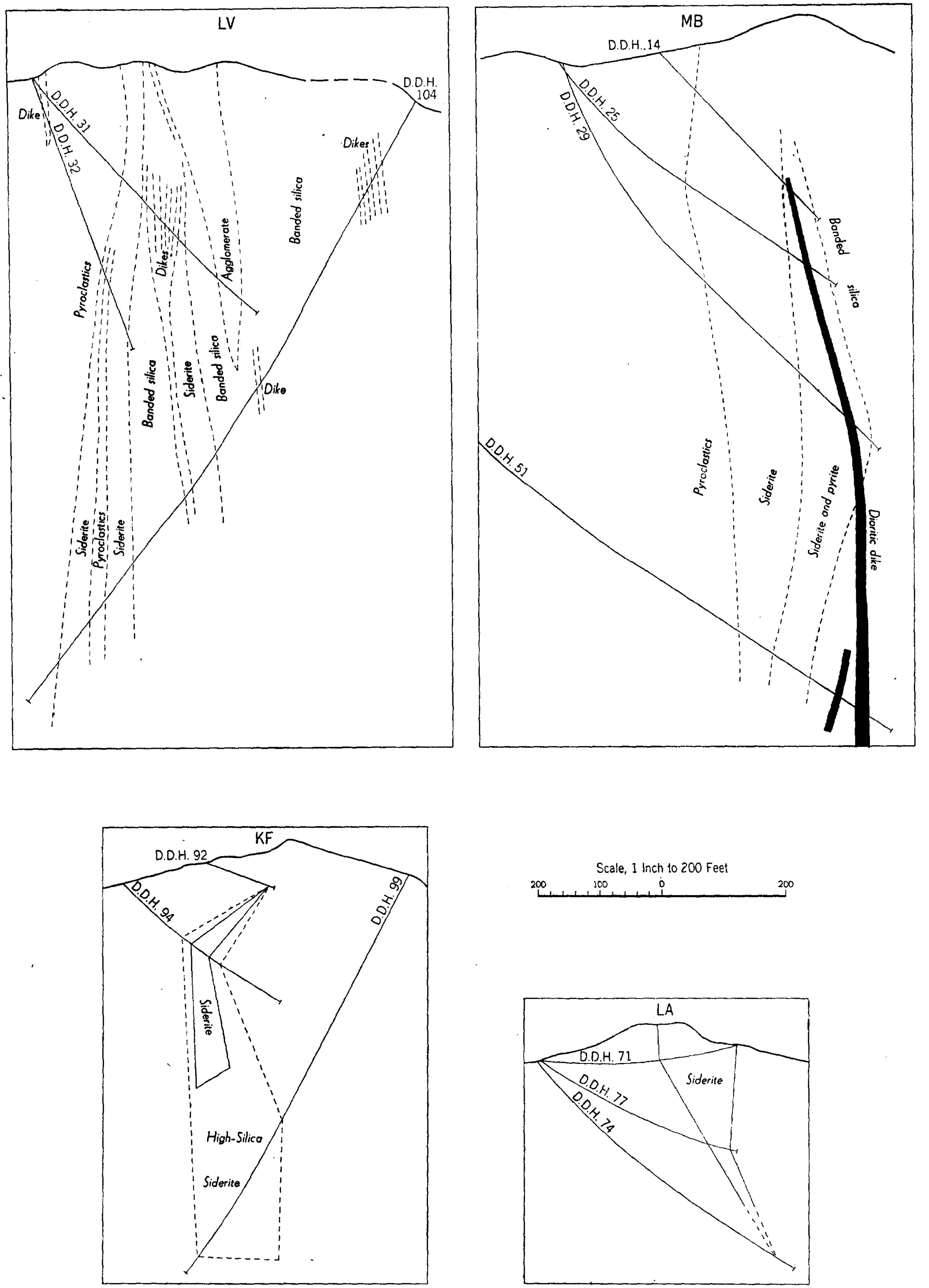
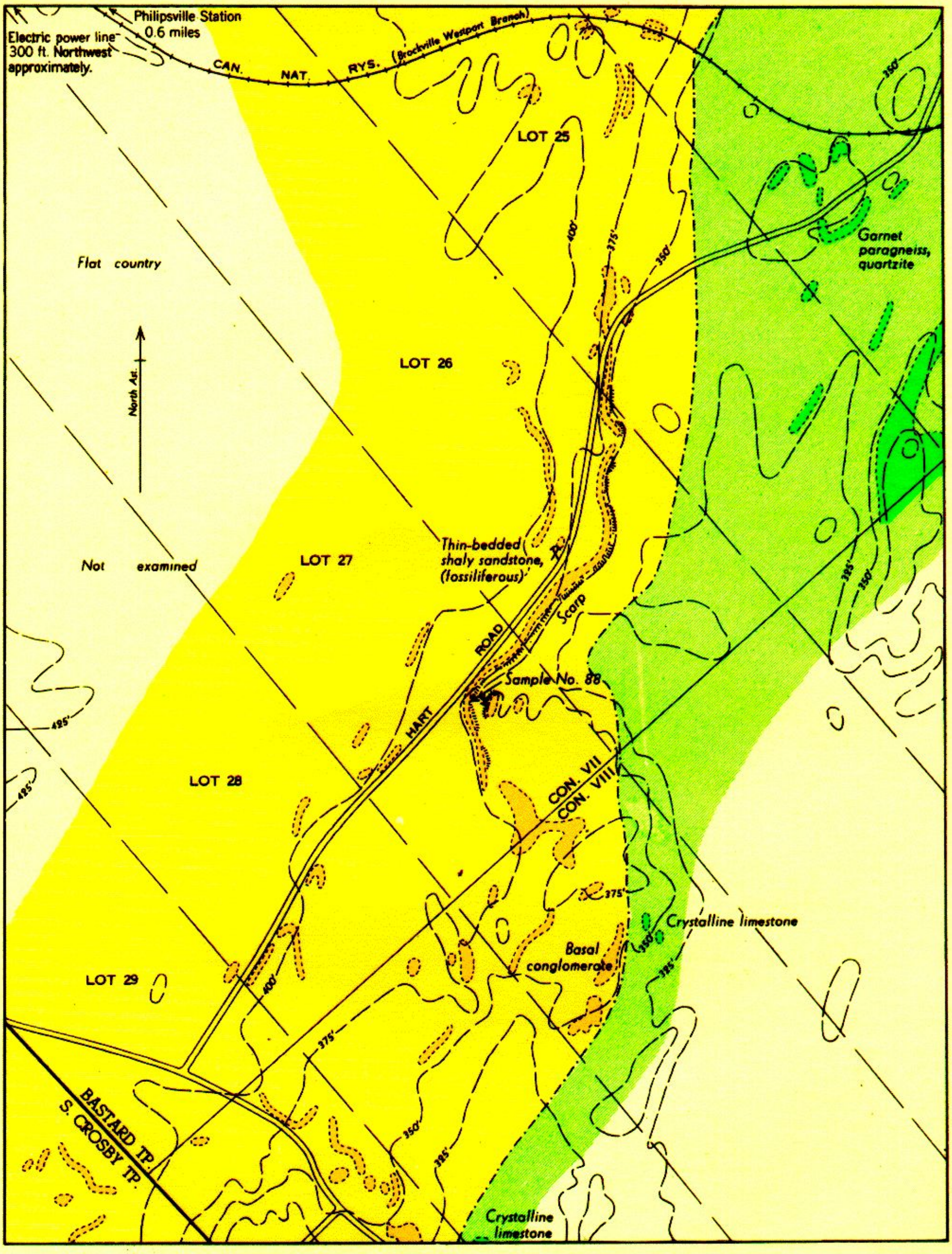


FIG. 12—SECTIONS THROUGH SIDERITE ORE BODIES AS SHOWN BY DRILLING ON CROSS-SECTIONS LV, MB, KF, AND LA, RUTH RANGE. The dikes are classed as lamprophyre or diorite. (From the drilling records of Michipicoten Iron Mines, Limited.)

To accompany report by M. L. Keith in Vol. LV, Part 5, Ontario Department of Mines, 1946.



HART ROAD AREA

BASTARD TOWNSHIP, LEEDS COUNTY

Scale of Feet

FEET 0 400 800 1600 2400 FEET

LEGEND

PALEOZOIC

CAMBRIAN OR ORDOVICIAN

Sandstone.

PRECAMBRIAN

Not differentiated.

SYMBOLS

Boundary of rock outcrop.

Geological contact.

Steep slope.

Contour approximate.

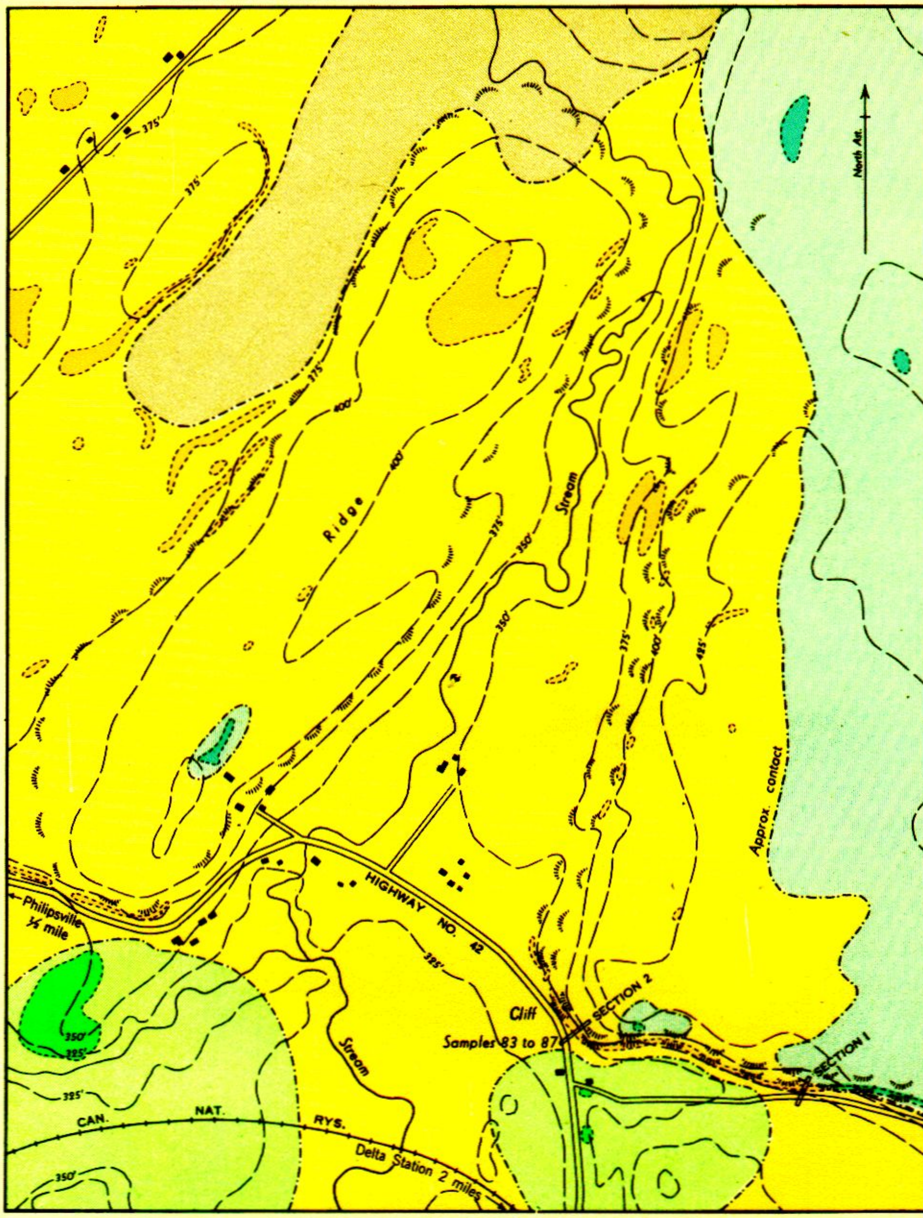
Quarry.

SOURCES OF INFORMATION

Topographical base map from aerial photographs, (R.C.A.F.) Contours from map of the National Topographic Series, (Westport Sheet).

Geology by M. L Keith, 1945.

To accompany report by M. L. Keith in Vol. LV, Part 5, Ontario Department of Mines, 1946.



PART OF PHILIPSVILLE-DELTA AREA

BASTARD TOWNSHIP, LEEDS COUNTY

Scale of Feet

FEET 0 400 800 1200 1600 2000 FEET

LEGEND

CENOZOIC

PLEISTOCENE AND RECENT

Sand, clay.

PALEOZOIC

ORDOVICIAN

Limestone.

CAMBRIAN-OR ORDOVICIAN

Sandstone.

PRECAMBRIAN

Not differentiated.

SYMBOLS

Boundary of rock outcrop.

Geological contact.

Steep slope.

375' *Contour, approximate.*

NO. 42 *King's Highway, with number.*

Road.

SOURCES OF INFORMATION

Topographical base map from aerial photographs, (R.C.A.F.) Contours from map of the National Topographic Series, (Westport Sheet).

Unpublished map, (Westport Sheet), G.S.C., by Morley Wilson.

Additional geology by M. L. Keith, 1945.

To accompany report by M. L. Keith in Vol. LV, Part 5, Ontario Department of Mines, 1946.

PART OF CHARLESTON LAKE AREA

REAR OF LEEDS & LANSDOWNE TOWNSHIP, LEEDS COUNTY

Scale of Feet

FEET 0 400 1200 2000 FEET

LEGEND

PALEOZOIC

CAMBRIAN OR ORDOVICIAN

Sandstone.

PRECAMBRIAN

Not differentiated.

SYMBOLS

Swamp.

Boundary of rock outcrop.

Geological contact.

Strike of gneissic structure.

Contour approximate.

Road.

Wagon road.

Building.

Steep slope.

SOURCES OF INFORMATION

Topographical base map from aerial photographs, (R.C.A.F.)
Contours from maps of the National Topographic Series, (Westport and Gananoque Sheets).
Unpublished map (Westport Sheet). G.S.C., by Morley Wilson.
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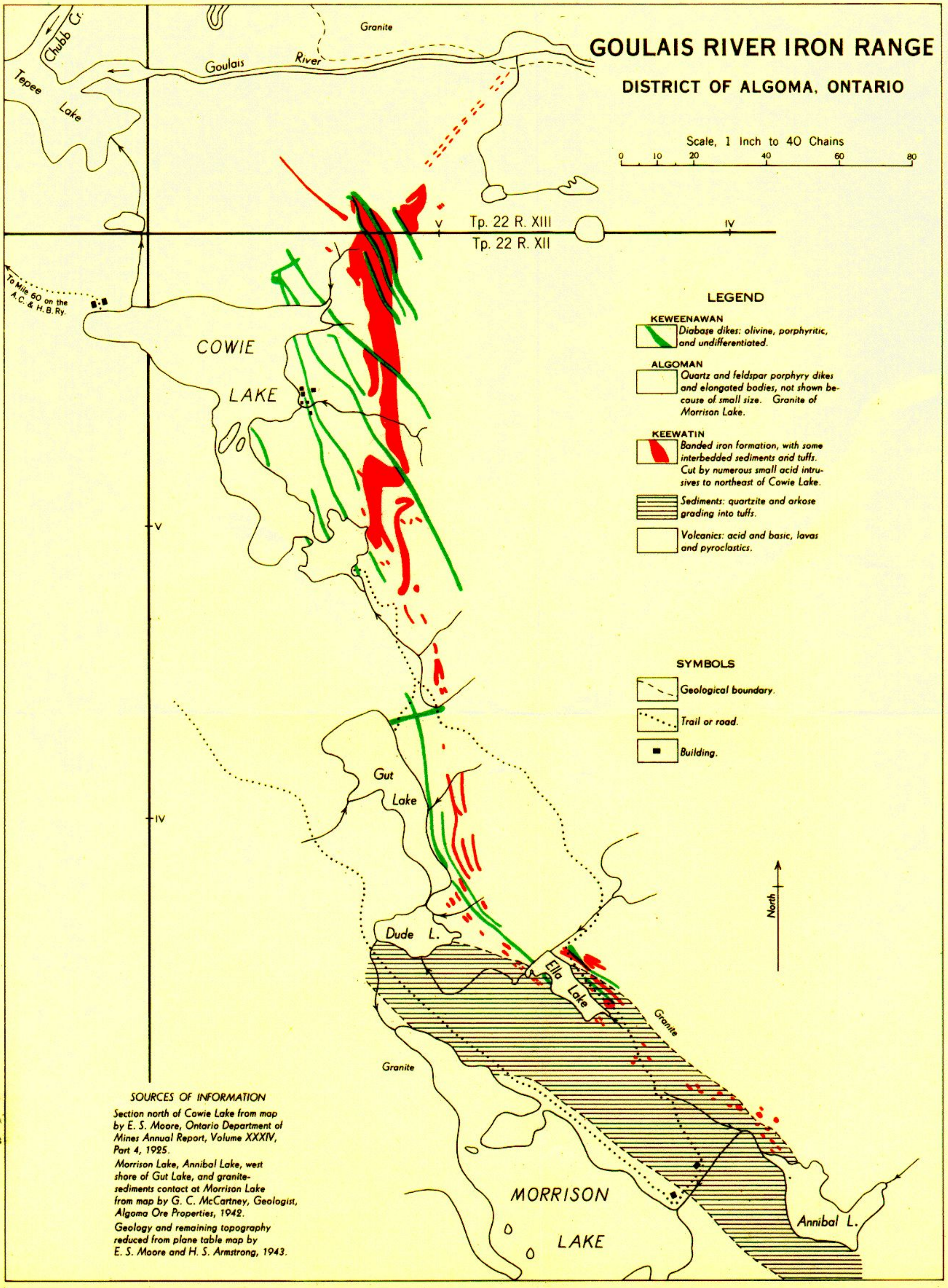

