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MINING OPERATIONS AND STATISTICS

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PROVINCE OF QUEBEC, CANADA

BUREAU OF MINES

Honourable J. E. PERRAULT, Minister of Mines

J. L. BOULANGER, Deputy-Minister A. O. DUFRESNE, Director

ANNUAL REPORT

OF THE

QUEBEC BUREAU OF MINES

FOR THE CALENDAR YEAR

1933

PART A

Mining Operations and Statistics

QUEBEC
PRINTED BY R. PARADIS
PRINTER TO HIS MAJESTY THE KING

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NOTE

In the statistical tables and in the review of the mining industry of the Province during the year, the term "production" is synonymous with "quantity sold, shipped, or used", and does not necessarily represent "output". The ore and other mineral products remaining as "stock on hand" at the end of the year are not included in the production figures.

The ton used throughout is that of 2,000 lb., except when specially mentioned.

The year referred to is the calendar year, ending December 31st, unless otherwise stated.

We endeavour to give the values of non-metallic products, raw or prepared, as estimated at the point of shipment or at the pit-mouth. As regards metallic products, we give the value of the metal content of the ore, calculated at average yearly market prices of the refined metals after certain deductions for treatment losses. This method is adopted by the Quebec Bureau of Mines in order to conform with the practice of the Dominion Bureau of Statistics.

The values are given in Canadian funds. As regards gold, the total value of the production is given in two parts.—(1) the value at the standard rate of $20.671834 an ounce; (2) the additional exchange equalization calculated at the average rate for the year to convert standard value into Canadian funds. Both of course are included in the totals.

The report now presented was preceded on March 10th, 1934, by a statistical statement on the mineral production in 1933, giving provisional figures, subject to revision. The present report gives the revised statistics, and the tables in this volume supersede those of the preliminary statement.

Since 1929, the Annual Report of the Bureau of Mines has been published in separate parts or volumes. Part *A* of the 1933 report deals with mining operations and statistics. It is followed by Parts *B*, *C*, *D* and *E*, which consist of volumes presenting geological reports, with accompanying maps, on the field-work done during the year.

QUEBEC BUREAU OF MINES,
Quebec, June, 1934.

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IN THE
PROVINCE OF QUEBEC
DURING THE YEAR 1933

GENERAL REVIEW

After a decline in value of the production of our mines and quarries for three successive years, following the record figures of 1929, it is very gratifying to record a substantial increase, of 9.6 per cent, in the value of the output during 1933. The total value advanced to $28,164,540, from $25,683,066 in the previous year.

The first quarter of the year did not bring any improvement in the general economic situation. Prices of commodities continued low, and the metal market reached its lowest ebb. But in the course of April, the tide began to turn. The improvement which then set in continued slowly but steadily till the end of the year, and in the early months of 1934 the curve of general business activity was showing a decided upward tendency. Apparently, the nadir of the depression was reached in March, 1933.

The progress towards recovery made by the mining industry of the Province during 1933 was much more marked than might be inferred from the comparative figures for total production, quoted above. When the total is subdivided into the customary three classes of Metallics, Non-metallics, and Building Materials, it is found that the value of the metallics increased 17 per cent as compared with 1932, and the gain in the non-metallics class was no less than 64 per cent. The value of our output of building materials was, however, 29 per cent less than in 1932, and it is this decrease that masks the excellent gains made by the other two classes, when one considers only the value of the mineral production as a whole. The decrease in production of building materials is, of course, a matter beyond the control of the mineral industry, and does not in any way suggest lack of resources. This class of mine product usually lags behind the others in reflecting business conditions: they are slower to feel the effects of business depression, and slower also to participate in

the benefits of improved conditions. Thus it was not until 1932 that the output of building materials in Quebec was noticeably affected by the industrial dislocation that had commenced two years earlier. But normal conditions will necessarily reassert themselves as the situation continues to improve. A great shortage of both industrial and residential construction is now accumulating, which will have to be filled. The quarries, the brickyards, and the cement plants will then resume their old-time activity.

SUBDIVISION OF QUEBEC'S MINERAL PRODUCTION FOR THE YEARS 1930-1933

YEAR	METALS	%	NON-METALLICS	%	BUILDING MATERIALS	%
1930	$ 13,926,682	35	$9,322,151	22	$17,909,907	43
1931	* 12,367,932	34	5,516,899	15	18,166,535	51
1932	* 13,914,089	54	3,671,634	14	8,097,343	32
1933	* 16,360,011	58	6,043,308	22	5,761,221	20

TABLE OF ANNUAL VALUE OF MINERAL PRODUCTION SINCE 1898

YEAR	VALUE	YEAR	VALUE
1898	$ 1,673,337	1916	$ 13,287,024
1899	2,083,272	1917	16,189,179
1900	2,546,076	1918	18,707,762
1901	2,987,731	1919	20,813,670
1902	2,985,463	1920	28,392,939
1903	2,772,762	1921	15,522,988
1904	3,023,568	1922	18,335,153
1905	3,750,300	1923	21,326,314
1906	5,019,932	1924	18,952,896
1907	5,391,368	1925	23,824,912
1908	5,458,598	1926	25,740,002
1909	5,552,062	1927	29,124,110
1910	7,323,281	1928	37,325,237
1911	8,679,786	1929	46,454,820
1912	11,187,110	1930	41,158,740
1913	13,119,811	1931	* 36,051,366
1914	11,732,738	1932	* 25,683,066
1915	11,765,873	1933	* 28,164,540

* NOTE.—In the above tables, the figures for 1931, 1932, and 1933 include the exchange equalization converting the standard value of gold into Canadian funds. In the tables of mineral production that appeared in the Annual Reports for 1931 and 1932, gold was entered at the standard value of $20.671834 per ounce fine.