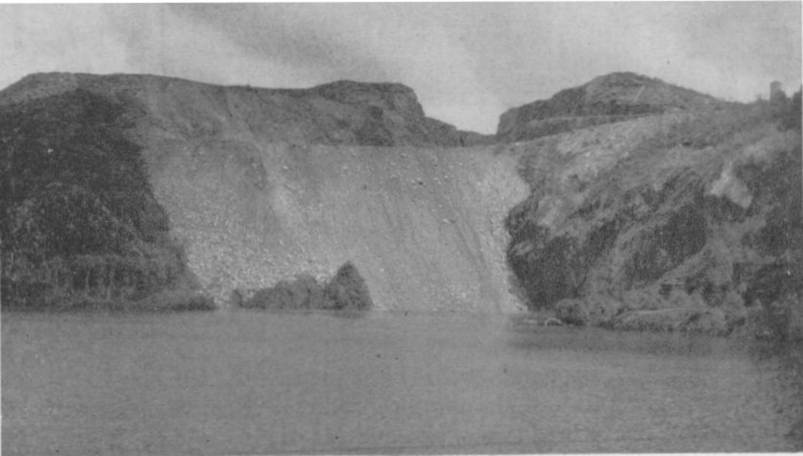

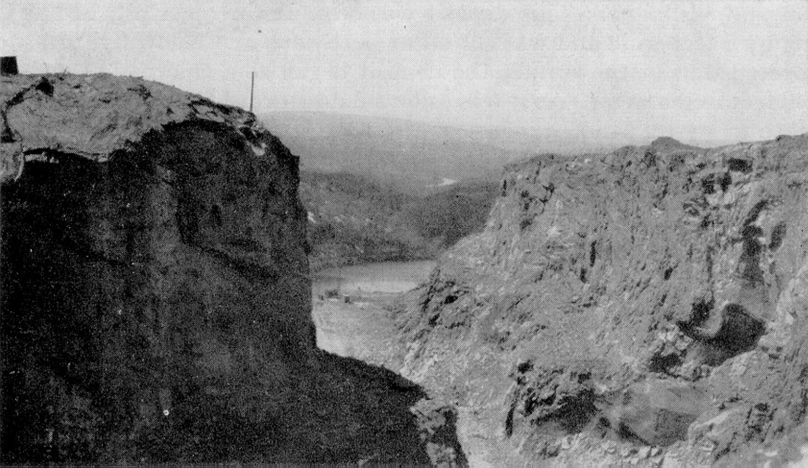

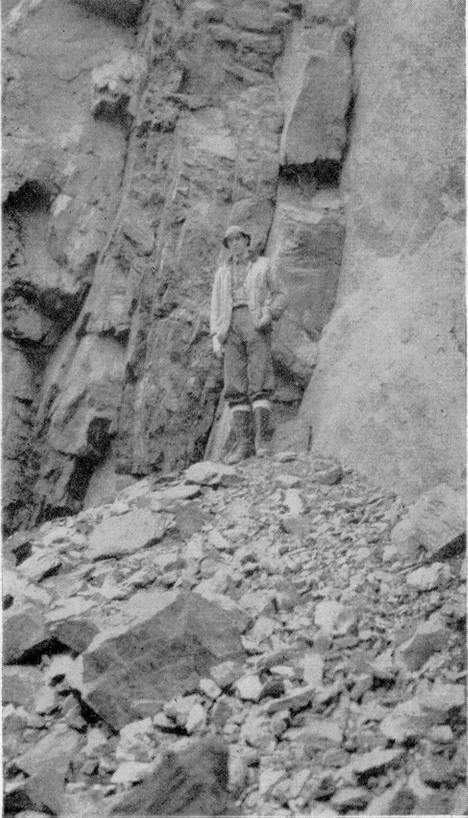

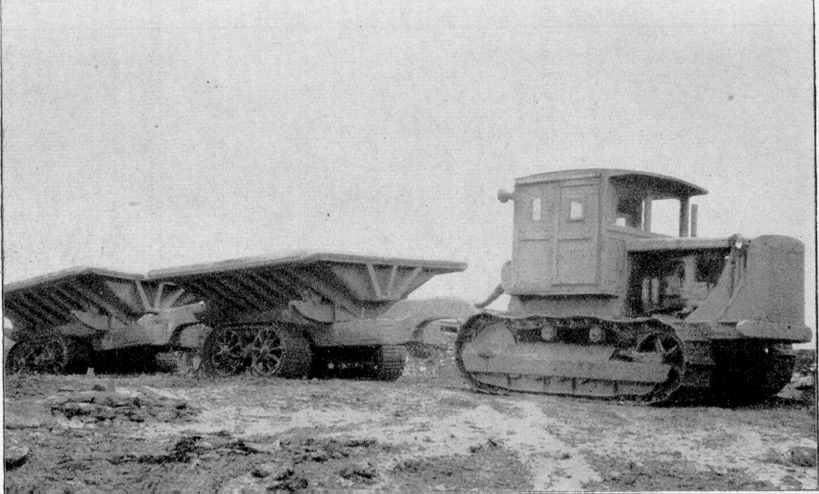

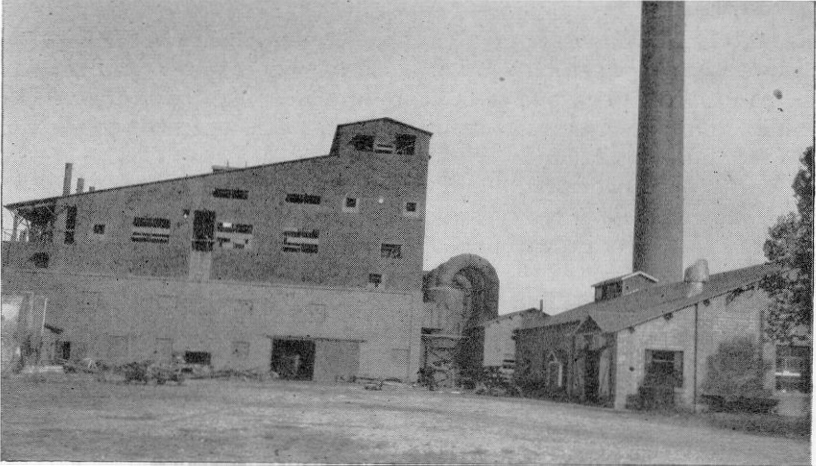

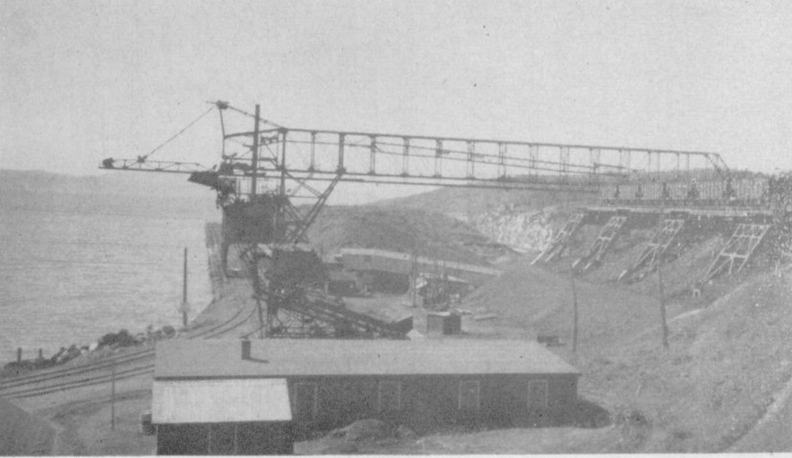

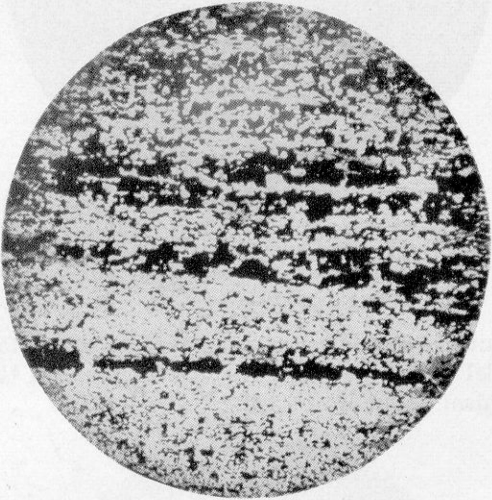

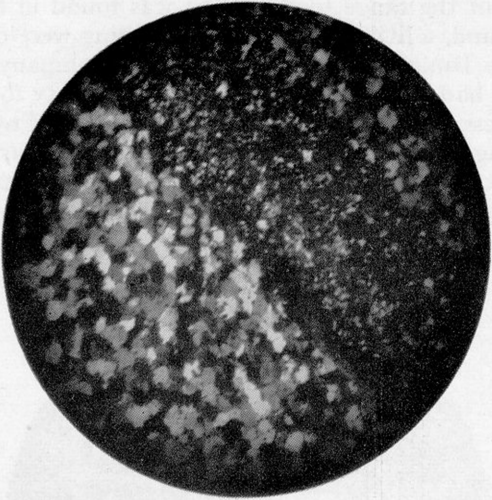

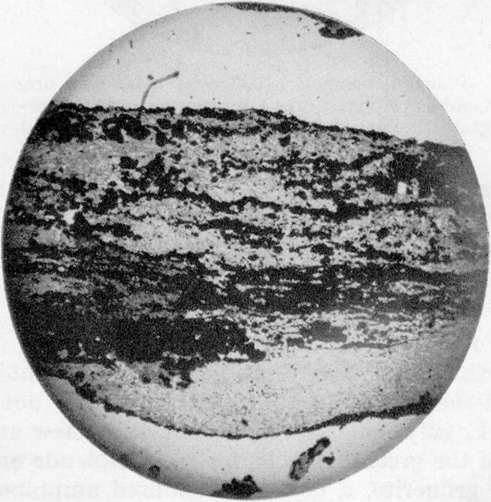

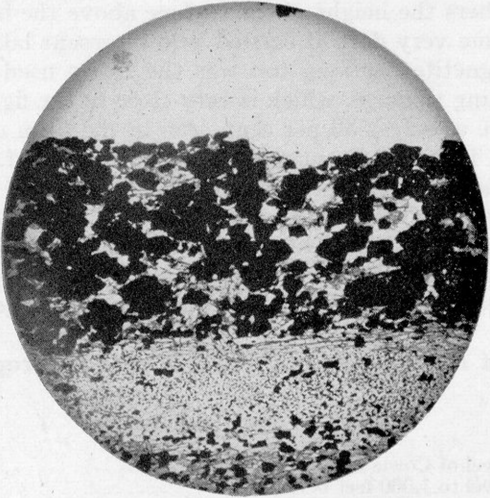

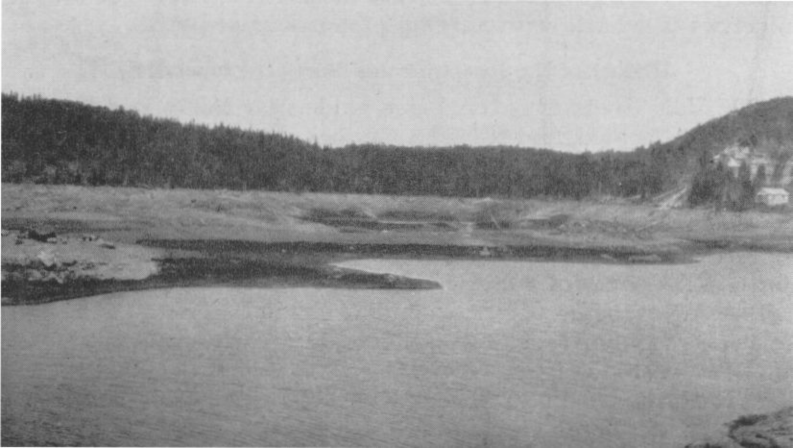

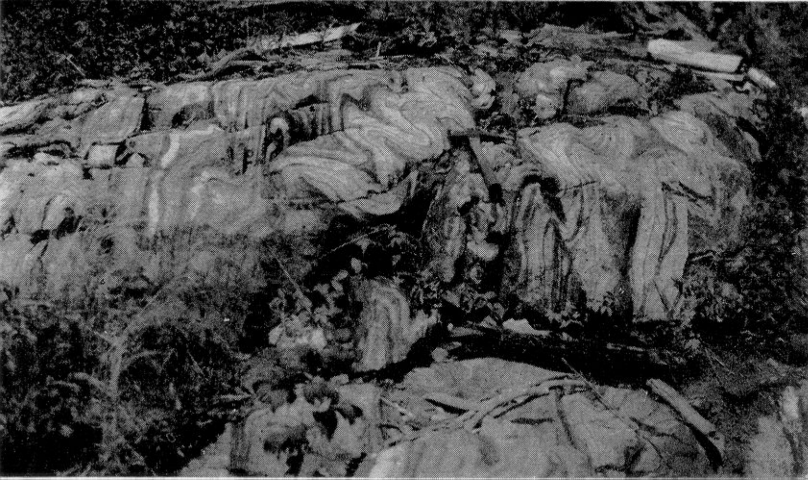

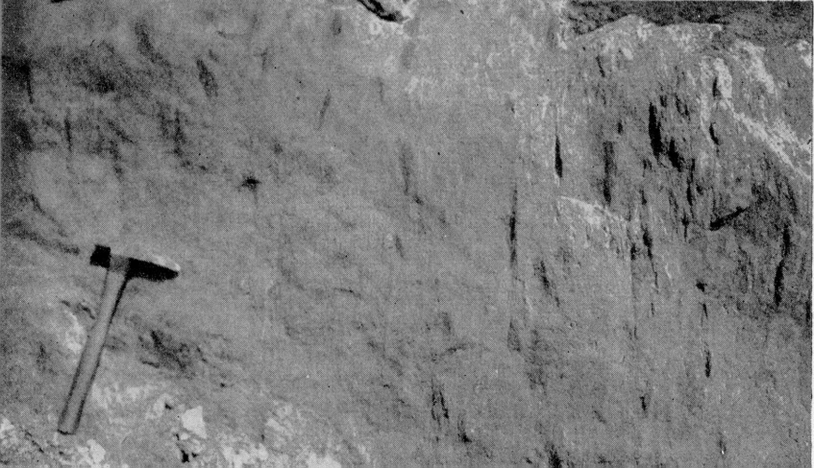

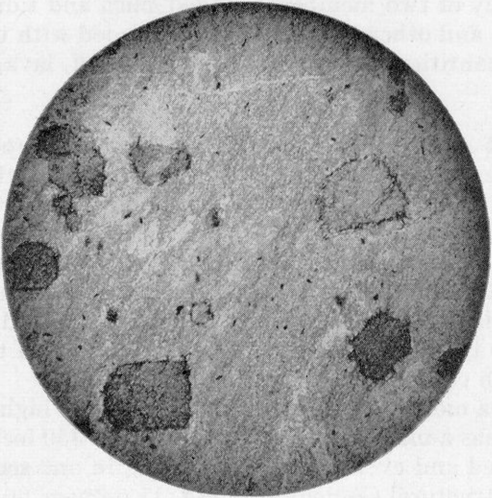

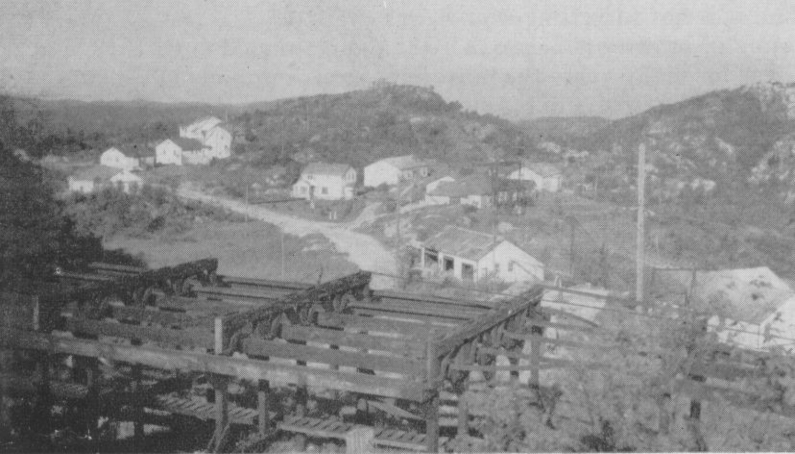

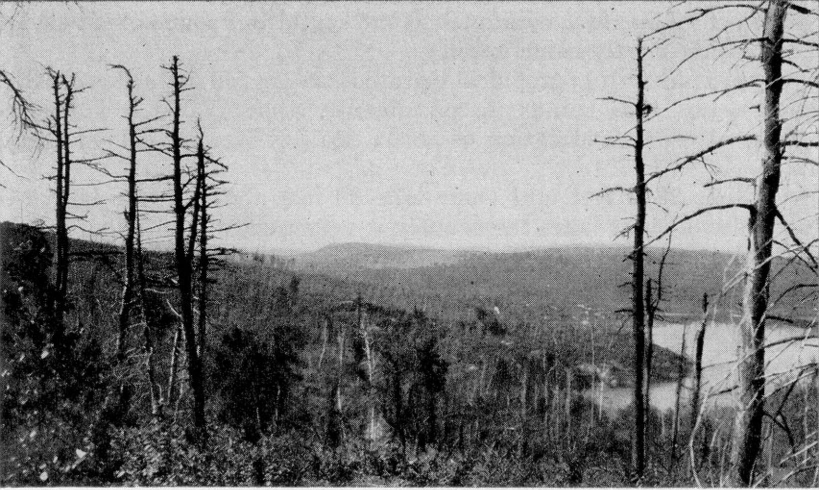

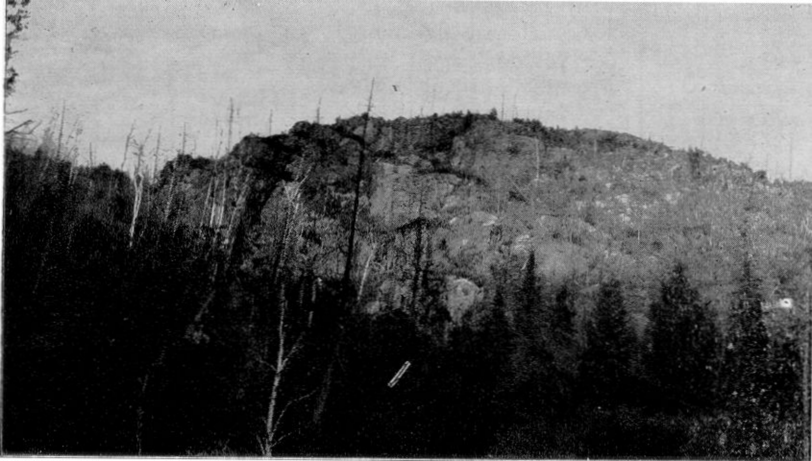

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. LESLIE M. FROST, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

FIFTY-FIFTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LV, PART V, 1946

Sandstone as a Source of Silica Sands in Southeastern Ontario

By

M. L. KEITH

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1949

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Sandstone as a Source of Silica Sands in Southeastern Ontario

By M. L. Keith

Introduction

The present investigation of the occurrence, composition, and utilization of sandstone in Southeastern Ontario was undertaken with the object of assisting and encouraging commercial development. The field work was carried out during the summer of 1945 and laboratory investigations during the following winter and the spring of 1946.

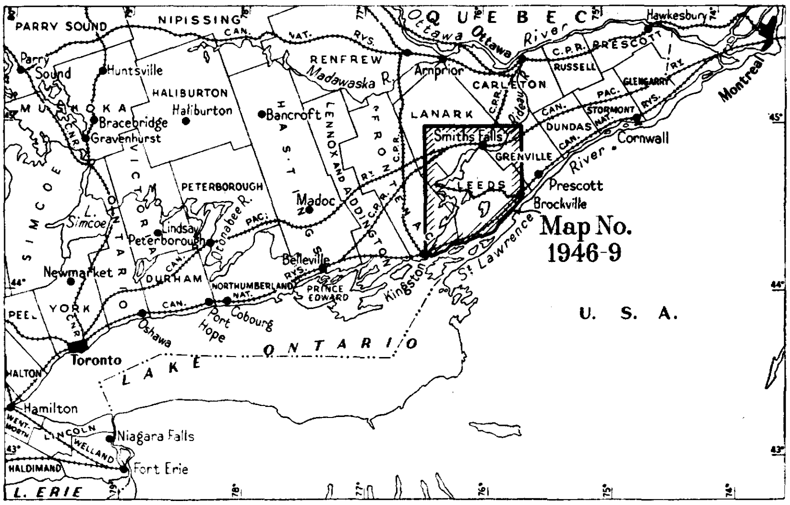


Fig. 1—Index map showing the part of Southeastern Ontario investigated for sandstone. Scale, 1 inch to 80 miles.

The area covered by the investigation comprises parts of Frontenac, Leeds, and Lanark counties (see Fig. 1). Sandstone occurrences in Carleton county to the northeast and in Prescott and Glengarry counties adjacent to the Quebec boundary were not examined.

The field work comprised the delineation of areas underlain by sandstone, the selection and mapping of potential quarry sites, and the sampling of occurrences that seemed to offer the best possible sources of raw material for the production of various grades of silica sand. Laboratory investigations included the study of representative specimens and thin sections to determine the physical character of the rocks and the variations of composition and of grain size and shape. Chemical analyses were made of selected samples. Some attention was given to methods of processing the sandstone to produce industrial silica sands and to the characteristics of such sands.

Acknowledgments

Information regarding the distribution of sandstone was obtained in part from published maps of M. B. Baker,[1] J. F. Wright,[2] and Alice E. Wilson[3] and from an unpublished map of the Westport sheet kindly lent by M. E. Wilson of the Geological Survey of Canada. L. H. Cole's report[4] on "Silica in Canada" was a valuable source of information, and supplementary information was obtained from members of the Bureau of Mines at Ottawa. Chemical analyses were made by D. A. Moddle, Provincial Assayer. Statistics on silica sand were furnished by the Dominion Bureau of Statistics through the courtesy of W. H. Losee of the Mining, Metallurgical, and Chemical Branch.

A. D. Bartlett and James Hill of Kingston Silica Mines very generously supplied information regarding their quarry and plant at Joyceville. The writer was ably assisted in the field during the summer of 1945 by H. I. Marshall.

Economic Considerations

USES AND SPECIFICATIONS

Sandstone is used as dimension stone or flagstone for building; as coarse lump silica; and, after processing involving crushing, screening, and washing, as silica sands of various grades and as fine-ground quartz. The present investigation is concerned primarily with the crushed and ground products, and only brief mention will be made of the use of sandstone for building stone.

Building Stone

Sandstone in order to be suitable for building stone must be tough rather than friable and must have well-developed bedding-planes from 4 to 10 inches apart to facilitate quarrying and working. Common cementing materials of sandstone are quartz, calcite, clays, and iron oxide. Rocks with siliceous or calcareous cements are generally preferred for building purposes. Red and brown colours are desired in some cases, but a uniform white or buff stone would probably have the widest market. Weathering properties are important; some sandstones become more friable or disintegrate on weathering and are therefore undesirable. The porosity of commercial sandstones ranges from 1 to 10 per cent.; high porosity may result in the spalling of a building stone subjected to frost action. Disseminated iron-bearing minerals, such as pyrite, marcasite, and siderite, are deleterious because they may produce irregular iron stains on the surface.

Variations in Specifications

In considering specifications for silica sands and lump silica, it should be noted that some industrial users have rigid specifications as to chemical composition and require that the content of certain objectionable impurities be less than the standard maximum figures. Other users lay down requirements as to size, shape, and toughness of grains and are less concerned about high chemical purity; and still other industries can use low-grade sands and have no rigid specifications. In some cases specifications are a function of price, within limits, and a cheap, easily accessible sand may be allowed substandard specifications.

[1]M. B. Baker, "South Part of Frontenac County, Eastern Ontario," Ont. Bur. Mines, map No. 25e accompanying Vol. XXV, 1916, pt. 3; "County of Leeds," Ont. Dept. Mines, map No. 31c accompanying Vol. XXXI, 1922, pt. 6.

[2]J. F. Wright, "Brockville-Mallorytown Area," Geol. Surv. Can., Pub. No. 1964, 1923, accompanying Mem. 134.

[3]Alice E. Wilson, "Nepean," Geol. Surv. Can., map No. 588A, 1940.

[4]L. H. Cole, "Silica in Canada: Its Occurrence, Exploitation, and Uses," part 1, Can. Dept. Mines, Mines Branch, Pub. No. 555, 1923.

Some general requirements are given in the following paragraphs. Specifications are not standardized and may vary from one company to another. Reference should be made to the section of L. H. Cole's report[1] dealing with the industrial uses of silica and to the bibliographies given by H. Ries[2] and R. B. Ladoo.[3]

Lump Silica

Lump silica is used in metallurgy, particularly as a flux for base-metal ores low in silica. For this purpose ½-inch to 2-inch lump is used, with the minimum grade set at about 70 per cent. SiO_2. The common practice is to crush a local supply of quartz or quartzite or a low-grade siliceous ore close to the smelter. Lump silica in ½-inch to 6-inch size, produced by crushing quartzite or quartz, is specified by most manufacturers of ferrosilicon and silicon. A dense, compact sandstone would probably be satisfactory, but much of the sandstone of Southeastern Ontario is too friable to be produced and shipped as lump. The general chemical requirements are as follows:—

		Per cent.
Silica	minimum	97 to 98
Iron oxide and alumina (iron content should be uniform)	maximum	1 to 1.7
Lime	maximum	0.2
Magnesia	maximum	0.2
Phosphorus and arsenic (particularly deleterious)		nil

Glass Sand

Sand for the manufacture of glass and fused silica-ware must be a washed high-silica product, all minus 20 mesh. Some users specify 1 per cent. maximum of fines below 150 mesh. Typical chemical requirements are:—

	Best grades (maximum)	Cheaper grades (maximum)
	per cent.	per cent.
Iron oxide	0.02	1
Alumina	.1	4
Lime and magnesia	.1	.5
Moisture in delivered sand	2.5	2.5

A Canadian glass manufacturer set the upper limit of iron oxide at 0.03 per cent. and of alumina at 0.5 per cent. Weigel[4] gives the following analysis of a typical high-grade glass sand from Ottawa, Ill.:—

	Per cent.
SiO_2	99.61
Fe_2O_3	.02
Al_2O_3	.16
CaO	.05
MgO	.03
Loss on ignition	.08

Specifications vary somewhat with price. A very low priced sand may be allowed a higher iron tolerance, the effect of iron in the glass batch being counteracted by decolourizers. High-grade glass sand would also be suitable for the manufacture of sodium silicate.

[1]L. H. Cole, op. cit., pp 17–34.
[2]H. Ries, "Industrial Minerals and Rocks," Am. Inst. Min. Eng., 1937, p. 762.
[3]R. B. Ladoo, "Non-Metallic Minerals," McGraw-Hill, 1925, p. 514.
[4]W. M. Weigel, "Technology and Uses of Silica and Sand," U.S. Bur. Mines, Bull. 266, 1927, p. 134.

Sand for Silicon Carbide

Sand for the manufacture of silicon carbide (trade names Carborundum, Crystolon, Carbolon, etc.) has somewhat less rigid specifications than those for glass. The silica content is generally specified as 99.25 per cent. minimum. Lime, magnesia, and phosphorus are objectionable. Small amounts of iron and alumina are tolerated but should be constant from one shipment to another. Canadian manufacturers are using a sand with A.F.A. fineness No. 35.[1]

Foundry Sand

The specifications as to sizing and grain shape of foundry sands have become more rigid in recent years, but there are usually no chemical requirements except that a refractory, high-silica sand is preferred. The classifications used are those of the American Foundrymen's Association.[2] Some foundries prefer an artificial or mixed moulding sand to a natural-bonded moulding sand. The artificial sands are prepared by mixing a sized silica sand with refractory clay bond. The sizes used in greatest bulk are between A.F.A. No. 35 and A.F.A. No. 48, finer sizes (larger A.F.A. numbers) being used for small castings and fine work and coarser sizes for large castings. Minor amounts are used in sizes down to A.F.A. No. 90. Most foundries now require a washed sand free from the fine dusts that are a silicosis hazard. Sands with rounded or subrounded rather than angular grains are preferred because the round-grain sands have a higher porosity and allow the escape of gases around castings. Grains should be rough rather than smooth in order that the clay bond will adhere. An iron oxide coating on grains is considered advantageous in assisting the adherence of the clay bond. Grains should be refractory and tough enough to allow moulding sands to be used several times without excessive loss to fines.

Sandblast Sand

Sandblast sand is used with an air blast to clean castings, to carve stone, to remove paint, etc. Both rounded and sharp angular grains are used; angular grains are reported to grind a smoother surface on metal. Grains should be tough rather than brittle, and even sizing is important. Recent practice requires a washed sand free of dust. Following is a table of grades of sandblast sand quoted from the Minerals Yearbook, U.S. Bureau of Mines:[3]—

Retained on mesh	Sand No. 1	Sand No. 2	Sand No. 3	Sand No. 4
	per cent.	per cent.	per cent.	per cent.
4	......	......	......	2.70
6	......	......	0.00	76.60
8	......	......	1.55	99.80
10	......	0.00	53.15	100.00
14	0.40	32.20	84.25	......
20	35.70	78.35	99.70	......
28	97.20	92.05	100.00	......
35	99.90	98.20	......	......
48	100.00	99.70	......	......

Gannister

Silica brick is used for lining coke ovens, metallurgical furnaces, and glass-melting furnaces. Silica sand for the manufacture of such brick is a coarse,

[1]See page 15.
[2]"Testing and Grading Foundry Sands and Clays," 4th ed., 1938, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.
[3]"Industrial Minerals and Rocks," Am. Inst. Min. Eng., 1937, p. 760.

splintery, or angular material called gannister, which is commonly prepared by crushing quartzite or vein quartz to pass an 8-mesh screen. Most sandstones give grains that are too round to be suitable. The brick is formed by bonding the gannister with about 2 per cent. lime. The general requirements for gannister, in addition to irregular grain shape, are as follows:—

		Per cent.
Silica	minimum	97
Alkalis	maximum	0.4
Alumina	maximum	1 to 1½
Total impurities	not over	3

Somewhat similar material, although with less rigid specifications, is used for making sand-lime building brick.

Furnace Sand

The bottoms of open-hearth steel furnaces and some remelt furnaces are lined with what is called furnace sand. For this purpose sand should be refractory, generally more than 95 per cent. silica, although sand with as little as 80 per cent. silica has been used. A small amount of bonding material is desirable, but this may be supplied by adding plastic fire clay. Furnace sands should have a wide variation in grain size in the range between 42 mesh and 150 mesh. Coarser sizes are used in some cases. Silica sands similar to those used for foundry sands but with wider size limits should be suitable.

Lower-Grade Sands

Sands are required for building construction (for concrete and mortar), for increasing the silica content of raw materials for Portland cement, for railroad-engine sand, for filtration beds used in water treatment, and for agricultural sand used to lighten heavy clay soils. Specifications for building-construction sand are not standardized; an outline of typical tests and grades is given by J. R Thoenen.[1] There seem to be no set specifications for sand for cement manufacture except that a fairly high silica content is desirable and the amounts of other constituents should be constant. Unsized sand and fines are accepted. Engine sand should be free-running, mostly plus 80 mesh and with a minimum of clay and fines (less than 1 per cent. minus 200 mesh in the most suitable sands). An outline of tests and requirements is given in a recent paper by G. M. Hutt.[2] For agricultural purposes almost any sand is satisfactory, including waste products obtained during the production of higher-grade sands. Filter sands are required to be of fairly uniform grain size, commonly from 90 per cent. over 0.35 mm. to 90 per cent. over 0.65 mm. Either rounded or angular grains are suitable. Amount of constituents soluble in hydrochloric acid should be less than 2 per cent.

Ground Quartz

Finely ground quartz is used as an ingredient of ceramic bodies and glazes, as a filler in rubber and fertilizers, as an extender for paints, and as an abrasive ingredient in some scouring powders and soaps. Some users of pulverized silica prefer the so-called soft or porous forms, such as diatomite and tripoli, but there is a market for the ground quartz that can be prepared from clean silica sand. The ceramic grade of ground silica is required to be from minus 140 mesh to minus 200 mesh, white, and with a low iron content (0.5 per cent. maximum iron oxide

[1]J. L. Thoenen, "Industrial Mineral and Rocks," Am. Inst. Min. Eng., 1937, pp. 705-716.
[2]G. M. Hutt, "Engine Sands," Bull. Can. Inst. Min. Met., October, 1945, pp. 631-637.

in the best grades). A manufacturer of porcelain enamels sets the upper limit of lime at 0.2 per cent. For fillers in rubber, etc., and for paint extender use, pure white, sized products are required in various size grades from 200 mesh to 400 mesh. The rubber industry has special tests made on trial batches of rubber. The grade used as a filler in fertilizer is specified as 99 per cent. through 200 mesh. A Canadian paint manufacturer gave the following specifications for ground silica:—

		Per cent.
Size	through 325 mesh	99
Silica	minimum	98
Loss on ignition	maximum	1.5
Moisture	maximum	1

Oil absorption.....about 20 per cent.
Colour.....white to match standard sample.

Further data on paint grades are given by Henry A. Gardner.[1]

Abrasive grades should have sharp angular grains. Ground feldspar is reportedly replacing ground quartz in scouring soaps and cleansers. One manufacturer of household cleanser gave the disadvantage of ground quartz as a tendency to cake in the presence of tri-sodium phosphate, which is used as an ingredient.

MARKETS AND PRICES

Silica sand from the section of Southeastern Ontario covered by the present report has potential market outlets in Ontario and Quebec; shipping distances are limited by the grade of sand produced and competitive prices and indirectly by production costs. The best grades of pulverized quartz and high-grade silica sands can be shipped long distances; whereas low-cost, low-grade products, such as construction sands and agricultural and engine sands, are restricted to purely local markets.

A single grade of sand may have a variety of market outlets in different industries. For example, a good grade of glass sand might be sized to give several grades of foundry sand, sand for the manufacture of carborundum, and sands suitable for sand-blasting, lining metallurgical furnaces, and a variety of other uses. If a producer can meet the requirements of industries that specify a high-grade silica sand, he may have a potential market in industries with less rigid specifications.

Some idea of the size of the potential market for Canadian silica sands and allied products can be gained from the following data, compiled by the Mining, Metallurgical, and Chemical Branch of the Dominion Bureau of Statistics:—

	1941	1942	1943
	tons	tons	tons
IMPORTS INTO CANADA:			
Silica sand	421,143	540,904	[2]509,043
Ground quartz	5,075	9,791	11,410
Total	426,218	550,695	520,453
PRODUCTION IN CANADA:			
Silica sand and ground quartz	37,987	63,833	73,772

[1]Henry A. Gardner, "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colours," Institute of Paint and Varnish Research, Washington, D.C.

[2]Silica sand imported in 1943 (509,043 net tons) was valued at $1,011,117. Most of this, 464,845 tons valued at $916,264, was imported into Ontario and Quebec.

AVAILABLE DATA ON CONSUMPTION IN CANADA, 1941–43
(As reported by consumers)

Industry	1941	1942	1943
	net tons	net tons	net tons
Glass	114,761	145,005	132,992
Steel foundries	91,192	134,724	129,881
Artificial abrasives	57,362	76,943	89,002
Iron foundries	11,136	9,156	9,681
Chemicals	16,397	15,276	17,305
Ferro-alloys	2,347	4,338	4,535
Clay products	3,284	3,753	2,555
Cleaning and scouring powders	2,617	2,482	3,250
Roofing paper	2,641	2,879	2,135
Paints	1,019	1,310	1,239
Refractories	1,635	483	1,420
Matches	269	333	334
Prepared foundry supplies	602	60	126
Non-ferrous smelters and refineries	644	321	3,308
Brass foundries	1,094	1,874	2,829
Fertilizers (filler)	not available	20,000	30,000
Electrical apparatus	1,150	329	681
Enamelling	1,447	627	593
White metal foundries	176	42	12
Miscellaneous	137	840	4,112
Total	309,910	420,795	436,010

A partial list of Ontario and Quebec companies that use silica sand and ground quartz is appended to the present report.[1]

Prices for silica sands and ground quartz vary widely, depending on grade and use, and also vary from place to place because of differences in freight rates. For a Michigan core sand that costs $5.85 per short ton delivered in Smiths Falls, approximately $5.35 of the cost is freight. The following prices are approximate and are based on data obtained from industrial users of ground quartz and silica sands in 1945:—

	Per short ton
GROUND QUARTZ:	
Ceramic grade	$16.00
Paint grade	$20.00 to $26.00
SILICA SANDS (various grades):	
In Toronto	2.40 to 5.00
In Windsor	3.90 to 5.28
In Smiths Falls	4.30 to 5.85
In Montreal	4.75 to 5.55

The above price ranges are for the higher-grade sands. Prices for construction sands, agricultural sands, and engine sands are much lower, from 80 cents to $1.30 in local markets.

Sands produced from sandstone in Frontenac county are priced (1946) at $3.00 per short ton f.o.b. Rideau Station north of Kingston.

FACILITIES FOR LOCAL PROCESSING

The sandstone area under discussion lies about half way between Toronto and Montreal, in which centres major market outlets are located. Rail freight rates per short ton of silica sand are $1.80 Rideau Station to Montreal, Toronto, or Hamilton; $2.00 to Thorold; and $2.10 to Shawinigan Falls. The one operating sandstone quarry and some of the sandstone occurrences judged to have commercial possibilities lie close to the Rideau Canal system, and it may be feasible to ship silica sands by water.

[1]See page 33.

Southeastern Ontario has low electric-power rates, which may be considered an advantage in the development of sandstone deposits adjacent to existing transmission lines.

General Description of the Potsdam Formation

Areal Distribution

Sandstone of the Potsdam formation outcrops in scattered discontinuous patches within an area extending from Kingston to Brockville along the St. Lawrence and from the St. Lawrence northward beyond Perth and Smiths Falls (see map No. 1946-9 in pocket). In the northeastern and northwestern parts of the area, calcareous sandstone and argillaceous sandstone beds are abundant, and the sandstone in many places is overlain by Ordovician limestone. Siliceous sandstone is predominant in the central and southern parts of the area except along the Rideau canal northeast of Kingston, where red and brown ferruginous sandstone outcrops.

Position in the Geological Column

Following is a general geological table for the part of Southeastern Ontario covered during the investigation of sandstone occurrences:—

CENOZOIC	
PLEISTOCENE and RECENT:	Sands, clay, glacial till.
	Unconformity
PALEOZOIC	
ORDOVICIAN (Trenton, Black River, Chazy, and Beekmantown groups):	Mainly limestone and shale with interbedded sandstone and calcareous sandstone in the March formation at the base of the Beekmantown.
ORDOVICIAN or CAMBRIAN (Potsdam formation = Nepean?):	Sandstone.
	Unconformity
PRECAMBRIAN:	Granite, syenite, etc. Gneiss, quartzite, crystalline limestone.

The sandstone formation in Southeastern Ontario has been assumed to be equivalent to the Potsdam formation (late Cambrian?) of New York State, and the term Potsdam has been in use in Ontario for many years. Alice E. Wilson uses the term Nepean for the sandstone formation in the vicinity of Ottawa and states:[1]—

> There is no discernible break between the Nepean and the overlying March formation and, therefore, it is possible the Nepean sandstone is of Ordovician age.

In the present report the established term Potsdam is retained for the sandstone of the Kingston–Brockville–Smiths Falls area without prejudice to the controversy as to whether the sandstone should be considered Cambrian or Ordovician. It rests unconformably on Precambrian rocks and is conformably overlain in places by the March formation of the Beekmantown group and by younger Ordovician sedimentary rocks. Fossils are not abundant.[2]

In two localities, one of which is 1,900 feet southwest of the plant of Kingston Silica Mines, which is about 12 miles northeast of Kingston, and the other half a mile north of Holleford on the boundary line between Portland and

[1]Geol. Surv. Can., map No. 588A, 1940, descriptive notes.

[2]The following fossils were collected by the writer from shaly horizons in calcareous sandstone at about 6 miles southwest of Brockville and were identified by Dr. Alice E. Wilson:—

Raphistomena canadensis, Billings *Raphistomena calcifera*, Billings *Eccyliopterus disjunctus*, Billings	Beekmantown age.

A fossil collected by R. W. Ells from sandstone in the vicinity of Athens in Leeds county was identified by Dr. Wilson as *Lingulella acuminata* or *Lingulepis acuminata*, Conrad, Ordovician or Cambrian age.

Loughborough townships, Frontenac county, west of the map area, can be seen blocks of banded red and white sandstone disrupted and enclosed in massive brown sandstone. The disrupted and recemented blocks near the plant of the Kingston Silica Mines show on a glaciated surface more than 30 feet stratigraphically above the base of the formation; the occurrence, therefore, is taken to indicate an intraformational disturbance rather than two distinct sandstone formations.

Base and Thickness of the Sandstone

The Precambrian erosion surface, which forms the base of the sandstone, has the characteristics of a gently rolling peneplain and consists of gneiss, quartzite, and crystalline limestone of the Grenville series, intruded by granite, syenite, and related intrusives. The Precambrian rocks underlying the Potsdam sandstone are generally highly decomposed and rusty, a condition in marked contrast to the fresh condition of Precambrian rocks where they lie directly under Ordovician limestone. The attitude of the sandstone beds conforms to the topography of the subsurface; over wide areas the dips of the Potsdam are less than 5 degrees. In places where the sandstone is deposited around monadnocks on the Precambrian peneplain, dips of as much as 40 degrees are observed.

The elevation of the base of the Potsdam sandstone above mean sea-level ranges from 300 feet along the Cataraqui river near Joyceville and at Charleston lake to about 470 feet at a point 3 miles southwest of the town of Perth. In places there are appreciable local variations in the elevation of the base. Between Joyceville in Frontenac county and the Rideau canal 1 mile west, the elevation of the base changes from 370 feet to 300 feet. The maximum thickness exposed in a single section is 72 feet, in a showing on a cliff face 2 miles north of Delta in Bastard township, Leeds county. The total thickness of the formation in this vicinity is about 125 feet. To the north, Alice E. Wilson[1] reports a maximum known thickness of 280 feet. To the south, toward Kingston and Brockville, the formation becomes thinner. At Kingston it is entirely missing from the section, and Ordovician limestone lies directly on the Precambrian surface.

Petrography of the Potsdam Formation

The Potsdam formation of Southeastern Ontario is composed largely of fine- to medium-grained sandstone, which is commonly white to pale buff on fresh surfaces and grey on weathered surfaces. A widespread variety, which is most interesting from the point of view of commercial utilization, is a massive, white, siliceous sandstone in which the cementing material as well as the grains are almost entirely quartz. There are two subvarieties: (1) a friable, partially cemented type and (2) a hard, quartzitic type.

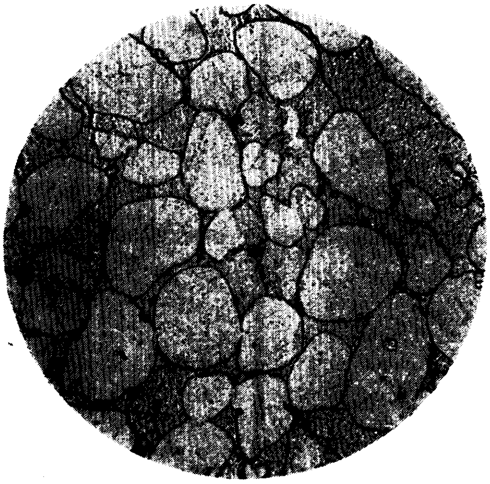
In most places where the base of the formation is exposed, there is a basal conglomerate from 1 to 3 feet thick, which is composed of angular to subrounded quartzite and quartz fragments in a matrix of medium- to coarse-grained, rusty sandstone. Most of the fragments are lithologically similar to the Grenville quartzite; they occur in a variety of sizes, from small pebbles to boulders 10 inches and more in diameter. The general scarcity of fragments of granite and gneiss is noteworthy. Lenticular intraformational conglomerates of similar character and as much as 5 feet in thickness are found in places.

In some localities, notably in the southeast corner of Frontenac county, there are beds of red and reddish-brown ferruginous sandstone. In these the cementing material is predominantly limonite with some hematite.

[1]Alice E. Wilson, op. cit.

Calcareous sandstones are fairly abundant in the northern and eastern parts of the area. Carbonates (calcite with minor ferrodolomite) and argillaceous material constitute from 5 to 40 per cent. of these beds (see photomicrograph below). The rocks weather to a pale-buff colour and can be distinguished by the fact that they weather more easily than the siliceous beds and are therefore recessive on an exposed cliff face. Many of the calcareous beds are filled with fossil-worm burrows about 2 mm. in diameter; these have a nearly vertical attitude and are probably *Scolithus linearis*.[1] Calcareous sandstones of the overlying March formation have a blue-grey colour, weather to brown, and contain predominant dolomite rather than calcite.

Thin grey and black carbonaceous layers are seen in places in the sandstone, and there are thick beds of black sandstone in parts of the quarry of Kingston



Photomicrograph of a specimen of calcareous sandstone from Caintown composed of quartz grains in a calcite cement. (× 35.)

Silica Mines in Pittsburgh township, Frontenac county. Examination shows the black material to occur as films around quartz grains and filling intergranular spaces and joint-planes. In some places it is disseminated in the sandstone for 1 to 10 inches on either side of a joint-plane. In other places there are round nodules of carbonaceous sandstone from half an inch to 6 inches in diameter. The carbon evidently is not a primary constituent.

Some of the black material separated from crushed sandstone by panning consists of charcoal-like carbon with a small amount of adsorbed hydrocarbon. By heating in a Penfield tube or by extraction with ether, benzol, or carbon disulphide, the hydrocarbon can be separated as a greasy yellow wax. A. A. Swinnerton[2] of the Fuels Division, Bureau of Mines, Ottawa, reports 0.17 per cent. of the yellow hydrocarbon in a sample of the black sandstone collected by the writer southwest of Joyceville.

Feldspathic sandstone is comparatively rare. A milky-white, thin-bedded sandstone, which outcrops a quarter of a mile north of Lyndhurst, Rear of Leeds and Lansdowne, Leeds county, contains about 5 per cent. of altered feldspar.

[1]H. W. Shimer, "An Introduction to the Study of Fossils," revised ed., p. 192, Fig. 79.
[2]Personal communication, Rept. of Analysis, dated January 12, 1946.

Similar beds occur near Delta and elsewhere in the area, and the basal conglomerate in places contains some altered feldspar. One of the beds exposed in a cliff near Philipsville, Bastard township, Leeds county, contains about 12 per cent. feldspar.

Thin-bedded argillaceous sandstone is interbedded with siliceous and calcareous sandstone in some sections, notably to the northeast of Lansdowne and north and northwest of Charleston lake.

On weathered surfaces, some beds of the siliceous and calcareous sandstone show round limonite spots from 2 to 8 mm. in diameter. The limonite-stained patches are generally weathered to a level below that of the surrounding sandstone so that the rock has a pitted surface. Some of the limonite spots are derived from disseminated pyrite and spherical pyrite concretions (see photomicrograph above); others are derived from concretionary masses of an iron-bearing carbonate (ferrodolomite or siderite).

Photomicrograph of a section of drill core from the quarry of Kingston Silica Mines, showing sandstone containing intergranular pyrite (black). (X 35.)

The following table gives a list of the constituents observed in the sandstone. Feldspar and the accessory minerals listed are in very minor amount in most beds. Many of the thin sections examined show no accessory minerals whatever.

GRAINS:

Essential	Quartz. Feldspar (accessory in most).
Accessory	Apatite. Zircon. Rutile. Amphibole. Biotite. Magnetite. Garnet.[1] Tourmaline.[1] Ilmenite.[2]

[1]Reported by W. D. Harding, unpublished thesis, Queen's University, 1930.

[2]Reported by J. E. Hawley and R. C. Hart, "Cylindrical Structures in Sandstones," Geol. Soc. Amer., Bull. 45, 1934, p. 1023.

Cementing Materials....................	Quartz. Calcite. Dolomite. Limonite. Hematite. Clays. Pyrite. Carbon. Hydrocarbon. Leucoxene. Chlorite. Sericite.

Structure and Texture

The sandstone is well bedded; the individual beds are commonly from 6 inches to 2 feet thick, but some of the beds near the base of the formation are

Photomicrograph of a specimen of friable sandstone from Battersea in Frontenac county showing partial regrowth of quartz grains. (× 35.)

as much as 6 feet in thickness. Complex cross-lamination is common, and wave-ripple marks are seen in places. Widely spaced joint-planes with dips from 60 degrees to vertical show in cliff sections and some outcrops. No attempt was made to record the joint pattern. Some of the thick basal beds contain vertical cylindrical concretions from 6 inches to 12 feet in diameter. These have been investigated and described in some detail by J. E. Hawley and R. C. Hart.[1]

The greater part of the sandstone is composed of quartz grains, most of which range from 0.1 to 0.5 mm. in size. The original shapes of the constituent grains range from ovoid or ellipsoidal to nearly spherical. Some rounded grains, including zircons and other accessory minerals, are mostly less than 0.1 mm. in diameter. An examination of a few oriented thin sections cut parallel to bedding planes shows a statistical alignment of the long axes of grains in a direction ranging from north (astronomic) to N. 36° W. The investigation of Dapples and Rominger[2] suggests that such statistical alignment directions may represent

[1]J. E. Hawley and R. C. Hart, op. cit., pp. 1017–1034.

[2]E. C. Dapples and J. F. Rominger, "Orientation Analysis of Fine-Grained Clastic Sediments," Jour. Geol., Vol. 53, No. 4, 1945, pp. 246–261.

current or wave directions and may assist in giving a picture of the basin of deposition.

Regrowth of quartz grains is common, and all stages of secondary growth can be seen in thin section. The extent of the regrowth affects the friability of the rock and the shape of grains, both important factors in evaluation of a rock as a source of silica sands. In the early stages, softer cementing materials such as iron oxides, carbonates, and clays are removed and replaced by silica in such a way that each quartz grain begins to grow a mantle of secondary quartz optically parallel with the quartz of the original sedimentary grain. In many of the sandstones of Southeastern Ontario the interspaces left by the removal of the original cementing materials are only partially filled by secondary quartz (see photo-

Photomicrograph of a specimen of a drill core of quartzitic sandstone from the quarry of Kingston Silica Mines, showing complete regrowth of quartz grains to form mosaic texture. Original grain shapes are outlined by films of clay-like material. (Crossed nicols, × 35.)

micrograph on page 12); the resultant rock is porous, friable, and in general a fairly pure silica sandstone.

In advanced stages of the same process (regrowth of quartz grains), the secondary quartz almost entirely fills interspaces and the resultant rock has the mosaic texture of a quartzite (see photomicrograph above) and low porosity and is tough rather than friable. In some cases a film of the original cementing material, commonly limonite or kaolin, remains outlining the original sedimentary grains (see photomicrograph above).

The Potsdam formation of the area is not folded and shows no evidence of regional pressure metamorphism. Therefore the regrowth of grains and the resultant progressive development of mosaic texture are attributed to the action of circulating solutions, and the process is considered to be neo-crystallization and not recrystallization. The change from sandstone to quartzite has not uniformly affected all beds; friable sandstone occurs interbedded with quartzitic sandstone. The present investigation offers no evidence that explains the selectivity of the process. Original differences of porosity may have influenced the rate of replacement of calcareous and ferruginous cements by quartz. It is possible that replacement occurred mainly in the basin of deposition and that the textural change should be considered part of the process of diagenesis.

Chemical Composition of the Sandstone

Following is an average of twelve analyses of siliceous sandstone from various parts of the area. Analyses of calcareous and argillaceous sandstones are excluded from the calculation of the average.

	Average	Range
	per cent.	per cent.
SiO_2	98.61	97.08 to 99.40
Al_2O_3	.47	.29 to 1.00
Fe_2O_3	.15	0 to .37
FeO	.10	0 to .41
CaO	.13	0 to .47
MgO	.05	0 to .08
S	.02	trace to .05
Loss on ignition	.35	.07 to .74
Total	99.88	....

Analyses of individual sandstone samples are given under "Descriptions of Selected Sandstone Occurrences," pages 16 to 27.

Preparation and Analysis of Samples

Sampling Methods

Samples for analysis and examination were obtained by selecting outcrops or cliff faces showing a sequence of beds and then breaking off pieces from each bed. In general, larger pieces or several pieces were broken from thicker beds and smaller pieces from thinner beds so as to make the samples approximately representative. Weathered material was then trimmed off and the fresh unweathered pieces were combined to make a single sample for each locality. At one showing, the sandstone cliff near Philipsville, the face was first chipped off to remove weathered material and then channel samples were taken with sampling moils. The method of channel sampling gives a better sample, that is one more accurately representative of the rock, but was found to introduce an appreciable amount of metallic iron into the sample from the moils.

Samples obtained by both methods were broken down in a jaw-crusher to ¼-inch size, thoroughly mixed, and then separated by cone-and-quarter method into two parts, one of which was submitted for chemical analysis. The other part was retained for further disaggregation and size analysis.

Chemical Analyses

Samples Nos. 83 to 88, inclusive, from the Philipsville-Delta area were found to contain small fragments of metallic iron introduced during sampling, and it was found necessary to apply a correction in order to determine the true iron content of the rock. This was done as follows:—

Samples were first analysed "as received."[1] A portion of each sample was then worked over with a simple magnet to remove iron filings, and "total iron in portion treated with magnet" was determined. The difference between the total

[1]Chemical analyses by D. A. Moddle, Provincial Assayer.

iron in the sample as received and the total iron in the portion treated with the magnet was considered to represent the metallic iron and was recalculated as FeO and subtracted from the FeO reported in the original analyses to give corrected analyses. The above method of correction is considered to be permissible in view of the fact that there is a negligible content of magnetic minerals in the rocks concerned.

Recasting to Mineral Proportions

Oxide proportions as reported in the chemical analyses were recalculated as molecular ratios, and mineral proportions were calculated by standard recasting procedure.[1] Calculated mineral percentages should not be considered significant to better than 0.1 per cent.

Disaggregation and Size Analyses

For size analysis a part of each sample previously crushed to ¼-inch size was heated in a crucible to dull-red heat and then quenched in water. Larger pieces in the quenched sample were rubbed between the fingers to separate the grains. The sample was then dried and passed over a 65-mesh screen, and the oversize was further treated by repeating the heating and quenching procedure twice. This treatment was found to separate the grains of a sandstone sample without breaking individual grains. Efficiency of the disaggregation treatment was assured by examining the treated samples under a binocular microscope for attached grains and broken grains.

Following disaggregation, samples were dried and then sized in a set of Tyler standard sieves agitated for 20 minutes on a Rotap shaker.

Calculation of A.F.A. Fineness Number

The A.F.A. number of a sand is an arbitrary grain-fineness number that is generally used for specifying and comparing sands for various uses. It represents approximately the number of mesh per inch of the sieve that would just pass the sample if its grains were of a uniform size.[2]

The fineness number is calculated by multiplying the per cent. weight held on each sieve by a factor set for each sieve size and then dividing the "weight times factor total" by the total sample weight, as shown in the following example (sample No. 123):—

On sieve mesh		Weight, per cent.	Factor	Per cent. times factor
Tyler series	U.S. series			
20	20	1.45	10	15
28	30	11.52	20	230
35	40	36.96	30	1,108
48	50	30.26	40	1,210
65	70	13.98	50	700
100	100	4.16	70	291
150	140	1.07	100	107
200	200	.35	140	49
270	270	.10	200	20
pan	pan	.15	300	45
Total		100		3,774

$$\text{A.F.A. fineness number} = \frac{3{,}774}{100} = 38$$

[1] J. F. Kemp, School of Mines Quarterly, Vol. 22, p. 75.

[2] "Testing and Grading Foundry Sands," 3rd ed., 1931, American Foundrymen's Association.

Description of Selected Sandstone Occurrences

Kingston Silica Mines Area

Kingston Silica Mines, Limited, is the only company now working the sandstone of Southeastern Ontario on a large scale, although there is some intermittent quarrying for building stone. They are engaged in the production of silica sands, which are marketed mainly as foundry sands and as raw material for the manufacture of silicon carbide, and are believed to be the first company so to utilize the Potsdam sandstone of Southeastern Ontario.

The quarry and plant of Kingston Silica Mines are located in Pittsburgh township, Frontenac county, on the east side of the drowned land that forms part of the main channel of the Rideau canal about 12 miles northeast of Kingston. The quarry road, three-quarters of a mile long, joins highway No. 15 at an old cemetery 0.7 miles southwest of Joyceville. The trucking distance to the nearest rail shipping point, Rideau Station on the Canadian National railway, is 7 miles. The quarry and plant are conveniently located for shipment by canal barge, but present practice is to ship by truck and rail.

The sandstone occurrence at this location is 6,400 feet long and from 200 to 900 feet wide and is exposed throughout most of its length in a 50-foot cliff running in a northeasterly direction. Ten vertical diamond-drill holes and the cliff section show a thickness of commercial sandstone of from 27 feet to 52 feet, with the average thickness about 38 feet. The total thickness of the formation, including conglomerate, averages about 45 feet. The deposit is estimated to contain about 10,000,000 tons of sandstone. The geological relations and the extent of the sandstone are shown on the geological map facing this page.

The bulk of the sandstone is creamy-white to grey, siliceous, and medium- to fine-grained. Sandstone with calcareous or ferruginous cement is in very minor amount. At the present quarry there is a considerable proportion of grey to black carbonaceous sandstone. There are some thin horizons of rusty sandstone, and the weathered surfaces of many of the beds show round limonite spots from 3 to 5 mm. in diameter. The limonite apparently is derived from spherical concretionary masses and disseminated grains of pyrite, remnants of which can be seen within limonite in drill-core specimens (drill-holes Nos. 2, 3, 8, and 9). At the base of the sandstone section, lying on rusty Precambrian gneiss and quartzite, is a basal conglomerate member, from 3 feet to 5 feet in thickness, which is composed of quartzite fragments of various sizes in a coarse sandstone matrix. Near the plant, at 8 feet above the basal conglomerate, there is a similar intraformational conglomerate 2 feet thick. It is lenticular and apparently not continuous for any great distance. Immediately above the basal conglomerate, in places, there are some thin-bedded shaly layers.

Chemical Analysis and Recast of Sample No. 108

Analysis	Per cent.	Recast	Per cent.
SiO_2	98.03	Quartz	97.50
Al_2O_3	1.00	Carbonates (mainly dolomite)	.35
Fe_2O_3	.26	Clay (kaolin)	1.07
FeO	.06	Limonite	.30
CaO	.12	Pyrite	.02
MgO	.06		
Na_2O	.00		
K_2O	.00		
S	.01		
Loss on ignition	.36		
Total	99.90		

The analysis in the table above was made from a chip sample (No. 108) taken from various parts of the quarry and from outcrops.

A size analysis of the same sample is given below:[1]—

Screen (mesh)	Per cent. weight
+20	0.20
-20+28	10.54
-28+35	34.86
-35+48	28.82
-48+65	15.34
-65+100	6.38
-100+150	2.09
-150+200	.87
-200	.90
Total	100.00

A.F.A. No. 41[2]

The following table gives the results of analyses[3] for silica and iron in sections of diamond-drill core from holes put down at the quarry of Kingston Silica Mines. Location of the drill-holes is shown on the map facing page 16.

Drill-hole	Approximate footage (from sections)	Length of core sample	Fe_2O_3	SiO_2
	feet	feet	per cent.	per cent.
No. 1	3 to 13	10	0.13	98.98
	13 to 21	8	.16	98.64
	21 to 25	4	.15	99.03
No. 2	12 to 22	10	.13	98.95
	22 to 30	8	.15	98.92
	30 to 40	10	.20	98.75
No. 3	11 to 22	11	.11	99.00
	22 to 31	9	.10	99.06
	31 to 42	11	.16	98.79
No. 4	2 to 12	10	.46	98.47
	12 to 21	9	.20	98.20
	21 to 31	10	.36	97.26
No. 5	2 to 10	8	.19	98.20
	10 to 19	9	.22	98.98
	19 to 26	7	.34	97.88
No. 6	3 to 12	9	.09	99.12
	12 to 22	10	.09	99.03
	22 to 32	10	.11	99.06
	32 to 37	5	.12	98.80
No. 7	2 to 12	10	.15	98.84
	12 to 22	10	.23	98.94
	22 to 32	10	.17	98.96
	32 to 41	9	.24	98.63
No. 8	10 to 20	10	.26	97.16
	20 to 27	7	.13	98.90
	27 to 40	13	.11	98.96
	40 to 50	10	.24	98.13
	50 to 54	4	.18	98.16

[1]The method of disaggregating sandstone samples for size analysis is described in the section on "Preparation and Examination of Samples," pages 14–15.

[2]See section of report on "Calculation of A.F.A. Fineness Number," page 15.

[3]From sections prepared by Chris. Riley and Cyril W. Knight; analyses by Donald Inspection, Limited.

Drill-hole	Approximate footage (from sections)	Length of core sample	Fe_2O_3	SiO_2
	feet	feet	per cent.	per cent.
No. 9	11 to 20	9	.29	96.03
	20 to 30	10	.10	99.09
	30 to 40	10	.12	97.08
	40 to 50	10	.11	98.95
	50 to 54	4	.36	97.51
No. 10	3 to 12	9	.12	98.73
	12 to 22	10	.10	98.75
	22 to 29	7	.23	98.46
Average of analysed core			.18	98.58

The above figures show a fairly uniform iron oxide content throughout, although the range is from 0.09 to 0.46 per cent. The silica content ranges from 96.03 to 99.12 per cent. Some of the holes show a slightly higher iron content in the top and bottom samples of the section than in samples from the centre of the section.

The iron content is mainly in limonite and pyrite, with minor amounts in hematite, magnetite, and possibly some siderite or ferrodolomite. The iron-bearing minerals are disseminated between grains and in films around quartz grains, and a high proportion of the iron content is removed with fines during the washing and screening processes involved in preparing the commercial silica sands.

Hart Road Area

The Hart Road area is west of the north end of Lower Beverley lake in Bastard township, Leeds county. Hart road is a secondary road that branches off highway No. 42 at the cemetery half a mile east of the Philipsville corner and extends in a southwesterly direction for 2.5 miles to join another secondary road running from Lower Beverley lake to highway No. 15 on the west.

The Brockville-Westport branch line of the Canadian National Railways crosses the northern part of the map area. Philipsville station on this line is 33 miles by rail from Brockville. The area is served by electric power; the Val Tetreau–Kingston power line runs parallel to and 1.2 miles to the northwest of Hart road.

Potsdam sandstone shows in numerous outcrops along Hart road (see map facing this page). On the east side of the road, in lots 26 and 27, there is a good quarry site with a total difference of elevation from the road level down to the low ground on the east, of more than 40 feet. A scarp, which is from 10 to 15 feet high and faces southeast, is composed of thick-bedded white sandstone with one bed of buff-weathering sandstone from 2 feet to 3 feet thick. The bulk of the sandstone is a friable type from which grains can be loosened by rubbing with the fingers. A minor amount is of a tougher, quartzitic type. Very minor amounts of limonite and a few small patches of clay-like material are the only minerals other than quartz which show under the microscope.

Similar sandstone outcrops to the south as far as the south limit of the map (see map facing this page) and beyond. At the east limit of the sandstone, there is exposed a basal conglomerate member not more than 2 feet thick, which rests on Precambrian crystalline limestone.

On the west side of the road, a 5-foot section of thin-bedded fossiliferous shale and shaly sandstone is exposed in a small quarry. At higher levels to the west, outcrops show buff and grey siliceous sandstone interbedded with minor calcareous sandstone. The sandstone horizons on the west side of Hart road appear to be of lower grade (i.e. they have a higher content of impurities) than the thick basal beds exposed on the east side of the road.

The following table gives a chemical analysis, recast, and size analysis of a chip sample taken to represent the sandstone exposed in a cliff section just east of Hart road in lot 27:—

CHEMICAL ANALYSIS AND RECAST OF SAMPLE No. 88

Analysis	Per cent.	Recast	Per cent.
SiO_2	99.40	Quartz	99.37
Al_2O_3	.30	Carbonates (siderite)	.10
Fe_2O_3	.13	Clay (kaolin)	.22
FeO	.13	Pyrite	.03
CaO	.00	Magnetite	.19
MgO	.00		
Na_2O	.00		
K_2O	.00		
S	.01		
Loss on ignition	.07		
Total	100.04		

A size analysis of the same sample is given below:—

Screen (mesh)	Per cent. weight
-20+28	4.00
-28+35	16.47
-35+48	28.95
-48+65	31.97
-65+100	12.63
-100+150	3.68
-150+200	1.17
-200+270	.48
-270	.68
Total	100.00

A.F.A. No. 46

The Hart Road area contains a large reserve of good-grade siliceous sandstone; and as the bulk of it is sufficiently friable to be cheaply crushed, it would seem to be ideal as a source rock for the production of silica sands and fine-ground quartz.

Philipsville-Delta Area

Within the same general region, in Bastard township, Leeds county, there is another sandstone area, which can be called the Philipsville-Delta area for descriptive purposes. Along the north side of highway No. 42 between the town of Delta and Philipsville corner, the Potsdam formation is exposed in cliffs rising to 100 feet above the highway and railway. The main cliff, 80 feet high, is directly above the highway and only 300 feet from the railway, so that development of this sandstone occurrence would have the advantage of the best possible transportation facilities. The Val Tetreau–Kingston power line is 1 mile west of Philipsville. The outcrops and the extent of the sandstone are shown on the geological map facing page 20.

The cliff section east of Philipsville represents a part of the Potsdam formation stratigraphically above the massive beds that outcrop along Hart road

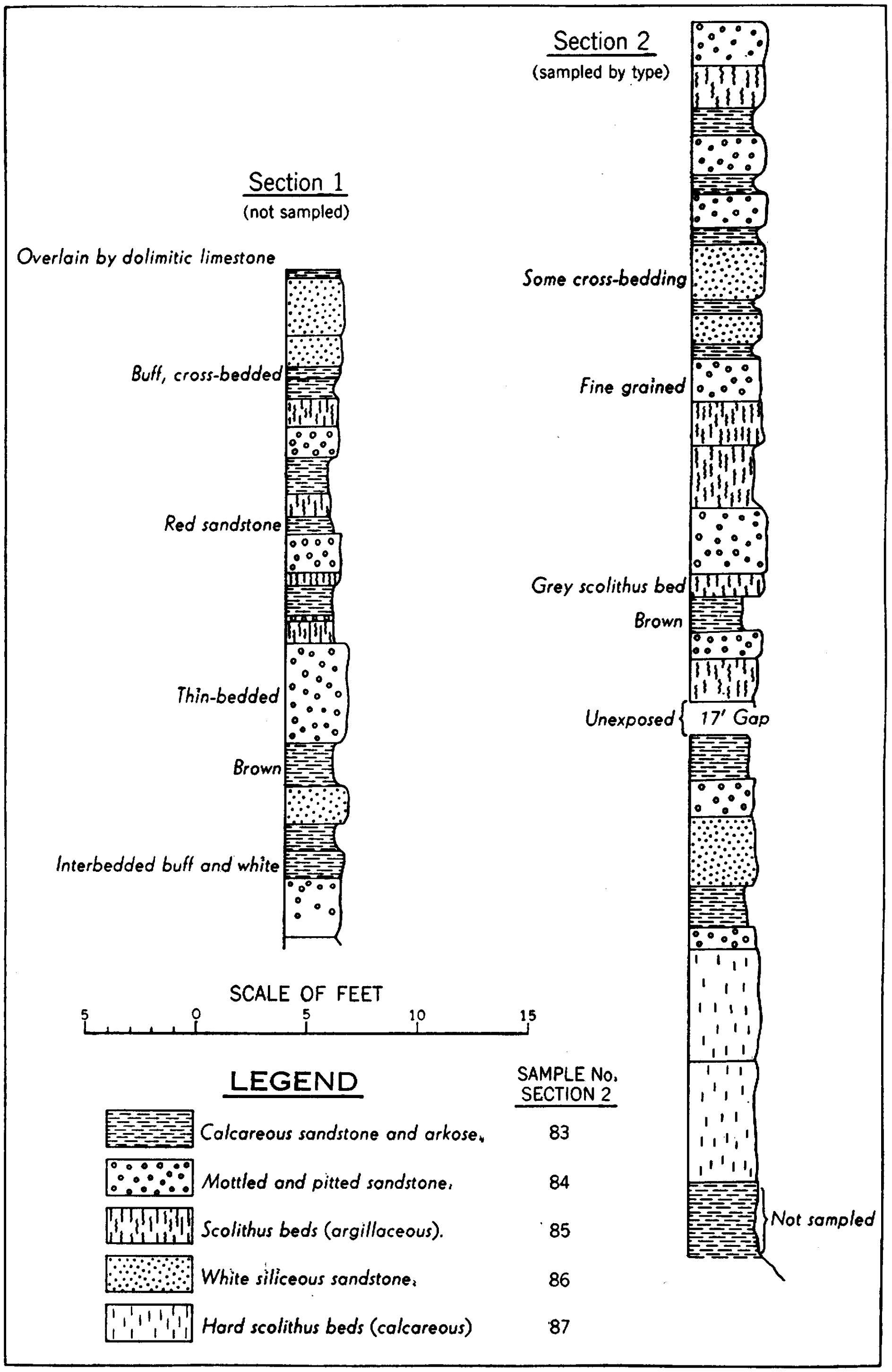


Fig. 2—Sections of sandstone exposed in cliffs, Philipsville-Delta area, Bastard township, Leeds county.

and exhibits a greater variety of rocks. The two cliff sections measured are represented in Fig. 2. Fifty-seven feet of cliff section No. 2 was channel-sampled by rock types, as follows:—

Rock type	Total footage sampled	Sample No.
Calcareous sandstone and arkose, mostly thin-bedded, buff-coloured, and including some shale	10	83
Mottled and pitted sandstone (hard buff and grey beds with limonite spots)	14	84
Friable "scolithus" beds—argillaceous limy sandstone with vertical worm-burrow casts (*Scolithus linearis*)	15	85
White siliceous sandstone	7	86
Hard "scolithus" beds, mostly tough calcareous sandstone with a few worm-burrow casts	11	87

Following are the results of chemical analyses, recasts, and size analyses of the samples listed in the preceding table:—

CHEMICAL ANALYSES AND RECASTS[1]

	No. 83	No. 84	No. 85	No. 86	No. 87
	per cent.	per cent.	per cent.	per cent.	per cent.
SiO_2	87.02	97.08	92.42	98.20	92.75
Al_2O_3	2.86	.48	1.43	.45	1.18
Fe_2O_3	.49	.37	.41	.00	.00
FeO	.28	.14	.29	.41	.50
CaO	3.41	.47	1.90	.00	2.13
MgO	.20	.06	.14	.06	.14
Na_2O	.00	....	....	....	.04
K_2O	1.98	....	....	....	.06
S	.06	.04	.06	.02	.04
Loss on ignition	3.35	.74	2.28	.50	2.17
Total	99.65	99.38	98.93	99.64	99.01
Quartz	78.70	96.00	90.90	97.60	91.80
Feldspar	11.68	....	....	....	.70
Carbonates	7.10	.99	4.18	.78	4.79
Clay (kaolin)	1.73	1.29	3.28	.97	.77
Limonite	.56	.42	.48	....	....
Pyrite	.10	.06	.13	.02	.08

SIZE ANALYSES (PER CENT. WEIGHT)

Screen (mesh)	No. 83	No. 84	No. 85	No. 86	No. 87
	per cent.	per cent.	per cent.	per cent.	per cent.
-20+28	1.42	1.03	0.41	1.67	0.35
-28+35	9.43	11.72	6.85	14.47	8.09
-35+48	20.49	21.48	20.51	23.50	24.50
-48+65	30.97	31.59	36.71	29.01	38.65
-65+100	20.42	21.48	22.35	19.02	16.32
-100+150	7.44	6.99	5.95	6.63	5.03
-150+200	4.65	2.87	2.65	2.78	2.80
-200	5.18	2.84	4.57	2.92	4.26
A.F.A. fineness No.	69	62	66	60	64

[1]Calcite is the predominant carbonate in all of the samples except No. 86, which contains an iron carbonate (siderite).

The rock at the Philipsville cliff section is finer-grained (A.F.A. Nos. 60 to 69) than that at the Kingston Silica Mines and Hart Road locations (A.F.A. Nos. 41 to 46) and has a higher iron content and a considerably higher content of carbonates and feldspar, although these are largely restricted to certain beds.

The sandstone of the Philipsville-Delta area is not considered to be a good potential source of the higher-grade silica sands because of the impurities that would have to be removed. Nevertheless, the occurrence may have some possibilities for development as a source of lower-grade silica sands in view of the easy access to transportation and power. A large, accessible deposit of this kind might form the basis of a quarrying and treatment operation with diversified market outlets. Some of the beds would be suitable for dimension stone for building, and quarry waste could be crushed and washed to produce some grades of foundry sand, blast sand, etc., and possibly sand for making sand-lime building brick. This would have to be tested.

Charleston Lake Area

Near the south end of Charleston lake, Rear of Leeds and Lansdowne township, Leeds county, there is another area of Potsdam sandstone, which composes the upper part of a plateau that rises to 70 feet above lake level between Running bay and Slack bay and extends to the southwest (see geological map facing this page.

There is no easy access to shipping facilities. The nearest rail point is Lansdowne on the main line of the Canadian National Railways. Between the Charleston Lake sandstone deposit and Lansdowne there are 4½ miles of narrow, unimproved road, 1½ miles of gravel-surfaced secondary road, and 2 miles of paved secondary road, a total distance of 8 miles. The north 4½ miles of road would have to be widened and surfaced in order to be suitable for all-weather trucking.

The area underlain by sandstone is 2 miles long, half a mile wide at the northeast end of the plateau, and a quarter of a mile wide at the southwest end. The average thickness of sandstone is probably at least 25 feet. The bulk of the rock is a friable siliceous sandstone similar to that at the Kingston Silica Mines location.

On the southeast side, facing Slack bay, there is a cliff from 65 to 70 feet high. At one point the section was measured as follows, from top to bottom:—

	Feet
Massive white to grey siliceous sandstone	12
Red and grey banded sandstone containing disseminated carbon	3
Intraformational conglomerate with quartzite boulders and pebbles	2.5
White siliceous sandstone	7
Reddish-brown conglomerate	1
Unexposed (sandstone rubble on steep slope)	25

Below the rubble section, at 20 feet above water level, there is a granite outcrop.

On the northwest side of the plateau, there is a good natural quarry site, a 15- to 20-foot cliff composed of grey to white siliceous sandstone with some thin lenticular beds of conglomerate. Conglomerate is more abundant in cliff sections to the northeast. Following are analytical results on a chip sample (No. 107) taken to represent the cliff section closest to the road (see map facing this page).—

CHEMICAL ANALYSES AND RECAST OF SAMPLE No. 107

Analysis	Per cent.	Recast	Per cent.
SiO_2	99.07	Quartz	98.50
Al_2O_3	.32	Feldspar	.70
Fe_2O_3	.10	Carbonates (mainly dolomite)	.37
FeO	.07	Clay (kaolin)	.29
CaO	.12	Limonite	.12
MgO	.07	Pyrite	.06
S	.03		
Loss on ignition	.24		
Total	100.02		

A size analysis of the same sample is given below:—

	Per cent. weight
−20+28	7.87
−28+35	23.97
−35+48	21.87
−48+65	23.88
−65+100	15.20
−100+150	4.42
−150+200	1.61
−200	1.18

A.F.A. No. 50.

The Charleston Lake sandstone occurrence is considered to have some promise for future development as a source of silica sands, dependent mainly upon improvement in transportation facilities.

Newboro Area

In the area northeast of the town of Newboro in North and South Crosby townships, Leeds county, there are a number of showings of Potsdam sandstone (see geological map facing page 24). Some of the showings are adjacent to the Brockville-Westport branch of the Canadian National Railways; others are within 2 miles of the railway. All showings are easily reached by good secondary roads and are close to Upper Rideau lake and the Rideau Canal system on the west. A power transmission line crosses the area in an east-west direction.

At the tip of Hudson bay in the northeast corner of the Newboro area, there is a 12-foot scarp composed of 10 feet of sandstone and 2 feet of basal conglomerate lying on Precambrian granite. The sandstone appears to be of fairly good grade, a buff- to grey-weathering friable sandstone, some of which is limonite-stained. Sample No. 99 is a chip sample taken from outcrops at this locality. There are numerous similar outcrops in the area between Hudson bay and the cross-roads three-quarters of a mile to the south.

One mile northeast of Newboro, on the north side of the power line, there is a flat-topped sandstone hill, from 1,000 to 1,200 feet across and rising about 20 feet above the surrounding country. The sandstone exposed here is mostly a white quartzitic variety, except for a 12-inch "scolithus" bed near the top of the section. Chip sample No. 103 represents the exposures around the edge of the hill.

Two miles due east of Newboro station, between highway No. 42 and the railway, Potsdam sandstone shows in a 10-foot cliff face. The upper 4 feet of the section shows some limonite spots from 4 to 8 mm. in diameter and a pitted surface, the latter suggesting the presence of concretionary carbonate masses in the cementing material. The lower 6 feet of the section is composed of white siliceous sandstone, hard and quartzitic in character. Sample No. 105 is a chip sample taken to represent the 10-foot cliff section. The adjacent area to the north across highway No. 42 probably is underlain by sandstone.

The following tables give the results of chemical analyses, recasts, and screen analyses of the three sandstone samples from the Newboro area:—

CHEMICAL ANALYSES AND RECASTS

	No. 99	No. 103	No. 105
	per cent.	per cent.	per cent.
SiO_2	99.19	99.00	98.41
Al_2O_3	.33	.29	.54
Fe_2O_3	.04	.13	.19
FeO	.08	.08	.06
CaO	.04	.06	.39
MgO	.05	.05	.07
S	.03	.02	.03
Loss on ignition	.22	.16	.53
Total	99.98	99.79	100.22
Quartz	98.75	98.40	96.90
Feldspar	....	.76	2.01
Carbonates	.22	.19	.86
Clay (kaolin)	.81	.38	.43
Limonite	.05	.15	.26
Pyrite	.07	.02	.07

SIZE ANALYSES (PER CENT. WEIGHT)

Screen (mesh)	No. 99	No. 103	No. 105
	per cent.	per cent.	per cent.
-20+28	1.88	0.77	1.04
-28+35	15.15	8.46	6.79
-35+48	30.17	26.95	18.07
-48+65	28.22	40.04	35.85
-65+100	16.48	16.96	24.11
-100+150	5.55	3.76	10.21
-150+200	1.56	1.85	2.42
-200	1.00	1.48	1.51
A.F.A. fineness No.	53	55	62

The sandstone occurrences of the Newboro area are close to rail and canal transportation and to an electric power line, and there are several easily accessible quarry sites where a face of from 10 to 20 feet could be developed. Most of the beds are siliceous and comparatively pure, although some are tough and quartzitic in character, so that crushing to produce silica sands would be more expensive than similar treatment of more friable sandstone.

Other Occurrences

Numerous other occurrences in the area were examined in some detail, and three of them were sampled: an occurrence just east of Battersea, a second on the east shore of Opinicon lake opposite Chaffey Locks, and a third at 1 mile south of Lyndhurst. No detail maps of the three localities were prepared, but the location and extent of the sandstone areas are shown on a small scale on map No. 1946-9 (in pocket at the back of the report).

The village of Battersea is between Loughborough lake and Dog lake in Storrington township, Frontenac county. Within the village thin patches of Potsdam sandstone can be seen lying on Precambrian granite. A quarter of a mile to the east along the road, there is a 7-foot section of buff sandstone showing in two scarps that face each other across a shallow north-south valley. Two or three feet at the bottom of the exposed section is thin-bedded, the individual beds not being more than 2 inches thick. The upper beds have a maximum thickness of 14 inches, and some horizons have a grey colour owing to disseminated carbon. South of the road junction, half a mile east of Battersea, there is exposed a 20-foot section of buff and grey, friable sandstone in two cliffs, an 8-foot face below road level on the west and a 12-foot face above road level on the east. Sample No. 123 is a composite chip sample taken to represent the 20-foot section. About 600 feet to the east, there is another 10-foot scarp of similar sandstone at a higher level, so that the total thickness of sandstone may be 30 feet or more. With regard to facilities for developing the sandstone at this locality, electric power is available close at hand; the Val Tetreau–Kingston power line is less than half a mile southeast of the road junction referred to above. The nearest rail shipping point is Kingston, 15 miles to the southwest by paved secondary road. Dog lake, which is three-quarters of a mile to the east of the Battersea sandstone occurrence, is connected with the Rideau Canal system, so that transportation by barge might be considered.

The main sandstone showings at Opinicon lake in South Crosby township, Leeds county, are along the east shore of the lake at three-quarters of a mile east of Chaffey Locks and on Barrel point. The nearest rail shipping point is Chaffey's Locks station, only 1 mile west in direct line across the lake, but 5½ miles distant by road around the lake. The nearest power line is 3½ miles to the southeast. An area about 4,000 feet long and from 800 to 200 feet in width contains numerous exposures of Potsdam sandstone with the underlying Precambrian gneiss and crystalline limestone showing through in places. The Precambrian surface is very irregular, and the beds of sandstone have maximum depositional dips of 35 degrees. Much of the area rises only from 10 to 20 feet above lake level, but in one place, almost due east of Chaffey Locks, there is a 35-foot sandstone cliff at the shore. Except at the cliff locality the Precambrian rocks are judged to be close to the surface and the sandstone generally not more than 10 to 15 feet thick. At the base of the section is a conglomerate member and red banded sandstone, which together have a thickness of from 3 to 4 feet. The sandstone above the basal horizon is mostly friable and white to pale-buff in colour, except for a few thin, grey, carbon-bearing bands. Sample No. 109 is a chip sample taken to represent the section exposed at the 35-foot cliff. Sample No. 110 is a grab sample that was taken from outcrops on Barrel point.

One mile due south of Lyndhurst, Rear of Leeds and Lansdowne township, Leeds county, there is a patch of Potsdam sandstone, about half a mile long in a north-south direction and a quarter of a mile wide, which rises from 15 to 20 feet above the surrounding country. Sample No. 106 represents a 9½-foot section exposed just south of the road junction at one mile south of Lyndhurst; the following beds are included, from top to bottom:—

	Feet
Buff-weathering sandstone with vertical worm-burrow casts	2.4
Thin-bedded argillaceous sandstone, rusty	1
Thin-bedded creamy white sandstone	2
Massive white sandstone with some disseminated carbon in thin lenticular layers	2
Thin-bedded white sandstone	2

Following are chemical analyses and recasts of samples from the three occurrences described above:—

CHEMICAL ANALYSES AND RECASTS

	No. 106 (Lyndhurst)	No. 109 (Opinicon lake)	No. 110 (Opinicon lake)	No. 123 (Battersea)
	per cent.	per cent.	per cent.	per cent.
SiO_2	99.10	98.50	99.04	98.21
Al_2O_3	.37	.45	.65	.50
Fe_2O_3	.16	.27	.03	.14
FeO	.09	.09	.04	.07
CaO	.11	.09	.07	.11
MgO	.08	.04	.03	.02
S	.01	trace	trace	.05
Loss on ignition	.30	.40	.22	.46
Total	100.22	99.84	100.08	99.56
Quartz	98.70	97.90	97.60	97.80
Feldspar	....	....	1.68	....
Carbonates	.37	.38	.24	.36
Clay (kaolin)	.80	1.07	.77	1.28
Limonite	....	.31	.04	.16
Pyrite	.02	trace	trace	trace
Magnetite	.23	....	....	....

The following table gives the size analyses of samples from the three occurrences described above:—

SIZE ANALYSES (PER CENT. WEIGHT)

	No. 106 (Lyndhurst)	No. 109 (Opinicon lake)	No. 110 (Opinicon lake)	No. 123 (Battersea)
	per cent.	per cent.	per cent.	per cent.
-10+20	....	....	....	1.45
-20+28	2.34	4.35	2.67	11.52
-28+35	9.25	16.07	16.95	36.96
-35+48	17.88	26.01	29.71	30.26
-48+65	29.21	34.51	24.93	13.98
-65+100	23.27	12.03	16.12	4.16
-100+150	12.70	3.24	6.14	1.07
-150+200	3.42	1.57	1.47	.35
-200	1.93	2.22	2.01	.25
A.F.A. fineness No.	64	53	55	38

The Battersea occurrence probably is the most promising of the three described above; there appears to be a large reserve of coarse-grained, friable sandstone, which would be particularly suitable for the production of foundry sands. Sample No. 110 from the Opinicon lake showing is of particular interest because of its exceptionally low iron content.

Other than the eight sandstone occurrences sampled during the present investigation, there are several areas of sandstone of potential value as sources of silica sand; they were not sampled or mapped mainly because of limited exposures. The following may be mentioned:—

To the east and northeast of Joyceville, along the boundary between Frontenac and Leeds counties, there are some small outcrops of sandstone that are similar to the sandstone at the quarry of Kingston Silica Mines although possibly less friable. The best exposure seen is along the road from South Lake to Washburn, at half a mile west of the east boundary of Frontenac county, where white, thick-bedded sandstone with some buff beds is exposed in a westward-facing scarp with a maximum height of 8 feet.

Half a mile east of Kilbirnie and about 700 feet north of the road along the south boundary of concession III, Pittsburgh township, Frontenac county, there is a 10-foot scarp, facing north, which is composed of white friable sandstone with some conglomerate at the top and bottom. There are a few limonite stains, but the rock seems to be of good average grade. Farther south, still in Pittsburgh township, there are some similar sandstone exposures along the Bateau channel of the St. Lawrence river. L. H. Cole[1] records two analyses of washed sand from sandstone showings along the shore at about 5 miles west of Gananoque, but gives no analysis of the rock.

East of Elgin in South Crosby township, Leeds county, along the road running northeast towards Philipsville, there is a flat area with scattered exposures of white, generally friable sandstone, some of which is pitted and iron-stained. It is difficult to assess the potentialities of the area because of the limited stratigraphical section exposed. L. H. Cole[2] gives an analysis of a sample (No. 1720) from an old quarry location 1 mile west of Philipsville.

There is another sandstone area of potential value to the south and southeast of Perth. Exposures are limited, however, and most of those seen during the present investigation are pitted and iron-stained. Cole lists four analyses of sandstone from this vicinity: No. 1724 from a locality in North Burgess township, Lanark county, 8 miles south of Glen Tay[3]; Nos. 1725 and 2011 from a point 1 mile south of Perth[4]; and No. 1809 from a locality 1 mile east of Perth.[5]

Little attention was paid to the ferruginous sandstones because they are not suitable for the production of high-grade silica sands. There are considerable exposures of red and brown ferruginous sandstone to the north of Kingston Mills along the Rideau Canal route. Some of the beds make good building stone, and quarry waste might be crushed and sized for sale as foundry sand. For such use, the iron oxide coating on grains would not be objectionable. Cole's analysis No. 1747 represents a salmon-pink bed showing at the southeast corner of Dog lake, west of Washburn,[6] Storrington township, Frontenac county.

Sandstone showings in the Nepean area, 9 or 10 miles west of Ottawa, were not examined. Cole[7] gives the location of the principal occurrences as in the southwest corner of Nepean township and the southern part of March township, and he records two analyses (Nos. 1753 and 2013) of white sandstone from the locality.

Processing of Sandstone to Produce Silica Sands

Treatment of sandstone to produce industrial silica sands involves crushing and washing, then dewatering and drying, and finally screening to market sizes. Fig. 3 is a flow sheet, which gives an outline of the treatment used at the mill of Kingston Silica Mines.

The primary objectives of processing are: (1) to crush the sandstone to its natural grain size without excessive breakage of grains; and (2) to remove fines

[1]L. H. Cole, "Silica in Canada: Its Occurrence, Exploitation, and Uses," part 1, Can. Dept. Mines, Mines Branch, Pub. No. 555, 1923, pp. 44, 97, samples Nos. 2002 and 2003.
[2]Ibid, pp. 45, 93.
[3]Ibid, pp. 46, 73.
[4]Ibid, pp. 46, 74, 83.
[5]Ibid, pp. 47, 78.
[6]L. H. Cole, op. cit., pp, 44, 76.
[7]Ibid, pp. 44, 95, 97.

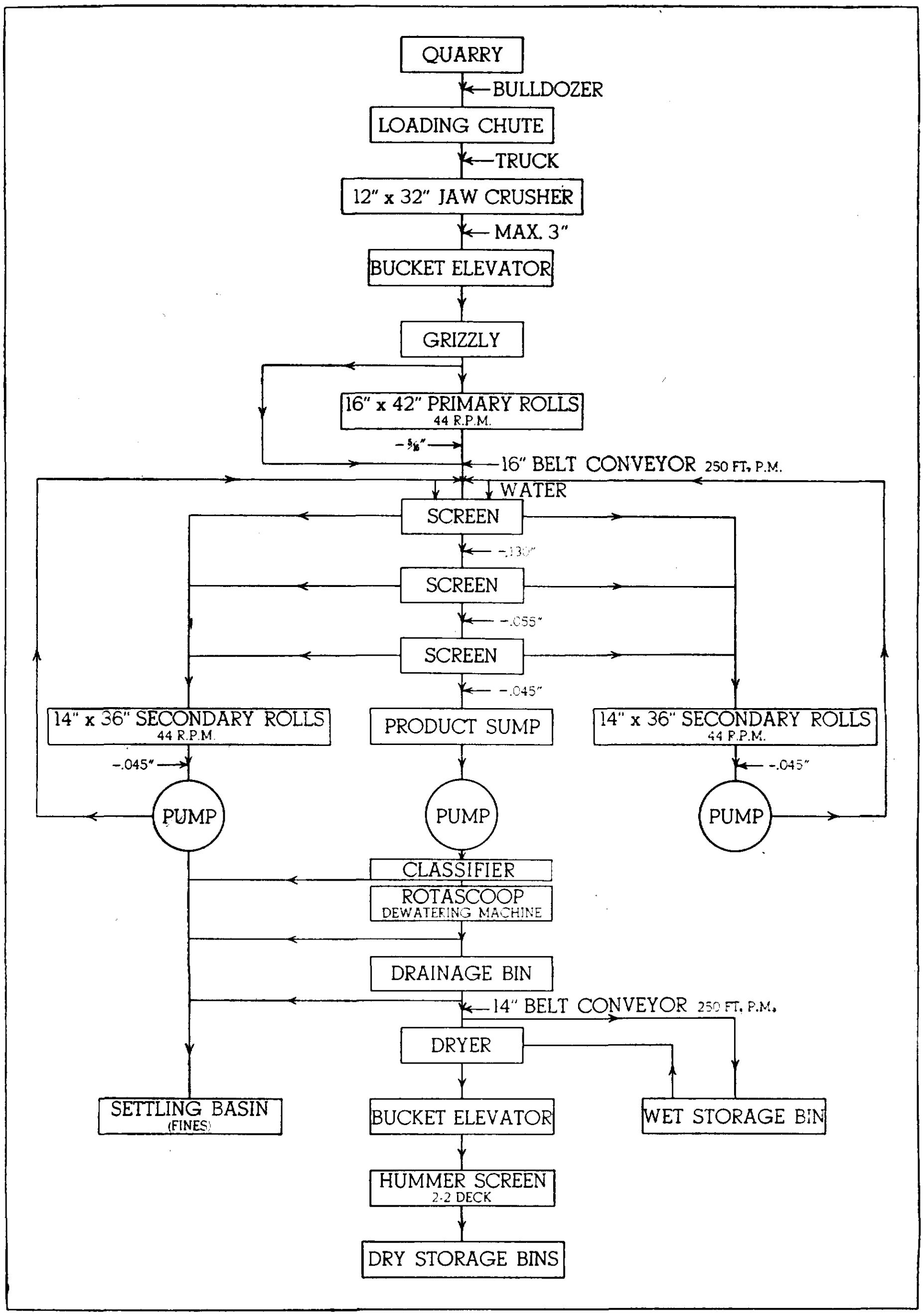


Fig. 3—Mill flow-sheet, Kingston Silica Mines.

and deleterious impurities such as iron-bearing minerals, clay, carbonates, and carbon.

Both of these objectives can more easily and more cheaply be attained on a friable sandstone, and it is, therefore, important to choose a source rock that is easily crushed in addition to being as pure as possible. If a specific market is sought it is further advisable to select a source rock with a high proportion of its grains within the size range of the desired market grade of sand.

No detailed study of commercial processing methods was made for the present report. There seems to be a need for investigation of treatment techniques, including crushing, beneficiation, and final drying. At the primary crushing stage, clogging difficulties are encountered when the mill feed from the quarry is wet. Beneficiation by removal of iron and alumina-bearing minerals is being improved, but the present operators have not as yet been able to produce a high-grade glass sand. Comparison of analyses of sand produced from the sandstone with analyses of the source rock shows that with the treatment methods now used, about 60 per cent. of the iron oxide and lime and 90 per cent. or more of the alumina and magnesia can be removed. Drying practice at Kingston Silica Mines is to feed drained sand to a rotary oil-fired drier, which is effective but appears to have a high heat loss.

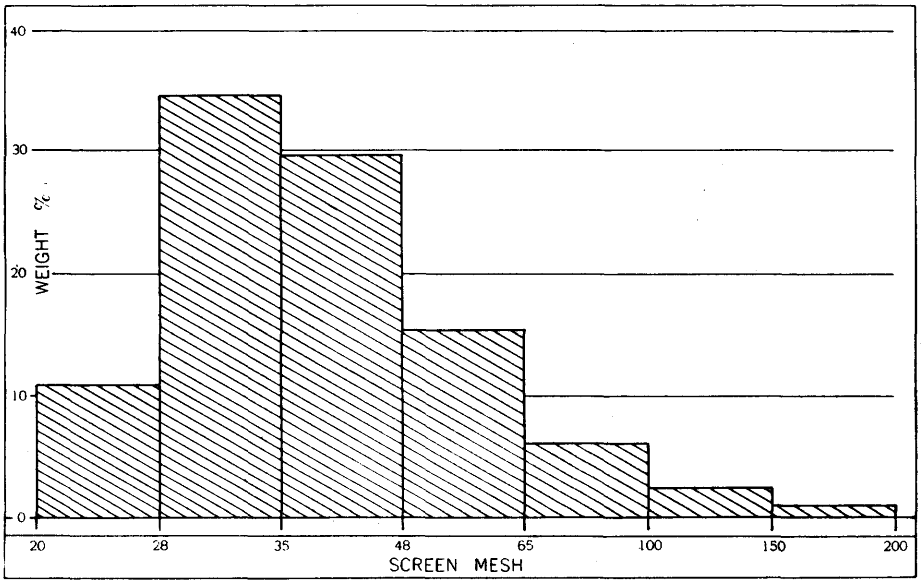


Fig. 4—Histogram showing the size analysis of sandstone sample No. 108 from the quarry of Kingston Silica Mines.

Characteristics of Sands Produced from Potsdam Sandstone

Grain Size

Sands produced by disaggregating the Potsdam sandstone to its component grains have an average A.F.A. fineness number of 56. The range of fineness numbers of samples tested is from A.F.A. No. 38 to A.F.A. No. 69, and the bulk of the grains (80 to 98 per cent.) are between 28 and 100 mesh, that is, between 0.59 mm. and 0.15 mm. in diameter. One coarser-grained sample, No. 123 from Battersea, has an A.F.A. No. of 38 and the distribution is 92.7 per cent. between 20 and 65 mesh (0.83 to 0.21 mm.).

Size analyses of individual samples are given in the section of the report headed "Description of Selected Sandstone Occurrences."[1] In Figs. 4 and 5 the

[1]Pages 16 to 24.

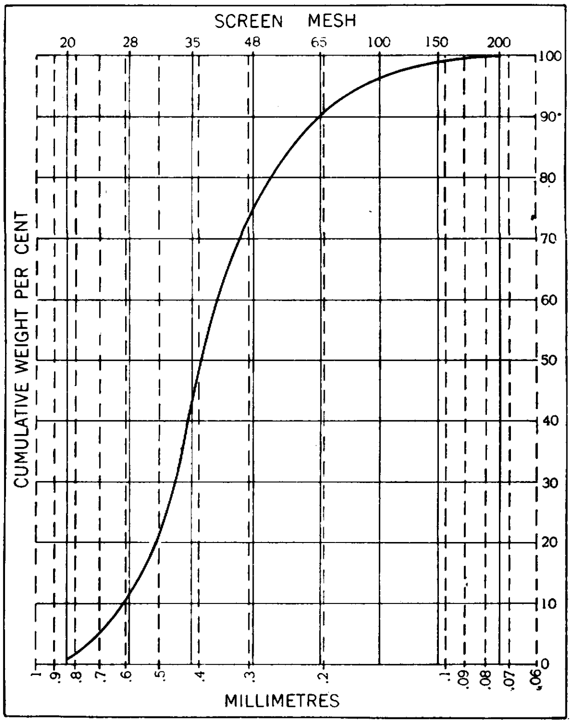


Fig. 5—Cumulative grade curve of sandstone sample No. 108 from the quarry of Kingston Silica Mines.

size analysis of sample No. 108 from the quarry of Kingston Silica Mines is represented graphically as a simple histogram and as a cumulative weight curve on a semilogarithmic scale.

Photomicrograph of silica sand produced from Potsdam sandstone, showing quartz grain shapes in screen fraction —28+35 mesh. (X 15.)

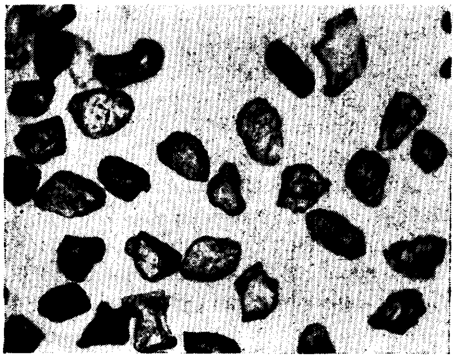
Grain Shape

The grains in sand produced from Potsdam sandstone are predominantly rounded to subangular and roughly spheroidal to ellipsoidal. Grains from friable sandstone are more perfectly rounded than grains from tough quartzitic sandstone; and grains from the more friable beds have frosted surfaces, whereas those from quartzitic beds exhibit some smooth flat faces.

In the finer sizes of commercial sands produced by crushing the sandstone, there is, of course, a proportion of broken grains and the proportion increases to more than 50 per cent. in sizes below 150 mesh. The photomicrographs on pages 30 and 31 show typical shapes of grains in two screen fractions, -28 $+35$ and -100 $+150$ mesh, from a commercial silica sand produced from Southeastern Ontario sandstone.

Composition

An examination of silica sands produced by Kingston Silica Mines shows them to consist of quartz grains, some of which have a thin coating of limonite. Very minor amounts of accessory minerals and rare fragments of cementing materials are observed, mainly in the finer screen sizes (below 100 mesh). It is noteworthy that a large proportion of the intergranular materials of the sandstone, including iron oxides, clay, carbonates, pyrite, and carbon, are fine-grained or are reduced to fine sizes and washed out of the sands during processing. A complete list of accessory minerals and cementing materials of the sandstone is given in the section of the report headed "Petrography of the Potsdam Formation."[1]



Photomicrograph of silica sand produced from Potsdam sandstone, showing quartz grain shapes in screen fraction —100+150 mesh. (× 35.)

Following is a chemical analysis of a sample representing one shipment of silica sand from Kingston Silica Mines. The analysis was made by a company using the silica sand for the manufacture of silicon carbide. Other analyses report a higher iron content.

	Per cent.
SiO_2	99.57
Fe_2O_3 (total iron)	.05
TiO_2	.02
Al_2O_3	.08
CaO	.05
MgO	trace
Loss on ignition	.14
Total	99.91

[1]Pages 9 to 12.

Summary of Conclusions and Recommendations

1. Southeastern Ontario contains some extensive deposits of sandstone with physical and chemical properties that make it suitable as a source material for industrial silica sands.

2. Some of the sandstone deposits are accessible to power and transportation facilities, and the area is about half way between market outlets in Ontario and Quebec.

3. The Canadian market for silica sands and ground quartz of various grades is large enough to justify the establishment of a considerable quarrying and processing industry. Ontario and Quebec use annually more than half a million tons of special silica sands and ground quartz, of which about 86 per cent. is imported (1943 figures).

4. In view of the present building boom, there would seem to be also some opportunity for the successful revival of quarrying of the Potsdam sandstone for dimension stone. No special attention was paid to building stone during the present investigation, but some of the less friable white sandstones would be suitable. Some of the red, white, and grey beds have been used in the past, notably the red, ferruginous sandstone along the Rideau canal north of Kingston Mills and the white and grey calcareous sandstone of the Brockville area, the Perth–Smiths Falls area, and the Nepean area to the north. Reference should be made to the report of W. A. Parks.[1]

5. Present processing practice produces silica sands suitable for foundry sands, sandblast sands, and sands for the manufacture of silicon carbide. In the writer's opinion it should be possible to modify and improve treatment methods to produce sands of glass grade from sandstone available in Southeastern Ontario. A first step in this direction might be the elimination of sizes below 100 mesh which contain a high proportion of the deleterious iron oxide, lime, and alumina.

6. If it is found feasible to produce a glass grade of silica sand, there would seem to be a good chance for successful preparation, from such a sand, of higher-priced, ground-quartz products for the ceramic and paint industries.

7. A large-scale sandstone-processing operation has the advantage over a smaller-scale operation of lower overhead costs and can assure consumers of a steady and uniform supply and thus build up a market. Further, a large operation producing several grades of material can keep waste sizes to a minimum.

8. Although some data regarding selected sandstone occurrences are presented herewith, it is emphasized that drilling and thorough sampling and testing, including pilot-plant processing, should precede any projected development of a sandstone deposit.

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[1]W. A. Parks, "Report on the Building and Ornamental Stones of Canada," Vol. I, Can. Dept. Mines, Mines Branch, Pub. No. 100, 1912, pp. 121-138.

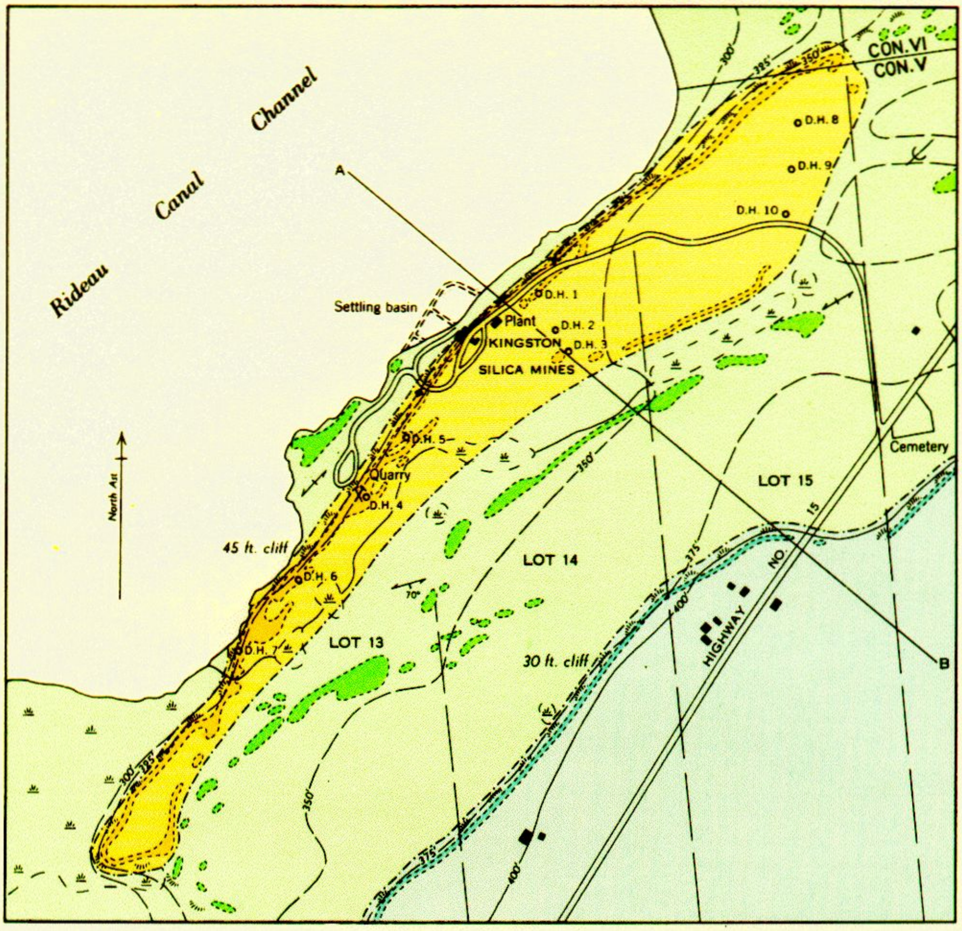
APPENDIX

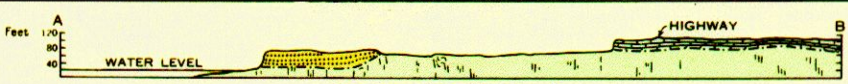
Partial List of Users of Silica Sand and Ground Quartz in Ontario and Quebec

Name	Address
GLASS:	
Consumers Glass Co., Ltd.	Ville St. Pierre, Que.
Dominion Glass Co., Ltd.	Head office: Montreal Que. Plants: Lachine, Que. Hamilton, Ont. Wallaceburg, Ont.
STEEL FOUNDRIES:	
Canadian Car and Foundry Co., Ltd.	621 Craig St. W., Montreal, Que.
Electric Steels, Ltd.	Cap de la Madeleine, Que.
Dominion Foundries and Steel, Ltd.	Hamilton, Ont.
Ford Motor Co. of Canada, Ltd.	Windsor, Ont.
FERRO-ALLOYS:	
St. Lawrence Alloys, Ltd.	Beauharnois, Que.
Electro Metallurgical Co. of Canada, Ltd.	Welland, Ont.
IRON FOUNDRIES:	
Canada Iron Foundries, Ltd.	Three Rivers, Que.
Robert Mitchell Co., Ltd.	64 Monkland Blvd., St. Laurent, Que.
Canadian Westinghouse, Ltd.	Hamilton, Ont.
Findlays, Ltd.	Carleton Place, Ont.
General Steel Wares, Ltd.	199 River St., Toronto, Ont.
The John Inglis Co., Ltd.	14 Strachan Ave., Toronto, Ont.
Moffats, Ltd.	Weston, Ont.
E. Long, Ltd.	Orillia, Ont.
ARTIFICIAL ABRASIVES:	
Canadian Carborundum Co., Ltd.	Niagara Falls, Ont.
Exolon Co.	Thorold, Ont.
Norton Co.	Chippawa, Ont.
CLAY PRODUCTS:	
Sovereign Potters, Ltd.	Hamilton, Ont.
St. John Potteries, Ltd.	St. Johns, Que.
Hamilton Potteries, Ltd.	100 Locke St. S., Hamilton, Ont.
National Refractories, Ltd.	Port Robinson, Ont.
CHEMICALS (SODIUM SILICATE):	
National Silicates, Ltd.	New Toronto, Ont.
North American Cyanamid, Ltd.	Niagara Falls, Ont.
FERTILIZERS:	
Canadian Industries, Ltd.	Head office: Montreal, Que. Plants: Montreal, Que. Hamilton, Ont. Chatham, Ont.
PAINTS:	
Canadian Industries, Ltd.	Montreal, Que., and Toronto, Ont.
Brandram-Henderson, Ltd.	6684 St. Urbain St., Montreal, Que.
Sherwin-Williams Co. of Canada, Ltd.	2875 Centre St., Montreal, Que.
Lowe Brothers Co., Ltd.	263 Sorauren Ave., Toronto, Ont.
Aulcraft Paints, Ltd.	313 Symington Ave., Toronto, Ont.
Benjamin Moore and Co., Ltd.	West Toronto, Ont.
SCOURING POWDERS:	
Duncan Products	367 Sorauren Ave., Toronto, Ont.
The Cudahy Packing Co.	64 Macauley Ave., Toronto, Ont.
COMPOSITION ROOFING:	
Building Products, Ltd.	Montreal, Que.
Brantford Roofing Co., Ltd.	Brantford, Ont.
MISCELLANEOUS:	
S. F. Lawrason and Co., Ltd.	639 Nelson St., London, Ont.
Ferro Enamels (Canada), Ltd.	629 Wellington St., Ottawa, Ont.
G. F. Sterne and Sons, Ltd.	126 Bruce St., Brantford, Ont.
Gypsum, Lime and Alabastine, Canada, Ltd.	Paris, Ont.
PORTLAND CEMENT:	
Canada Cement Co.	Head office: Montreal, Que. Plants: Hull, Que. Belleville, Ont.

INDEX, PART V

To accompany report by M. L. Keith in Vol. LV, Part 5, Ontario Department of Mines, 1946.





Section along line A—B

KINGSTON SILICA MINES AREA

PITTSBURGH TOWNSHIP, FRONTENAC COUNTY

Scale of Feet

FEET 0 400 800 1200 1600 2000 FEET

LEGEND

PALEOZOIC

ORDOVICIAN

Limestone.

CAMBRIAN OR ORDOVICIAN

Sandstone.

PRECAMBRIAN

Not differentiated.

SYMBOLS

Swamp.

Boundary of rock outcrop.

Geological contact.

70° *Strike and dip of gneissic structure.*

Glacial striae.

O D.H. 4 *Diamond drill hole, with number.*

Quarry.

Steep slope.

350' *Contour approximate.*

NO. 15 *Kings Highway with number.*

Road.

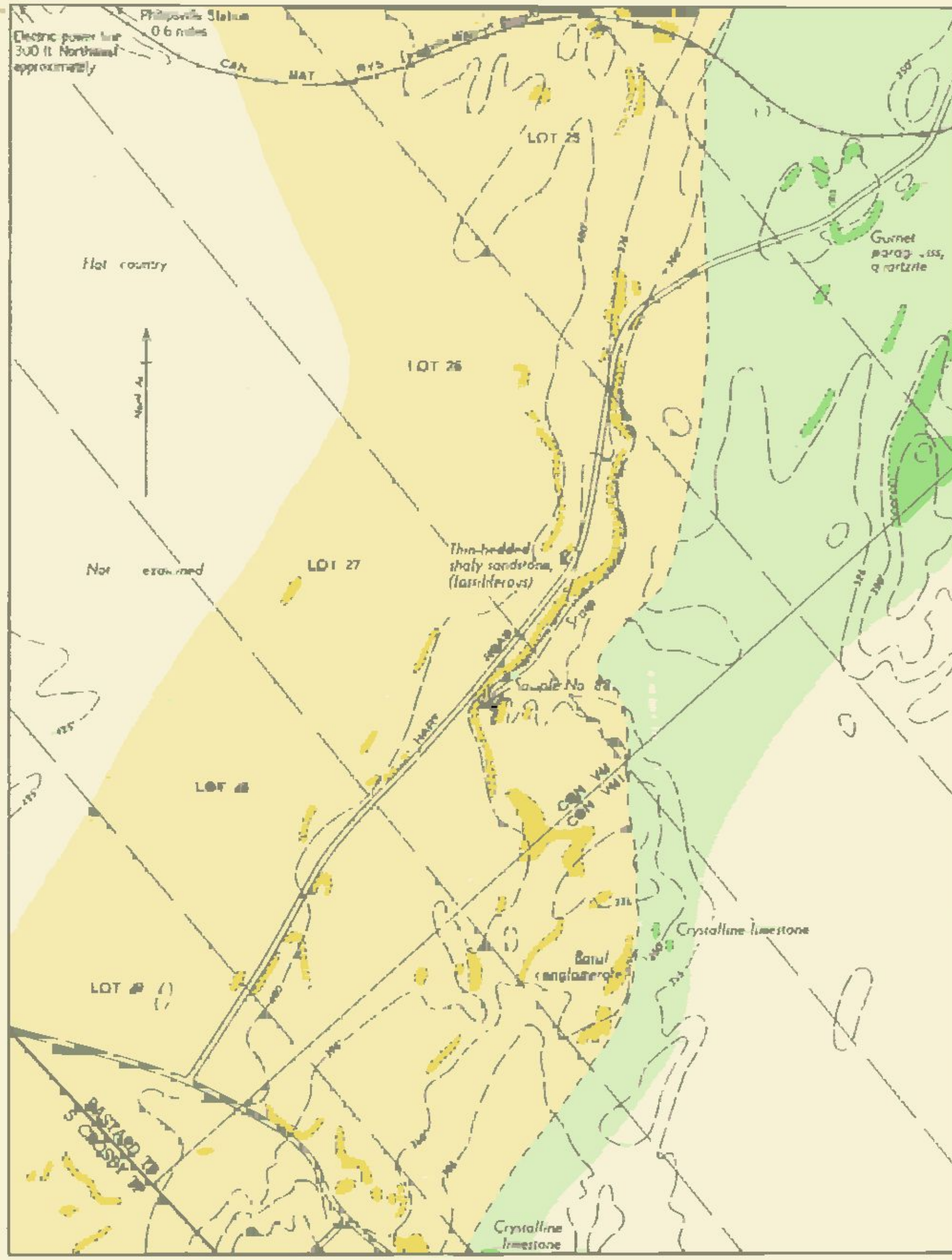
Building.

SOURCES OF INFORMATION

Topographical base map from aerial photographs, (R.C.A.F.)
Contours from map of the National Topographic Series, (Gananoque Sheet).

Geology by M. L. Keith, 1945.

To accompany report by M. L. Keith in Vol. LV, Part 5, Ontario Department of Mines, 1946



HART ROAD AREA

BASTARD TOWNSHIP, LEEDS COUNTY

Scale of Feet

FEET 0 400 800 1600 2400 FEET

LEGEND

PALEOZOIC

CAMBRIAN OR ORDOVICIAN

Sandstone

PRECAMBRIAN

Not differentiated.

SYMBOLS

Boundary of rock outcrop

Geological contact

Steep slope

Contour approximate.

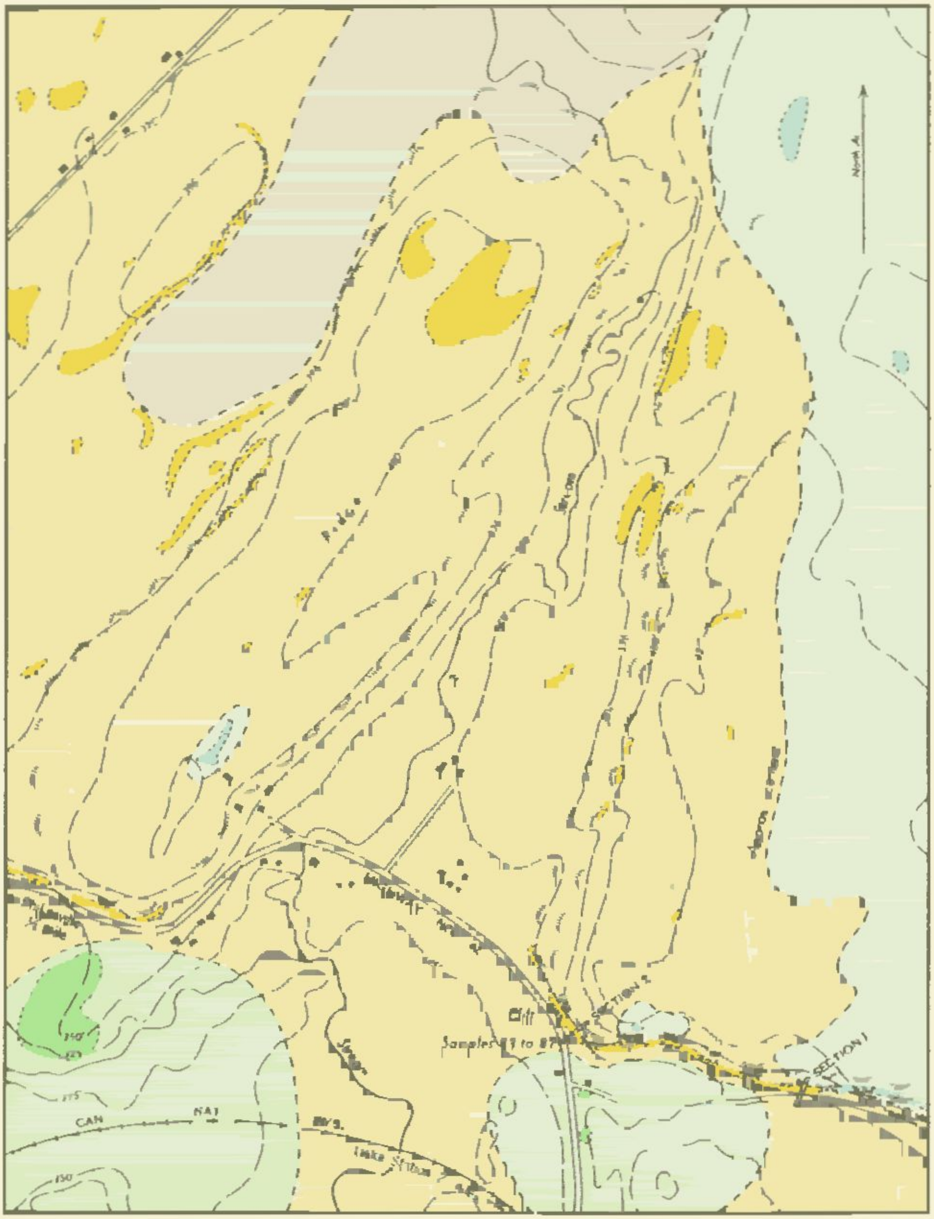
X *Quarry*

SOURCES OF INFORMATION

Topographical base map from aerial photographs, (R.C.A.F.) Contours from map of the National Topographic Series, (Westport Sheet).

Geology by M. L. Keith, 1945.

To accompany report by M. L. Keith in Vol. LV, Part 5, Ontario Department of Mines, 1946



PART OF PHILIPSVILLE-DELTA AREA

BASTARD TOWNSHIP, LEEDS COUNTY

Scale of Feet

FEET 0 400 800 1200 1600 2000 FEET

LEGEND

CENOZOIC

PLEISTOCENE AND RECENT

Sand, clay

PALEOZOIC

ORDOVICIAN

Limestone

CAMBRIAN OR ORDOVICIAN

Sandstone

PRECAMBRIAN

Not differentiated

SYMBOLS

Boundary of rock outcrop.

Geological contact

Steep slope

Contour, approximate

King's Highway, with number

Road.

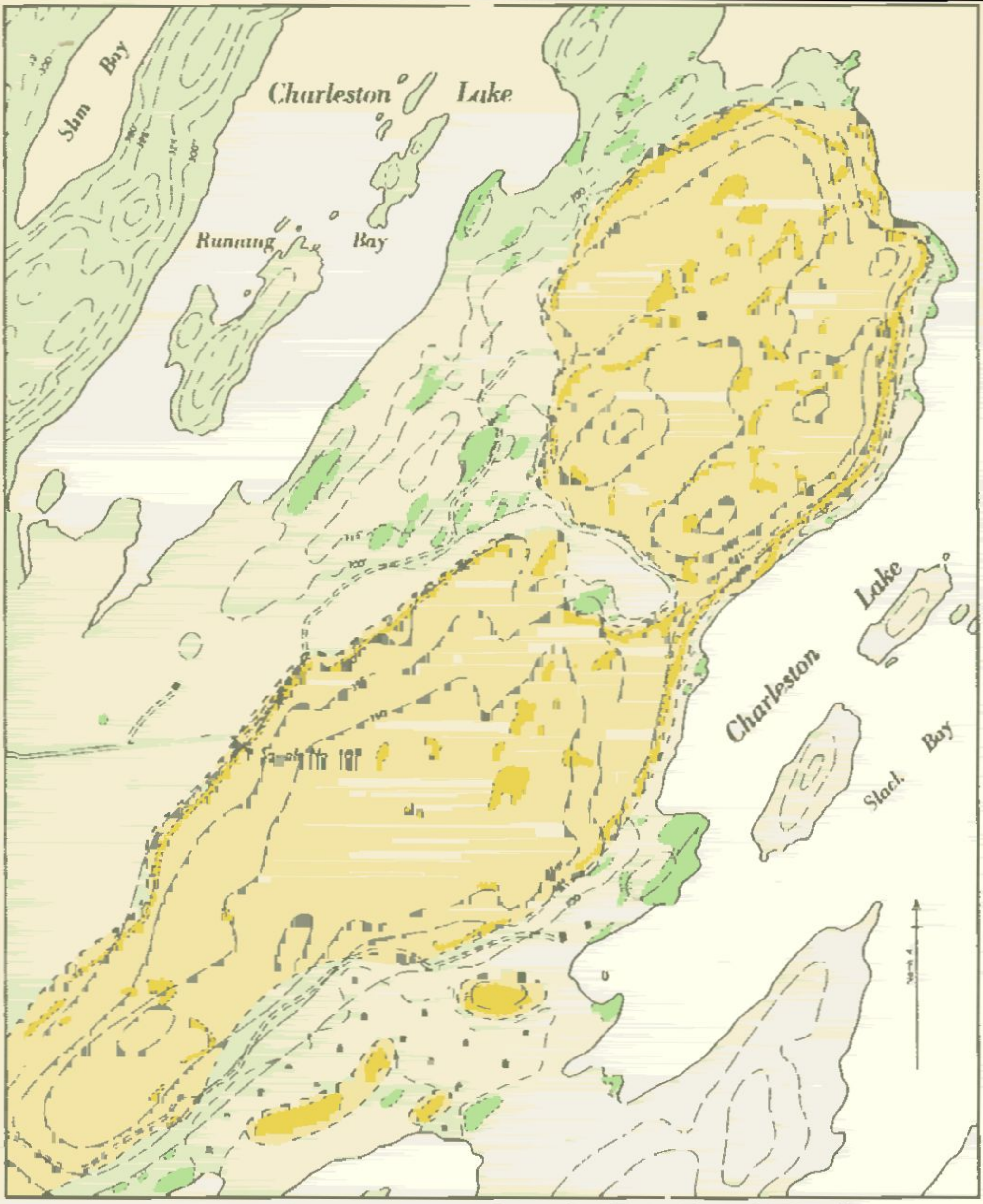
SOURCES OF INFORMATION

Topographical base map from aerial photographs, (R.C.A.F.) Contours from map of the National Topographic Series, (Westport Sheet)

Unpublished map, (Westport Sheet), G.S.C., by Morley Wilson

Additional geology by M. L. Keith, 1945.

To accompany report by M. L. Keith in Vol. LV, Part 5, Ontario Department of Mines, 1946.



PART OF CHARLESTON LAKE AREA

REAR OF LEEDS & LANSDOWNE TOWNSHIP, LEEDS COUNTY

Scale of Feet

FEET 0 400 1200 2000 FEET

LEGEND

PALEOZOIC

CAMBRIAN OR ORDOVICIAN

Sandstone

PRECAMBRIAN

Not differentiated.

SYMBOLS

Swamp

Boundary of rock outcrop

Geological contact

Strike of gneissic structure

Contour approximate.

Road

Wagon road

Building

Steep slope

SOURCES OF INFORMATION

Topographical base map from aerial photographs, (R.C.A.F.)
Contours from maps of the National Topographic Series, (Westport and Gananoque Sheets)
Unpublished map (Westport Sheet) G.S.C., by Morley Wilson
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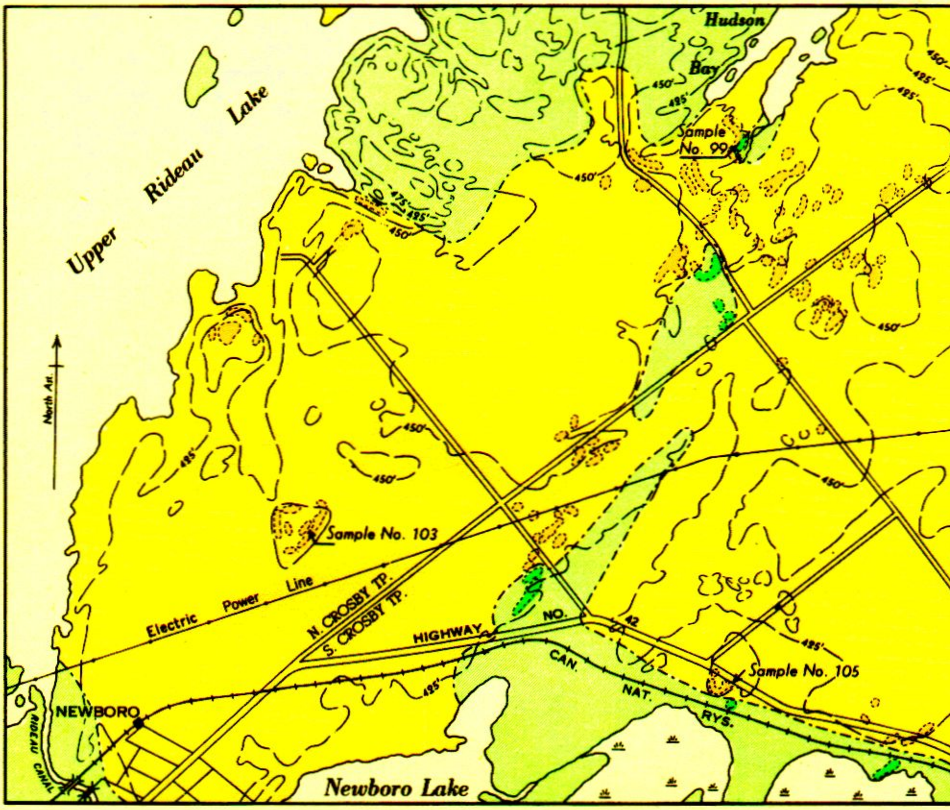


NEWBORO AREA

NORTH & SOUTH CROSBY TOWNSHIPS, LEEDS COUNTY

Scale of Feet

FEET 0 1200 2400 3600 4800 6000 FEET

LEGEND

PALEOZOIC

CAMBRIAN OR ORDOVICIAN

Sandstone.

PRECAMBRIAN

Not differentiated.

SYMBOLS

Swamp.

Boundary of rock outcrop.

Geological contact.

Contour approximate.

NO. 42 *King's Highway with number.*

Road.

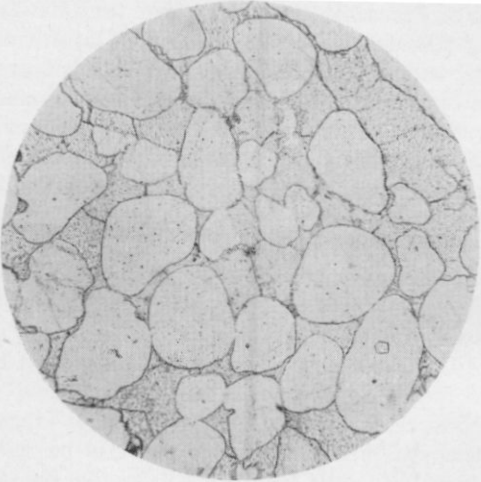
Electric power transmission line.

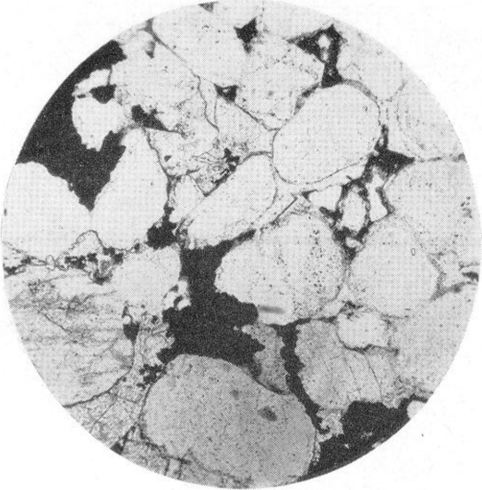
SOURCES OF INFORMATION

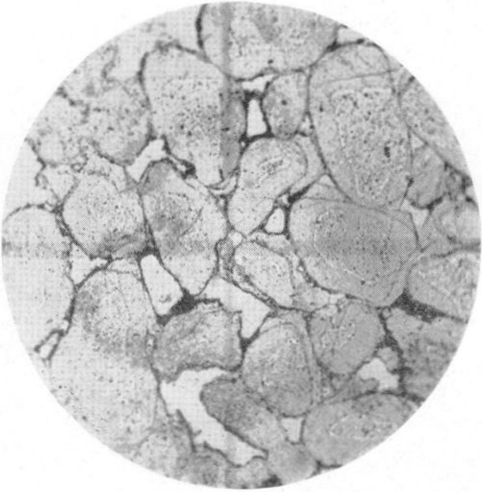
Topographical base map from aerial photographs, (R.C.A.F.) Contours from map of the National Topographic Series, (Westport Sheet).

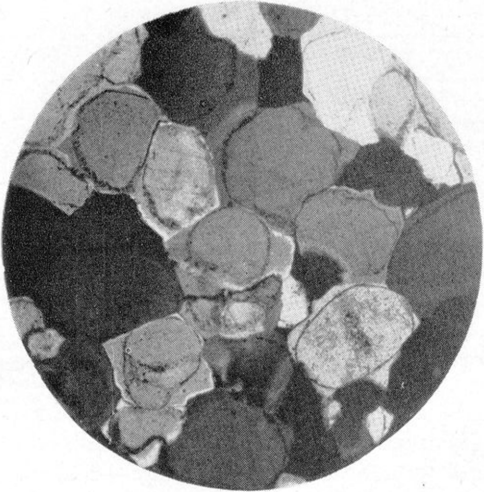
Unpublished map, (Westport Sheet), G.S.C., by Morley Wilson.

Additional geology by M. L. Keith, 1945.









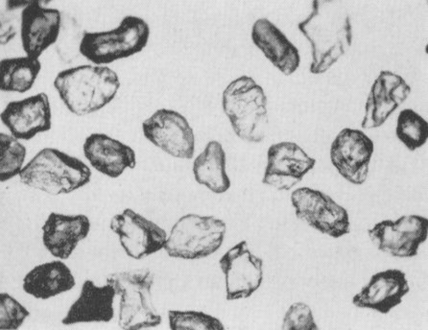


Table I

LARDER LAKE GOLD AREA

Annual Production Statistics by Mines, 1911–1945

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

Year	Omega[1]		Argonaut[2]		Kerr-Addison		Barry-Hollinger		Raven River		Chesterville		Yama[3]		Miscellaneous		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1918.	...	[4]10,000	[5]480	9,209	[6]125	314	...	...	...	...	...	...	...	...	[7]100	1,100	705	20,623
1918...	...	...	...	...	...	...	[8]1,502	10,051	...	...	...	...	...	...	...	[9]1,283	1,502	11,334
1919...	...	...	735	2,631	...	...	...	...	...	...	...	...	...	...	...	...	735	2,631
1920...	...	...	4,637	29,888	...	...	...	...	...	...	...	...	...	...	...	...	4,637	29,888
1921...	...	...	...	549	...	...	...	...	...	...	...	...	...	...	...	...	...	549
1922...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1923...	...	...	4,818	73,262	...	...	...	...	...	...	...	...	...	...	...	...	4,818	73,262
1924...	...	...	24,178	152,072	...	...	...	...	...	...	...	...	...	...	...	...	24,178	152,072
1925...	...	...	28,515	214,183	...	...	8,136	56,978	...	...	...	...	...	...	...	...	36,651	271,161
1926...	...	...	35,081	143,387	...	...	13,680	86,263	...	...	...	...	...	...	...	...	48,761	229,650
1927...	11,966	34,595	27,873	127,448	...	...	25,714	175,692	...	...	...	...	...	...	[10]39	865	65,592	338,600
1928...	10,619	17,700	5,219	32,430	...	...	23,060	111,767	...	...	...	...	...	...	[10]4,377	12,784	43,275	174,681
1929...	...	...	...	9,959	...	...	22,343	151,758	...	...	...	...	...	...	...	...	22,343	161,717
1930...	...	...	13	1,891	...	...	31,725	217,835	...	...	...	...	...	...	...	...	31,738	219,726
1931...	...	...	...	...	...	...	31,958	234,512	...	...	...	...	...	...	[11]80	835	32,038	235,347
1932...	...	...	...	...	...	...	34,977	181,585	...	...	...	...	...	...	[11]24	468	35,001	182,053
1933...	...	...	...	...	...	...	5,459	71,766	...	...	...	...	...	...	...	...	5,459	71,766
1934...	...	...	12	1,872	...	...	33,445	152,076	...	...	...	...	...	...	...	...	33,457	153,948
1935...	...	...	24	978	...	...	35,172	143,698	...	...	...	...	...	...	[9]31	3,590	35,227	148,266
1936...	113,897	461,934	...	...	...	...	570	8,311	...	...	...	...	...	...	[9]5	262	114,472	470,507
1937...	160,272	740,555	...	...	...	...	...	...	2,425	12,731	...	...	...	...	[12]43	740	162,740	754,026
1938...	176,852	865,968	...	...	148,642	980,713	...	...	23,964	200,302	...	...	...	...	...	...	349,458	2,064,938
1939...	176,796	881,064	...	...	268,409	1,983,783	...	...	14,125	53,408	97,060	493,559	...	...	...	...	556,390	3,411,814
1940...	172,595	878,208	...	...	445,864	3,554,460	...	...	...	...	220,816	1,282,840	...	...	...	[11]619	839,275	5,706,127
1941...	173,688	873,721	...	3,521	694,894	5,626,389	...	...	...	...	252,056	1,403,441	3,583	22,636	...	...	1,124,221	7,929,708
1942...	149,274	805,805	...	4,198	756,453	6,232,794	...	...	...	...	241,815	1,155,167	18,667	79.152	...	...	1,166,209	8,277,116
1943...	109,846	595,417	...	433	674,487	5,015,128	...	...	...	...	196,687	896,148	...	14,655	...	...	981,020	6,521,781
1944...	115.675	598,564	...	169	484,583	3,109,606	...	6,181	...	...	152,696	716.174	...	711	...	...	752,954	4,431,405
1945...	104,724	448,258	...	...	430,065	3,107,715	...	5,383	...	...	153,416	651,563	...	...	...	...	688,205	4,212,919
Total.	1,476,204	7,211,789	131,585	808,080	3,903,522	29,600,902	267,741	1,613,856	40,514	266,441	1,314,546	6,598,892	22,250	117,154	4,699	22,546	7,161,061	46,239,660

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

[2]Acquired by Beaverhouse Lake Gold Mines, Limited, in 1935. [3]Acquired by Cathroy Larder Mines, Limited, in 1943.

[4]Production for 1913 by Associated Goldfields, which was acquired by Canadian Associated Goldfields in 1921.

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

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

[7]American Eagle, 50 tons, $900; Detroit Syndicate, 50 tons, $200.

[8]Patricia mine, afterwards called Barry-Hollinger. [9]Miller Independence. [10]Gold Hill. [11]Telluride.

[12]Britcana, 21 tons, $702; Telluride (which was acquired on a 99-year lease by Minaura Mines, Limited, from Smelters Corporation of Canada, Limited, in November, 1935), 22 tons. $38.

Table II

KIRKLAND LAKE GOLD BELT

Annual Production Statistics by Mines, 1910–1945

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

Year	Toburn (Tough-Oakes Burnside[1])		Golden Gate (Lucky Cross[2])		Wright-Hargreaves		Teck-Hughes		Lake Shore		Kirkland Lake Gold		Sylvanite		Macassa		Bidgood		Morris Kirkland		Upper Canada		Miscellaneous[3]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1910																							30	286	30	286
1911																							675	4,650	675	4,650
1912																										
1913	2,220	66,632	2,500	14,006	3	1,127																	1,660	7,171	6,383	88,936
1914	3,734	117,644																							3,734	117,644
1915	26,196	555,539																							26,196	555,539
1916	39,865	711,626																							39,865	711,626
1917	38,695	342,830					11,257	66,722																	49,952	409,552
1918	22,000	139.683					14,774	80,570	16,749	416,414													3	1,113	53,526	637,780
1919							18,387	169,590	11,081	263,354	11,324	56,263													40,792	489,207
1920							30,646	277,878	19,779	545,311	40,812	322,533													91,237	1,145,722
1921					36,053	481,892	34,693	359,844	21,817	540,450	43,966	268,566													136,529	1,650,752
1922	16,108	107,617			66,181	767,445	41,194	604,006	24,279	476,461	37,489	226,527											6,496	10,082	191,747	2,192,138
1923	1,803	12,174			79,242	762,761	38,314	1,137,523	23,203	557,186	45,449	223,990													188,011	2,693,634
1924	8,438	47,548			84,487	1,094,462	44,209	1,035,338	56,168	1,104,550	8,091	46,513													201,393	3,328,411
1925	34,152	263,064			147,939	1,913,468	55,220	996,645	109,273	1,958,720														1,526	346,584	5,133,423
1926	43,871	309,709			153,392	2,150,844	87,074	1,600,613	171,197	2,775,000	10,829	126,999													466,363	6,963,165
1927	38,999	153,215			209,164	2,151,916	153,881	2,781,962	236,818	3,375,053	52,648	473,673	40,479	429,424											731,989	9,365,243
1928	14,396	82,316			256,331	1,838.510	317,213	4,951.707	279,661	4,073,965	57,883	414,596	69,791	738,146										32,805	995,275	12,132,045
1929					188,238	1,734,728	330,340	5,081,078	430,170	6,126,688	53,595	353,915	74,523	689,465									11	12,328	1,076,877	13,998,202
1930					220,430	2,432,888	338,555	5,403,030	550,501	7,847,508	52,106	534,154	81,213	794,459											1,242,805	17,012,039
1931					266,352	3,078,754	444,410	6,286,668	816,580	11,650,281	52,628	615,882	91,621	921,216									1	1,662	1,671,592	22,554,463
1932	14,689	227,956			295,525	3,984,125	475,700	6,631,755	818,698	14,317,113	56,492	592,451	96,891	930,305											1,757,995	26,683,705
1933	36,913	666,894	35	865	285,465	4,955,960	474,700	6,166,619	808,917	14,377,716	49,487	400,622	96,937	1,072,977	8,101	110,172								5,546	1,760,555	27,757,371
1934	36,230	708,119			354,418	7,572,292	442,745	5,801,691	836,023	16,305,819	64,952	703,300	111,767	1,740,384	66,557	1,111,098	2,433	6,804					8,476	100,221	1,923,601	34,049,728
1935	35,360	714,261	1	10	361,149	7,228,563	417,917	4,901,862	836,322	16,259,720	71,920	777,430	152,281	1,917,606	68,627	1,067,196	11,148	43,870					7,912	79,498	1,962,637	33,290,016
1936	34,440	723,295	25	1,499	400,310	7,588,550	403,712	4,747,833	887,571	15,882,078	84,679	746,189	162,185	2,099,128	70,878	1,260,414	26,518	362,318	3,130	18,044			749	3,112	2,074,197	33,432,460
1937	37,465	920,351	225	5,144	436,500	7,855,856	412,430	4,381,676	900,321	15,546,656	84,886	1,249,724	174,566	2,222,815	90,617	1,464,561	44,732	431,847	35,970	202,687			90	20,747	2,217,802	34,302,064
1938	52,434	1,112,385	11,090	167,759	434,650	7,800,875	380,215	3,625,284	921,837	15,149,635	92,665	1,483,769	190,714	2,419,734	110,718	1,769,951	52,636	617,581	22,929	113,770	6,270	53,547	1,263	7,506	2,277,421	34,321,796
1939	55,272	1,225,340	23,753	267,335	438,710	8,219,961	379,175	3,444,668	856,586	13,318,622	99,401	1,729,237	201,331	2,486,848	148,085	2,317,985	53,191	483,520			47,014	685,755			2,302,518	34,179,271
1940	59,524	1,296,428	25,481	261,861	442,920	8,688,806	317,560	3,577,194	647,426	10,930,962	137,986	2,051,790	212,519	2,658,723	150,674	2,680,188	50,437	404,546	39,579	164,995	66,656	1,079,453		619	2,150,762	33,795,565
1941	60,715	1,095,779	23,781	214,347	411,760	8,661,343	258,100	2,534,139	530,368	7,925,692	136,613	1,879,727	197,293	2,589,635	142,332	2,521,389	40,460	467,890	25,645	121,601	73,414	1,259,730		18,926	1,900,481	28,690,198
1942	43,635	730,350	8,324	73,489	283,580	5,669,063	93,335	1,365,513	347,951	5,560,188	100.854	1,458,823	175,745	2,021,506	120,400	2,144,501	47,960	507.219		447	86,523	1,359,021		5.730	1,308,307	20,895,850
1943	40,905	609,517		1,859	225,710	4,372,734	100.705	1,251,047	293,398	5,166,738	83,987	1,189,478	148,190	2,025,005	103,259	1,652,643	49,835	556,537			68,829	1,154,438		3,460	1,114,818	17,983,456
1944	39,940	493,270		481	184,520	3,494,958	102,920	989,004	258,544	4,223,731	77,457	1,053,156	137,822	1,722,722	83,392	1,398,011	48,594	347,105			78,036	1,062,214		1,812	1,011,225	14,786,464
1945	41,655	488,624			156,320	3,069,368	106,006	1,098,532	291,854	4,524,101	85,358	1,086,212	114,227	1,452,360	71,988	1,086,302	32,608	419,016			83,708	1,038,950		11,570	983,724	14,275,035
Total	879,654	13,922,166	95,215	1,008,655	6,419,349	107,271,249	6,325,387	81,349,991	12,003,092	201,199,712	1,693,557	20,065,519	2,530,095	30,932,458	1,235,628	20,584,411	460,552	4,648,253	127,253	621,544	510,450	7,693,108	27,366	330,370	32,307,598	489,627,436

[1]Acquired by Toburn Gold Mines, Limited, in 1931.
[2]Acquired by Golden Gate Mining Company, Limited, from Kirkland Gateway Gold Mines, Limited.
[3]See table of "Miscellaneous Production" to the right.

Miscellaneous Production, Kirkland Lake Gold Belt

Mine	Year	Quantity	Value
		tons	$
Fleming, P.M.	1940		619
Gold Pyramid	1911	175	650
Golden Summit	1936, 1937, 1945	737	3,738
Baldwin Kirkland[1]	1929, 1938	81	1,247
Mesabi (Bourkes[2])	1918, 1936-1938	1,298	8,935
Moffatt-Hal	1934, 1935	16,388	166,569
Ontario-Kirkland	1922	6.496	10,082
Swastika	1910, 1911, 1913	2,190	11,457
Trout Creek	1931	1	1,662
Miscellaneous[3]	1925, 1928, 1929, 1933, 1934, 1937, 1938, 1941-1945		125,411
Total		27,366	330,370

[1]Under lease by Lucky Kirkland Gold Mines, Limited, in 1938.
[2]The property of the Bourkes Syndicate was acquired by Mesabi Gold Mines, Limited, in 1937.
[3]This includes gold recovered from scrapped machinery, origin unknown, and

Table III

PORCUPINE GOLD BELT

ANNUAL PRODUCTION STATISTICS BY MINES, 1910–1945

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

Year	Hollinger		Dome		Vipond[1]		McIntyre-Porcupine		Porcupine Crown (Northcrown[2])	
	tons	$	tons	$	tons	$	tons	$	tons	$
1910		31,194		4,355						
1911		6,000		4,277	432	5,160				
1912	45,195	909,181	75,088	737,499	5,168	16,259	14,500	77,657		
1913	138,291	2,488,022	131,149	1,242,625			29,669	236,299	19,715	326,803
1914	208,936	2,719,355	221,390	1,059,238	9,700	73,628	62,284	549,166	40,857	685,135
1915	334,750	4,206,015	317,740	1,530,287	35,899	246,053	101,955	750,812	46,419	602,436
1916	601,854	5,073,401	440,900	2,153,820	43,041	176,686	136,489	1,218,073	51,273	578,322
1917	514,301	4,261,938	359,570	1,480,174	34,971	209,738	175,893	1,710,204	39,111	377,904
1918	578,755	5,752,371		82,127	15,134	82,868	176,976	1,578,444	10,907	124,474
1919	711,882	6,722,266	187,580	1,290,301			185,018	1,978,014		
1920	650,205	6,939,629	295,220	2,243,926			191,032	2,515,861	17,898	190,713
1921	1,072,493	10,015,712	335,680	2,386,357			172,287	2,005,443		7,943
1922	1,491,381	12,436,393	368,400	4,178,936			217,208	2,042,931		
1923	1,366,352	10,622,262	399,800	4,405,199	2,623	24,532	291,428	2,583,336		
1924	1,659,776	13,574,776	493,400	4,307,624	52,427	603,234	390,459	3,625,493		
1925	1,929,528	15,746,668	530,200	4,365,923	61,203	565,213	419,640	3,721,499		
1926	1,932,559	14,829,655	555,700	3,940,053	79,717	631,636	498,653	3,862,074		
1927	2,178,329	14,539,538	543,300	4,031,575	90,863	667,724	522,880	3,965,210		
1928	1,778,470	10,706,235	548,000	3,915,051	88,896	694,426	524,695	4,201,808		
1929	1,549,157	9,519,092	452,900	3,590,537	107,984	824,726	550,100	4,314,803		
1930	1,625,868	10,276,546	67,600	774,943	114,667	910,581	565,510	4,700,726		
1931	1,640,705	10,532,380	542,600	3,636,806	100,223	586,304	617,425	4,962,211		
1932	1,754,863	11,685,512	536,450	4,581,131	107,197	513,504	723,285	6,155,757		
1933	1,727,102	13,831,174	546,500	6,103,340	107,562	700,354	754,360	7,589,845		
1934	1,900,490	15,108,883	547,600	7,177,087	101,806	539,243	851,345	8,289,262		
1935	1,837,153	14,700,511	549,100	7,286,606	106,393	418,962	869,100	8,653,496		
1936	1,755,768	14,530,414	553,900	7,315,168	105,487	463,391	869,000	8,105,612		
1937	1,719,199	14,877,898	576,300	7,485,321	94,240	406,668	870,160	8,176,793		
1938	1,734,647	15,496,804	601,700	7,293,289	62,070	229,272	872,740	8,288,669		
1939	1,700,355	15,484,394	615,000	7,462,379	37,515	187,218	877,830	8,406,958		
1940	1,780,377	16,844,035	621,600	7,934,391			885,930	9,561,581		
1941	1,756,923	16,416,119	627,700	7,769,368		50,068	865,670	9,187,814		
1942	1,530,712	14,296,498	559,700	6,579,536			798,260	8,642,322		
1943	1,078,946	10,897,411	525,900	5,772,521			668,700	7,439,863		
1944	955,447	8,735,306	519,800	5,177,495			589,940	6,588,753		
1945	933,748	8,458,687	527,100	4,887,263			565,320	6,214,418		
Total	44,174,517	363,272,275	14,774,567	144,186,528	1,565,218	9,827,448	16,905,741	161,901,207	226,180	2,893,730

Year	Coniaurum (Newray[3])		Dome Lake and West Dome Lake[4]		Munro Croesus		Schumacher[5]		Paymaster[6]	
	tons	$	tons	$	tons	$	tons	$	tons	$
1910										
1911										
1912										
1913	2,456	18,858								
1914	11,607	125,255								
1915		36,925	11,727	102,880	100	73,215	9,240	48,236		
1916			6,542	16,814	477	51,722	46,463	225,301		
1917	340	1,447	16,388	44,434	1,541	60,046	37,323	198,605		
1918	401	1,516	12,229	103,745	692	64,780	19,098	92,842		
1919			4,433	23,910						
1920			4,707	52,531						
1921										
1922										2,800
1923					518	27,375				
1924			8,114	60,765						
1925			35,278	235,091						
1926			36,946	220,758					28,049	63,551
1927			16,982	87,919					62,129	135,025
1928	52,005	220,534							94,050	183,271
1929	103,293	635,485	35,142	155,797						
1930	122,972	738,941		15,662						
1931	130,585	783,096			550	4,171				
1932	144,654	977,007				6,520				
1933	145,657	945,765								
1934	138,114	979,156			205	10,467				
1935	151,055	1,134,596			1,237	25,513				
1936	168,715	1,390,261			13	2,904				
1937	166,980	1,462,212								
1938	188,975	1,675,230								
1939	187,405	1,753,902								
1940	185,455	1,870,570								
1941	186,885	1,873,891								
1942	162,390	1,664,496								
1943	111,455	1,189,629								
1944	98,540	1,037,676								
1945	98,210	1,013,678								
Total	2,558,149	21,530,126	188,488	1,120,306	5,333	326,713	112,124	564,984	184,228	334,647

Year	Porcupine Peninsular (Night Hawk Peninsular[7])		Buffalo Ankerite[8]		Marbuan (March[9])		De Santis		Gillies Lake–Porcupine (Rochester[10])		Naybob (Hayden[11])	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1910												
1911												
1912												
1913												
1914												
1915												
1916												
1917												
1918												
1919												
1920												
1921												
1922												
1923												
1924	38,326	268,518										
1925	39,758	196,947										
1926	21,604	111,154	23,060	140,588	4,655	11,055		146				
1927		166	69,863	359,005	4,566	19,839						
1928			66,606	289,960	32,627	133,879						
1929			12,912	71,684	48,484	256,303			4,848	44,285		
1930				878	53,953	306,262			7,815	56,913		
1931					58,462	228,507			1,396	5,439		
1932			55,267	247,536	26,812	89,566					2,580	1,497
1933			111,402	650,591	2,800	5,288	5,630	18,386			1,593	3,188
1934			131,720	712,898	26,030	113,422						
1935			159,383	1,035,987	59,380	290,542			5,122	56,933	10,681	23,666
1936			271,736	1,888,829					18,410	166,531		
1937			343,093	2,832,513					16,911	132,381		16,615
1938			362,838	2,971,464							10,339	41,584
1939			360,014	2,625,952			35,539	247,888			44,271	266,356
1940		3,577	378,337	2,508,556			56,444	433,341			53,524	560,351
1941			448,621	2,760,980			60,405	410,605			53,807	531,152
1942			358,419	2,444,285			38,910	256,341			58,870	345,891
1943			260,271	1,894,052								33,938
1944		100	235,442	1,582,581								
1945			197,691	1,253,829								
Total	99,688	580,462	3,846,675	26,272,168	317,769	1,454,663	196,928	1,366,707	54,502	462,482	235,665	1,824,238

Year	Paymaster Consolidated[12]		Pamour		Ross[13]		Delnite		Hallnor		Moneta	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1910												
1911												
1912												
1913												
1914												
1915												
1916												
1917												
1918												
1919												
1920												
1921												
1922												
1923												
1924												
1925												
1926												
1927												
1928												
1929												
1930												
1931												
1932												
1933												
1934	13,824	69,522										
1935	79,845	567,076										
1936	140,962	976,605	138,187	809,933	27,540	225,775						
1937	169,658	1,266,639	276,168	2,044,049	31,336	351,746	38,750	228,437				
1938	190,107	1,402,304	515,193	3,313,830	44,399	467,767	85,816	662,870	60,979	1,373,141	54,577	1,016,153
1939	201,775	1,545,431	585,399	2,561,086	55,727	521,201	111,395	825,045	122,868	2,600,181	63,206	1,076,340
1940	207,168	1,742,283	575,728	2,729,365	94,522	836,412	127,741	853,551	140,529	2,649,275	64,439	1,141,751
1941	215,113	1,811,579	559,528	2,577,574	100,787	949,733	166,596	1,183,053	132,267	2,527,328	61,416	1,169,846
1942	207,566	1,707,484	574,653	2,342,426	101,409	816,683	172,727	1,220,663	128,973	2,308,711	57,103	956,746
1943	138,531	1,139,290	525,557	2,084,530	85,221	581,837	125,887	819,672	105,544	1,460,953	14,088	228,520
1944	132,063	1,110,414	470,532	1,615,502	77,544	552,855	93,112	570,247	102,742	1,585,267		
1945	130,793	1,055,259	417,914	1,465,107	73,538	458,676	66,120	363,063	95,436	1,724,505		
Total	2,011,633	14,778,533	4,638,859	21,543,402	692,023	5,762,685	988,144	6,726,601	889,338	16,229,361	314,829	5,589,356

Year	Preston East Dome		Broulan		Aunor		Faymar		Nakhodas		Bonetal	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1910												
1911												
1912												
1913												
1914												
1915												
1916												
1917												
1918												
1919												
1920												
1921												
1922												
1923												
1924												
1925												
1926												
1927												
1928												
1929												
1930												
1931												
1932												
1933												
1934												
1935												
1936												
1937												
1938		138,564										
1939	118,853	2,116,708	14,911	105,820								
1940	175,773	2,341,387	110,637	1,190,489	127,111	1,373,285	50,666	381,944	3,968	25,091		
1941	194,817	2,399,270	138,888	1,067,657	159,341	1,658,955	55,626	333,551	23,782	142,299	6,805	40,580
1942	306,687	2,791,973	137,701	1,038,593	173,369	1,848,229	12,889	137,797	16,278	83,662	40,318	234,147
1943	247,026	2,282,318	118,007	1,102,514	159,436	1,915,846					27,798	165,657
1944	249,268	2,218,751	100,481	770,810	137,321	1,932,564				1,740	26,081	150,778
1945	222,359	2,171,301	89,392	653,929	143,390	2,163,291					23,992	168,826
Total	1,514,783	16,460,272	710,017	5,929,812	899,968	10,892,170	119,181	853,292	44,028	252,792	124,994	759,988

Year	Hoyle		Miscellaneous[14]		Total	
	tons	$	tons	$	tons	$
1910						35,549
1911					432	15,437
1912					139,951	1,740,596
1913			25	4,200	321,305	4,316,807
1914				20,212	554,774	5,231,989
1915			139	9,134	857,969	7,605,993
1916					1,327,039	9,494,139
1917			31	877	1,179,469	8,345,367
1918			2,562	16,214	816,754	7,899,381
1919			3,831	27,088	1,092,744	10,041,579
1920			3,003	11,247	1,162,065	11,953,907
1921					1,580,460	14,415,455
1922				1,664	2,076,989	18,662,724
1923				11,845	2,060,721	17,674,549
1924				5,270	2,642,502	22,445,680
1925				3,452	3,015,607	24,834,793
1926				634	3,180,943	23,811,304
1927			60	223,243	3,488,972	24,029,244
1928			255	39,740	3,185,604	20,384,904
1929				47,701	2,864,820	19,460,413
1930				61,940	2,558,385	17,843,392
1931				33,587	3,091,946	20,772,501
1932			155	31,944	3,351,263	24,289,974
1933			26	80,918	3,402,632	29,928,849
1934			580	2,830	3,711,714	33,002,770
1935			830	9,062	3,829,279	34,202,950
1936			68	45,522	4,049,786	35,920,945
1937			252	23,888	4,303,047	39,305,160
1938			4,714	27,698	4,789,094	44,398,639
1939			1,123	4,800	5,133,186	47,791,659
1940			7,265	19,719	5,647,214	55,000,954
1941	159,470	644,765			5,974,447	55,506,187
1942	187,620	766,813		5,730	5,624,554	50,489,026
1943	105,606	375,101		3,460	4,297,973	39,387,112
1944		42,406		5,746	3,788,313	33,678,991
1945				9,520	3,585,003	32,061,352
Total	452,696	1,829,085	24,919	788,885	98,686,956	845,980,271

[1]Acquired by Anglo-Huronian, Limited, in 1933 and by Mace Gold Mines, Limited, in 1937, together with properties of Inspiration Gold Mines, Limited.
[2]The Porcupine Crown was acquired by Northcrown Porcupine Mines, Limited, on May 15, 1920, and by Vipond Consolidated Mines, Limited (now Mace Gold Mines, Limited), in 1926.
[3]The Rea mine (production of which is shown in the figures for 1913, 1914, and 1915) was operated by Newray Mines, Limited, in 1917 and 1918. In 1924 the Newray was taken over by Coniaurum Mines, Limited.
[4]From 1915 to 1920, the production shown was from the Dome Lake mine, except 300 tons with a value of $2,462 from the West Dome Lake in 1918. In 1922 the properties were amalgamated as Consolidated West Dome Lake Mines, Limited, and in 1930 acquired by Paymaster Consolidated Mines, Limited.
[5]Purchased by the Hollinger in 1922.
[6]Now owned by Paymaster Consolidated Mines, Limited.
[7]Acquired by Porcupine Peninsular Gold Mines, Limited, in 1933.
[8]The production shown from 1926 to 1930 is from the Ankerite mine before it was acquired by Buffalo Ankerite Gold Mines, Limited, in 1932. The Marbuan was acquired in 1936, and the figures from 1936 on include production from both mines.
[9]The March was taken over by Marbuan Gold Mines, Limited, in 1933; the Buffalo Ankerite operated the Marbuan mill in 1933, treating 2,800 tons from the dump of New York Porcupine Gold Mines, Limited. The Marbuan was taken over by Buffalo Ankerite Gold Mines, Limited, in 1936; its production since that date is shown under Buffalo Ankerite.
[10]The Rochester mine and other property was acquired from Porcupine United Gold Mines, Limited, in 1933.
[11]The Hayden mine was acquired by Naybob Gold Mines, Limited, in 1934 and by Naybob Mines, Limited, in 1943.
[12]Paymaster Consolidated Mines, Limited, incorporated in 1930, is a merger of West Dome Lake Gold Mines, Limited, and United Mineral Lands Corporation (which owned the Paymaster mine). Practically all the production has come from the old Dome Lake and West Dome Lake shafts.
[13]The Ross mine in Hislop township is owned by Hollinger Consolidated Gold Mines, Limited.
[14]See table of "Miscellaneous Production" to the right.

MISCELLANEOUS PRODUCTION, PORCUPINE GOLD BELT

Mine	Year	Quantity	Value	Mine	Year	Quantity	Value
		tons	$			tons	$
Amca	1937		1,298	J. Huddlestone and P. Clyne	1923, 1925		3,257
Blue Quartz (Amal. Goldfields)	1923, 1926, 1928		1,303	Hughes	1926		30
	1934	500	663	McLaren-Porcupine	[2]1933, 1934, 1935, 1937	876	6,819
Canusa (Scottish-Ontario)	1927, 1928	315	12,688	Northern Turnbull	1934	30	172
	1933, 1935		2,152	Porcupine Lake	1937-1940, 1944	10,821	50,100
Clifton Porcupine (Preston[1])	1913, 1914		15,212	Porcupine Pet	1914, 1915		10,551
	1922-1924		15,363	Porphyry Hill	1913, 1915	46	6,236
Concordia (Jones-Porter)	1935	230	580	J. Spence (Triple Lake)	1932	155	2,738
Coulson (Devon)	1940	2,333	1,632	Tommy Burns	1917	21	289
Davidson Consolidated	1918-1920	9,371	53,914	Miscellaneous[3]	1925, 1927-1938, 1942-1945	68	601,118
Gold Reef	1915, 1917	128	2,135	Total		24,919	788,885
Hill Gold (Beatty tp.)	1918	25	635				

[1]The Preston claim in Deloro township was acquired in 1919 by Clifton Porcupine Mines, Limited, from Preston East Dome Mines, Limited.
[2]J. M. McLaren shipped to Noranda 26 tons, $326.
[3]This is high-grading and recoveries from scrapped machinery.

Table VI

PATRICIA PORTION OF KENORA DISTRICT

Annual Production Statistics of Gold Mines, 1911–1945

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

Year	Howey		Central Patricia		J-M Consolidated (Jackson Manion)		Jason (Argosy[1])		Pickle Crow		McKenzie Red Lake	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1911	...	...	...	...	...	...	...	...	...	...	...	...
1923	...	...	...	...	...	...	...	...	...	...	...	...
1924	...	...	...	...	...	...	...	...	...	...	...	...
1929	...	...	...	...	...	...	...	...	...	...	...	...
1930	110,438	460,857	...	...	...	...	...	...	...	...	...	...
1931	211,552	914,291	...	...	...	...	...	...	...	...	...	...
1932	284,664	1,268,780	...	...	...	...	...	...	...	...	...	...
1933	344,135	1,161,436	...	...	...	...	...	...	...	...	...	...
1934	481,757	1,594,223	11,536	219,562	3,443	35,389	4,094	30,673	...	...	...	...
1935	484,966	1,332,950	35,192	777,570	1,381	12,851	...	...	37,277	878,745	36,117	533,223
1936	528,528	1,251,588	58,466	1,144,154	12,160	119,603	9,872	130,027	63,758	1,612,451	52,465	747,795
1937	447,344	1,095,508	77,119	1,392,840	31,225	334,475	31,741	353,981	98,063	2,270,113	58,001	860,214
1938	448,115	1,210,032	101,376	1,607,140	17,005	141,532	1,636	35,370	115,915	2,769,291	63,321	892,404
1939	449,488	1,138,713	108,091	1,764,651	35,549	277,100	...	...	126,959	2,902,154	70,445	1,111,339
1940	454,183	968,486	118,803	1,888,637	4,594	50,733	23,964	394,681	141,992	2,879,222	76,572	1,012,548
1941	385,609	849,642	142,516	1,950,549	...	...	48,362	768,826	146,375	2,736,169	84,146	1,000,436
1942	...	...	138,790	1,720,634	...	...	32,992	538,416	107,951	1,976,684	85,547	1,039,210
1943	...	...	104,451	1,425,771	...	...	...	...	70,575	1,328,548	85,973	952,247
1944	...	...	91,512	1,139,476	...	...	...	...	63,388	1,453,312	78,279	733,913
1945	...	2,590	89,301	1,071,246	...	...	...	...	60,227	1,291,181	63,460	492,583
Total	4,630,779	13,249,096	1,077,153	16,102,230	105,357	971,683	152,661	2,251,974	1,032,480	22,097,870	754,326	9,375,912

Year	Red Lake Gold Shore		Gold Eagle		Sachigo River		Madsen Red Lake		Hasaga		Uchi	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
1911	...	...	...	...	...	...	...	...	...	...	...	...
1923	...	...	...	...	...	...	...	...	...	...	...	...
1924	...	...	...	...	...	...	...	...	...	...	...	...
1929	...	...	...	...	...	...	...	...	...	...	...	...
1930	...	...	...	...	...	...	...	...	...	...	...	...
1931	...	...	...	...	...	...	...	...	...	...	...	...
1932	...	...	...	...	...	...	...	...	...	...	...	...
1933	...	...	...	...	...	...	...	...	...	...	...	...
1934	...	...	...	...	...	...	...	...	...	...	...	...
1935	...	...	...	...	...	...	...	...	...	...	...	...
1936	14,918	138,706	...	...	...	...	...	...	...	...	...	...
1937	47,557	451,147	6,599	73,005	...	...	...	...	...	...	...	...
1938	23,858	157,724	43,811	363,516	6084	376,993	44,663	327,827	3,206	24,993	...	...
1939	...	...	45,374	351,730	10699	536,626	136,929	954,302	58,184	457,724	103,122	686,942
1940	...	...	46,116	420,628	13030	482,200	141,625	1,129,725	88,077	637,445	227,294	1,299,788
1941	...	...	38,195	287,965	16603	545,153	145,995	1,203,311	134,816	1,000,684	249,417	1,424,370
1942	...	...	...	...	...	16,112	146,226	1,473,029	133,885	891,610	162,627	858,385
1943	...	...	...	...	...	...	144,792	1,321,889	120,318	709,572	14,614	122,248
1944	...	...	...	...	...	...	132,759	1,448,533	118,249	648,890	...	...
1945	...	...	...	...	...	...	101,663	1,001,661	105,068	453,731	...	...
Total	86,333	747,577	180,095	1,496,844	46416	1,957,084	994,652	8,860,277	761,803	4,824,649	757,074	4,391,733

Year	Berens River		Cochenour Willans		McMarmac		Miscellaneous[2]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$
1911	...	...	...	...	...	...	30	57	30	57
1923	...	...	...	...	...	...	...	124	...	124
1924	...	...	...	...	...	...	...	126	...	126
1929	...	...	...	...	...	...	...	14,617	...	14,617
1930	...	...	...	...	...	...	...	...	110,438	460,857
1931	...	...	...	...	...	...	...	...	211,552	914,291
1932	...	...	...	...	...	...	...	...	284,664	1,268,780
1933	...	...	...	...	...	...	175	4,205	344,310	1,165,641
1934	...	...	...	...	...	...	130	2,551	500,960	1,882,398
1935	...	...	...	...	...	...	293	6,097	595,226	3,541,436
1936	...	...	...	...	...	...	8,986	69,370	749,153	5,213,694
1937	...	...	...	...	...	...	3,000	10,232	800,649	6,841,515
1938	...	...	...	...	...	...	...	...	868,990	7,906,822
1939	19,217	277,114	9,070	127,430	...	...	...	...	1,173,127	10,585,825
1940	82,346	1,279,928	53,921	817,269	4,561	67,305	...	...	1,477,078	13,328,595
1941	86,373	1,528,840	61,415	945,444	29,794	586,300	...	...	1,569,616	14,827,689
1942	86,850	1,517,709	60,240	1,244,546	32,589	424.458	...	...	987,697	11,700,793
1943	53,255	854,202	55,663	1,105,078	32,073	277.809	...	...	681,714	8,097,364
1944	40,436	526,995	44,928	767,649	31,890	194,905	...	...	601,441	6,913,673
1945	72,880	1,007,036	31,445	351,992	...	...	...	...	524,044	5,672,020
Total	441,357	6,991,824	316,682	5,359,408	130,907	1,550,777	12,614	107,379	11,480,689	100,336,317

[1]The Casey Summit mine was acquired by Argosy Gold Mines, Limited, in 1935 and by Jason Mines, Limited, in November, 1938.
[2]See table of "Miscellaneous Production" to the right.

Miscellaneous Production, Patricia Portion of Kenora District

Mine	Year	Quantity	Value
		tons	$
Bathurst	[1]1929, [2]1936	307	5,809
Bobjo	[1]1929	...	11,510
W. D. Cooper and P. A. Barry[3]	1935, 1936	...	5,591
Hudson-Patricia	1936, 1937	11,228	65,166
N. McDonald	1924	...	126
R. McDonald	1923	...	124
Red Crest (Rowan Discovery)	1935, 1936	591	9,721
Geo. A. Rowan	1933	...	368
Geo. Singleton	1933	...	137
Sol D'Or[4]	1933–1936	458	8,770
J. Tingley	1911	30	57
Total	...	12,614	107,379

[1]High-grade.
[2]Under option to Car Lake Syndicate.
[3]Produced from the McIntyre Birch Lake property in 1934, reported in 1936.
[4]This property was operated in 1933 by the Highgrade Syndicate and in 1934 J. Hendrick, when it was acquired by Sol D'Or Gold Mines, Limited.

Table V

THUNDER BAY DISTRICT

ANNUAL PRODUCTION STATISTICS OF GOLD MINES, 1905–1945

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

Year	St. Anthony[1]		North Shores (McKellar-Longworth[2])		Tashota[3]		Ardeen (Moss[4])		Northern Empire		Little Long Lac	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910	13,100	58,304										
1911	540	4,318										
1912	11,500	61,327										
1913	6,432	20,408										
1917		1,967										
1918	3,603	18,340										
1920		8,771										
1921	320	5,069										
1923				1,707								
1924												
1929	678	2,388		226								
1930	8	458										
1931					34	315						
1932			179	15,480			25,363	196,473				
1933			11	288			34,789	270,077				
1934	21,618	123,198					38,143	216,094	22,507	195,647	5,485	85,480
1935	44,550	303,152	1,404	29,358	12,827	76,627	5,884	32,531	45,736	645,296	62,073	1,108,269
1936	28,408	160,394	2,214	26,212	23,590	224,183	39,545	234,134	64,645	1,002,521	83,555	1,500,792
1937	17,896	156,225		202	14,454	122,960			65,026	706,179	104,931	1,638,545
1938	28,945	220,001			329	16,137			59,332	804,044	97,320	1,544,990
1939	23,792	293,502							67,914	928,616	106,775	1,698,766
1940	59,039	423,563				51			61,691	672,427	113,065	1,761,820
1941	70,640	303,907		243		1,371			39,015	419,719	118,332	1,634,811
1942								13,017			115,790	1,517,548
1943											88,890	1,008,830
1944											67,538	877,902
1945											72,117	815,183
Total	331,069	2,165,292	3,808	73,716	51,234	441,644	143,724	962,326	425,866	5,374,449	1,035,871	15,192,936

Year	Sturgeon River		Leitch		Bankfield		Sand River		MacLeod-Cockshutt		Hard Rock	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910												
1911												
1912												
1913												
1917												
1918												
1920												
1921												
1923												
1924												
1929												
1930												
1931												
1932												
1933												
1934												
1935												
1936	1,290	20,711		[6]2,048								
1937	17,978	310,102	23,058	449,260	26,437	390,212	2,537	11,932				
1938	28,157	509,011	30,584	709,799	47,500	648,074	35,670	459,466	126,291	900,582	76,074	648,075
1939	26,282	441,309	31,206	784,784	47,566	593,636	36,518	437,450	208,095	1,649,469	107,086	803,607
1940	27,790	513,306	31,118	874,122	42,699	428,783	34,726	403,027	238,780	2,108,966	119,255	1,197,693
1941	25,869	458,589	30,493	894,926	39,175	238,408	31,824	383,124	237,076	2,324,324	135,337	1,174,510
1942	17,757	475,877	30,076	973,111	27,632	109,419	16,595	168,841	233,036	2,619,030	134,122	1,238,828
1943			27,438	842,680					181,761	2,103,641	97,373	926,544
1944			21,727	624,283		6,181			124,964	1,536,383	91,047	838,489
1945			20,089	683,452		731			30,000	367,785	6,337	51,565
Total	145,123	2,728,905	245,789	6,838,465	231,009	2,415,444	157,870	1,863,840	1,380,003	13,610,180	766,631	6,879,311

Year	Tombill		Magnet		Jellicoe		Miscellaneous[5]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910							1,100	2,378	14,200	60,682
1911									540	4,318
1912									11,500	61,327
1913									6,432	20,408
1917										1,967
1918									3,603	18,340
1920							1	63	1	8,834
1921							30	1,122	350	6,191
1923										1,707
1924								114		114
1929							1	71	679	2,685
1930									8	458
1931									34	315
1932							32	1,474	25,574	213,427
1933									34,800	270,365
1934							230	37,638	87,983	658,057
1935							3,346	51,820	175,820	2,247,053
1936							27	2,019	243,274	3,173,014
1937							183	6,147	272,500	3,791,764
1938	26,486	387,554	2,946	61,640			190	544	559,824	6,909,917
1939	38,704	613,789	17,493	457,247	3,015	45,748			714,446	8,747,923
1940	45,228	645,882	41,485	1,103,149	10,116	150,810	20	500	825,012	10,284,099
1941	46,956	513,263	45,609	976,859	1,591	19,930		4,646	821,917	9,348,630
1942	33,248	429,496	50,613	865,161			3,947	42,017	662,816	8,452,345
1943			43,060	573,408				1,083	438,522	5,456,186
1944									305,276	3,883,238
1945								832	128,543	1,919,548
Total	190,622	2,589,984	201,206	4,037,464	14,722	216,488	9,107	152,468	5,333,654	65,542,912

[1]Records are incomplete; operations were reported from 1905 to 1907. This property was formerly owned by Northern Gold Reef, Limited.
[2]Acquired from Schreiber Gold Mines, Limited, by North Shores Gold Mines, Limited, in 1933, which was succeeded in 1936 by North Shores Mines (1936), Limited.
[3]In addition to gold values shown, this mine produced large quantities of copper (see detailed gold table in previous reports).
[4]Originally known as the Huronian; this mine produced in the seventies, but no records are available; acquired by Ardeen Gold Mines, Limited, in 1933, and by Kerry Gold Mines, Limited, in 1937.
[5]See table of "Miscellaneous Production" to the right.
[6]Surface ore.

MISCELLANEOUS PRODUCTION, THUNDER BAY DISTRICT

Mine	Year	Quantity	Value
		tons	$
Anderson, R.	1943		116
Brengold	1941		3,551
Caouette claims	[1]1935, [2]1938, [2]1941, [2]1943, [2]1945	224	3,220
Cook Lake[3]	1937	32	918
Mary J. Coveney	1924		114
Dikdik[4]	1934, 1935	3,525	86,756
Elmos	1942	3,947	39,168
Empress[5]	1897	1,100	2,378
Gold Range	1941		668
Harkness-Hays	[6]1920, 1929, 1932, 1935, 1936	78	5,879
Maloney Sturgeon	1937	1	2,549
A. Pilon & M. Richards	1921	30	1,122
Schreiber Pyramid	1937	150	2,680
M. C. Williams	1940	20	500
Miscellaneous	[7]1942		2,849
Total		9,107	152,468

[1]Afton.
[2]Theresa.
[3]Milled by Little Long Lac.
[4]Owned by J. Bruce McMartin.
[5]No statistics available; data taken from report of J. H. Chewett April 22, 1897
[6]W. S. Jackson claims; acquired by Harkness-Hays in 1925.
[7]Mint sundries.

Table IV

ALGOMA DISTRICT

ANNUAL PRODUCTION STATISTICS OF GOLD MINES, 1893–1945

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

Year	Darwin (Grace[1])		Algold (New Goudreau[2])		Minto, Jubilee, and Cooper[3]		Parkhill[4]		Algoma Summit[5] (McCarthy-Webb)		Alden-Goudreau		Cline Lake		Miscellaneous[6]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910	10,297	69,922					[7]9	347							2,512	8,874	12,818	79,143
1910	60	2,020													1,600	5,070	1,660	7,090
1911																627		627
1923		153																153
1925		41																41
1926			415	1,847													415	1,847
1929						6,184	33	2,057								14	33	8,255
1930	750	588			1,074	2,559											1,824	3,147
1931					9,448	80.269	9,082	75,543									18,530	155,812
1932			117	474	18,765	185.171	16.822	166,009									35,704	351,654
1933					23,671	182,376	11,565	246,580							60	282	35,296	429,238
1934					22,189	169,301	19,431	310,647	421	4,926							42,041	484,874
1935	2,103	17,750			31,890	196.252	20,871	338,388	205	3,008					7,946	49,027	66,015	604,425
1936	17,598	231,401	3,073	14,948	39,385	150,596	22,441	330,886	2,711	8,516					5,660	64,786	90,868	801,133
1937	14,720	214,707	11,064	41,613	15,577	35,325	25,209	200,048	44,869	68,130		988			1,951	25,322	113,390	586,133
1938			8,542	24,862	7,831	74.519	315	7,149	66,670	204,875			32,344	259,781		445	115,702	571,631
1939					11,770	55,099			1,751	8,009			86,085	812,620	11,314	29,438	110,920	905,166
1940		7.614		[8]832				9.299			[9]1,582	26,361	81,981	594,895		5,195	83,563	644.196
1941											[9]4,109	32,034	85,313	413,831		210	89,422	446,075
1942						2,325		1,540		1,289	[9]6,006	53,885	46,119	284,584			52,125	343,623
1943		2,175						2,821			[9]1,782	10,932				586	1,782	16,514
1944		481				481		481										1,443
1945												[9]153				1,383		1,536
Total	45,528	546,852	23,211	84,576	184,600	1,140,457	125,778	1,691,795	116,627	298,753	13,479	124,353	331,842	2,365,711	31,043	191,259	872,108	6,443,756

[1]Acquired by Darwin Gold Mines, Limited, in 1934 and by New Darwin Gold Mines, Limited, in 1938. Operated by the Algoma Commercial Company in 1902 and 1903, who produced 6,097 tons, $48,708; and by Le Page Gold Mining Company from 1907 to 1910, who produced 4,260 tons, $23,235.

[2]Acquired by Algold Mines, Limited, in 1934 and by Amherst Gold Mines, Limited, in 1939.

[3]Minto Gold Mines, Limited, owns three adjoining mines in Algoma district. Production shown from 1930 to 1933 was from the Minto; in 1934, 11,946 tons came from the Jubilee; from 1935 to 1937 the whole production was from the Jubilee; in 1938 the production came from the Jubilee and the Cooper; in 1939 from the Jubilee.

[4]Acquired by Ward Lake Gold Mines, Limited, in 1938.

[5]Acquired by Magino Gold Mines, Limited, in September, 1939.

[6]See table of "Miscellaneous Production" to the right.

[7]Production for 1904 from the Mariposa mine, which was acquired by Parkhill Gold Mines, Limited, in 1929.

[8]Under option to Norgold Mines, Limited.

[9]Under option to Regnery Metals.

MISCELLANEOUS PRODUCTION, ALGOMA DISTRICT

Mine	Year	Quantity	Value
		tons	$
Centennial (Agawa)	1939, 1940	8,612	22,397
Deep Lake	1936–1938, 1943	2,790	57,180
P. Edward	1929, 1941		224
Edwards (mine)	1937	1,573	16,977
Golden Reed	1908	3	125
Havilah (Ophir)[1]	1893, 1910, 1911	3,289	13,034
Hiawatha (Louittit)	1937, 1939, 1940	1,931	6,826
Kremzar	1940		96
Norwalk (Manxman)	1904, 1910	820	1,412
Ranson	1939	774	5,938
Shenango	1936, 1937, 1945		2,457
S. B. Smith (Van Sickle)	1935, 1936	9,228	60.251
Soo Mg. and Prosp. Synd.	1933	60	282
Stanley	1936, 1943	1,963	3,522
G. L. White	1936		1,124
Total		31,043	191,259

[1]Galbraith township.

Table VII

ONTARIO'S GOLD MINING INDUSTRY

ANNUAL PRODUCTION STATISTICS BY AREAS, 1885–1945

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

Year	Southeastern Ontario		Larder Lake area		Kirkland Lake belt		Porcupine belt		Matachewan area		Sudbury district		Algoma district		Thunder Bay district		Rainy River district		Kenora district		Patricia portion of Kenora district		Miscellaneous[1]		Total	
	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$	tons	$
Prior to 1910	[2]124,569	587,843									[3]9,320	55,982	[4]12,818	79,143	[5]14,200	60,682	[6]35,944	281,108	[7]214,040	1,354,760			[8]909	29,793	411,800	2,449,311
1910	500	3,349			30	286		35,549			3,294	18,553	1,660	7,090						3,791					5,484	68,618
1911			225	1,414	675	4,650	432	15,437			1,750	9,828		627	540	4,318			500	6,981	30	57			4,152	43,312
1912	4,221	13,963					139,951	1,740,596							11,500	61,327	50	400	400	2,101					156,072	1,817,987
1913	9,950	24,088	480	14,005	6,383	88,936	321,305	4,316,807			20,646	114,833			6,432	20,408									365,246	4,579,477
1914	424	2,793		5,204	3,734	117,644	554,774	5,231,989			45,458	217,103													604,390	5,574,733
1915	1,036	4,043			26,196	555,539	857,969	7,605,993			44,271	282,123							450	562					929,922	8,448,260
1916					39,865	711,626	1,327,039	9,494,139			26,846	187,103							1	130					1,393,751	10,392,998
1917	860	593			49,952	409,552	1,179,469	8,345,367								1,967			40	279					1,230,321	8,757,758
1918			1,502	11,334	53,526	637,780	816,754	7,899,381							3,603	18,340			208	216					875,593	8,567,051
1919		300	735	2,631	40,792	489,207	1,092,744	10,041,579										211							1,134,271	10,533,928
1920			4,637	29,888	91,237	1,145,722	1,162,065	11,953,907							1	8,834	2	108	291	2,367					1,258,233	13,140,826
1921				549	136,529	1,650,752	1,580,460	14,415,455							350	6,191									1,717,339	16,072,947
1922		1,064			191,747	2,192,138	2,076,989	18,662,724		987															2,268,736	20,856,913
1923			4,818	73,262	188,011	2,693,634	2,060,721	17,674,549						153		1,707			915	3,012		124		136	2,254,465	20,446,577
1924			24,178	152,072	201,393	3,328,411	2,642,502	22,445,680								114						126			2,868,073	25,926,403
1925			36,651	271,161	346,584	5,133,423	3,015,607	24,834,793						41											3,398,842	30,239,418
1926			48,761	229,650	466,363	6,963,165	3,180,943	23,811,304					415	1,847										2,468	3,696,482	31,008,434
1927			65,592	338,600	731,989	9,365,243	3,488,972	24,029,244																	4,286,553	33,733,087
1928			43,275	174,681	995,275	12,132,045	3,185,604	20,384,904																	4,224,154	32,691,630
1929			22,343	161,717	1,076,877	13,998,202	2,864,820	19,460,413					33	8,255	679	2,685	19	245	334	908		14,617			3,965,105	33,647,042
1930			31,738	219,726	1,242,805	17,012,039	2,558,385	17,843,392					1,824	3,147	8	458			25	326	110,438	460,857			3,945,223	35,539,945
1931			32,038	235,347	1,671,592	22,554,463	3,091,946	20,772,501					18,530	155,812	34	315			33	3,855	211,552	914,291			5,025,725	44,636,584
1932			35,001	182,053	1,757,995	26,683,705	3,351,263	24,289,974	6,805	70,142	32	3,718	35,704	351,654	25,574	213,427			48	3,888	284,664	1,268,780			5,497,086	53,067,341
1933			5,459	71,766	1,760,555	27,757,371	3,402,632	29,928,849	38,004	495,984			35,296	429,238	34,800	270,365	415	4,677			344,310	1,165,641			5,621,471	60,123,891
1934			33,457	153,948	1,923,601	34,049,728	3,711,714	33,002,770	100,054	614,909	12,320	68,600	42,041	484,874	87,983	658,057	855	12,270	25	2,242	500,960	1,882,398			6,413,010	70,929,796
1935			35,227	148,266	1,962,637	33,290,016	3,829,279	34,202,950	325,521	1,510,729	40,474	274,980	66,015	604,425	175,820	2,247,053		671	3,675	98,973	595,226	3,541,436		2,245	7,033,874	75,921,744
1936			114,472	470,507	2,074,197	33,432,460	4,049,786	35,920,945	378,918	1,476,505	10,555	80,615	90,868	801,133	243,274	3,173,014		105	36,144	380,339	749,153	5,213,694	46	2,637	7,747,413	80,951,954
1937		238	162,740	754,026	2,217,802	34,302,064	4,303,047	39,305,160	470,310	1,836,854	56,067	401,747	113,390	586,133	272,500	3,791,764	330	1,737	30,063	272,981	800,649	6,841,515		891	8,426,898	88,095,110
1938			349,458	2,046,983	2,277,421	34,321,796	4,789,094	44,398,639	513,675	2,071,929	76,910	741,452	115,702	571,631	559,824	6,909,917		822	32,516	377,306	868,990	7,906,822		4,196	9,583,590	99,351,493
1939	6,908	14,596	556,390	3,411,814	2,302,518	34,179,271	5,133,186	47,791,659	591,847	2,600,838	61,188	661,343	110,920	905,166	714,446	8,747,923			72,599	697,402	1,173,127	10,585,825		9,976	10,723,129	109,605,813
1940	26,526	119,505	839,275	5,706,127	2,150,762	33,795,565	5,647,214	55,000,954	630,155	2,719,471	38,575	443,045	83,563	641,196	825,012	10,284,099	1,072	6,523	49,041	570,585	1,477,078	13,328,595		7,936	11,768,273	122,626,601
1941	300	2,310	1,124,221	7,929,708	1,900,481	28,690,198	5,974,447	55,506,187	620,477	2,695,319	71,319	470,730	89,422	446,075	821,917	9,348,630	1,880	12,739	51,154	688,673	1,569,616	14,827,689		7,489	12,225,234	120,625,747
1942			1,166,209	8,277,116	1,308,307	20,895,850	5,624,554	50,489,026	643,365	2,432,574	168,628	1,138,027	52,125	343,623	662,816	8,452,345		26,300	36,449	457,761	987,697	11,700,793		16,190	10,650,150	104,229,605
1943			981,020	6,521,781	1,114,818	17,983,456	4,297,973	39,387,112	442,506	1,495,884	107,608	719,778	1,782	16,514	438,522	5,456,186			3,420	59,667	681,714	8,097,364		1,531	8,069,363	79,739,273
1944			752,954	4,431,405	1,011,225	14,786,464	3,788,313	33,678,991	341,359	1,105,877		1,918		1,443	305,276	3,883,238					601,441	6,913,673			6,800,568	64,803,009
1945			688,205	4,212,919	983,724	14,275,035	3,585,003	32,061,352	367,917	1,355,175		414		1,536	128,543	1,919,548				970	524,044	5,672,020			6,277,436	59,498,969
Total	175,294	774,685	7,161,061	46,239,660	32,307,598	489,627,436	98,686,956	845,980,271	5,470,913	22,483,177	795,261	5,891,892	872,108	6,443,756	5,333,654	65,542,912	40,567	347,916	532,371	4,990,075	11,480,689	100,336,317	955	85,488	162,857,427	1,588,743,585

[1]Origin unknown.
[2]1891-1909.
[3]1897, 1898, 1905–1908.
[4]1893, 1902–1904, 1907–1910.
[5]1897, 1905–1907.
[6]1895–1901.
[7]1885, 1886, 1893–1909.
[8]1899–1902.