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1933

SUBSTANCE	No. of workmen	Wages	Quantity	Value in 1933	Value in 1932
METALLICS		$		$	$
Chrome, tons	6	207	30	343	1,113
Copper, lb	1,568	2,309,970	69,943,882	5,214,177	4,296,216
Gold (at standard rate), oz	1,202	1,506,031	382,886	7,914,956	8,291,576
Exchange equalization on gold				3,035,584	1,126,000
Selenium, lb			22,131	16,600	
Silver, oz			471,419	178,351	199,184
Zinc and lead	8	2,085			
Assessment work on claims	1,033	804,383			
Sub-totals	3,817	$ 4,622,676		$16,360,011	$13,914,089
NON-METALLICS					
Asbestos, tons	1,589	1,017,409	158,367	5,211,177	3,039,721
Feldspar, tons	55	9,445	6,183	59,283	39,062
Graphite, tons			43	2,222	
Magnesitic dolomite	108	77,177		360,128	262,860
Marl, tons	21	325	23,875	9,550	10,204
Mica, lb	49	18,792	511,467	39,061	4,076
Mineral paints (iron oxide, ochre), tons	23	12,344	4,192	51,965	44,161
Mineral water, gals	4	180	9,024	3,094	4,697
Molybdenite	6	458			
Natural gas	16	15,345			
Peat, tons	1	477	681	2,549	2,286
Phosphate, tons	6	350	105	805	12,333
Pyrite, tons			39,320	146,261	133,838
Quartz and industrial sand, tons	95	40,576	28,294	109,533	71,645
Talc and soapstone	63	24,882		47,680	46,751
Sub-totals	2,036	$ 1,217,760		$ 6,043,308	$ 3,671,634
BUILDING-MATERIALS					
Cement, barrels	338	336,355	1,517,555	2,128,899	3,155,702
Clay products:					
Brick, M	455	141,885	26,190	446,403	763,041
Other				133,687	301,510
Granite, tons	723	175,008	131,837	408,207	541,689
Lime, tons	214	106,274	110,033	645,467	583,386
Limestone, tons	1,114	338,105	1,105,373	930,469	1,327,484
Marble, tons	56	23,671	7,983	42,283	206,502
Sand and gravel, tons	1,897	430,100	3,356,232	942,429	892,305
Sand-lime brick, M	27	5,282	1,896	25,146	50,702
Sandstone, tons	76	6,324	72,986	57,403	275,022
Slate and shale, tons	6	120	439	828	
Sub-totals	4,906	$ 1,563,124		$ 5,761,221	$ 8,097,343
Totals	10,759	$ 7,403,560		$28,164,540	$25,683,066

The general improvement which took place in the course of 1933 is well shown by the fact that the mines employed nearly one thousand men more than in 1932, and this in spite of the fact that in all branches of mining, except gold, the first quarter of the year 1933 was about the worst period of the depression. The total number of men employed rose from 9,821 in 1932 to 10,737 in 1933.

In addition, prospecting was very active in western Quebec. During the fiscal year ended July 1st, 1933, there were 11,211 mining claims recorded and 3,178 miners' certificates sold, against 8,108 claims recorded and 2,324 certificates sold in 1932; and this activity was on the increase during the second half of 1933 and in the early months of 1934. These last few months, especially, have brought greater cause for hope of an early return to normal conditions in the Canadian mining industry than we have had at any time since 1929.

Mining and prospecting in western Quebec during the year are reviewed at length in the report by R. H. Taschereau, Inspector of Mines, on *Mining Operations and Development in Western Quebec in 1933*, which appears in a later section of this volume.

The monetary exchange situation in 1933 passed through unusual phases. From the time Great Britain abandoned the gold standard, in September, 1931, the Canadian dollar fluctuated appreciably in value as compared with the U. S. dollar, which remained on a gold basis. The price of New York funds in March, 1933, exceeded $1.20 in Canadian funds. On April 20th, 1933, the United States abandoned the gold standard and the rate of exchange between the two currencies soon decreased, until they reached the same level in the last quarter of the year. In January, 1934, the price of gold was stabilized in the United States, by a proclamation which reduced the weight of the U. S. dollar from 25.8 grains to $15^{5}/_{21}$ grains, 0.9 fine, thereby establishing the price of fine gold at $35 an ounce, U. S. funds.

METALS

In the first quarter of 1933, prices of base-metals reached very low levels. As concerns the value of our production of metals, however, the high price of gold compensated in very large measure

for the low prices of copper, lead, and zinc. The price of gold for the whole year averaged $28.60 an ounce in Canadian funds. Average base-metal prices over a period of years are shown in the accompanying table.

AVERAGE YEARLY PRICES OF INDUSTRIAL METALS, 1930-33

METAL	MARKET	UNIT	1930	1931	1932	1933
Copper.....	New York.	Cents per lb.	12.982	8.116	5.555	7.025
	Montreal..	" " "	14.980	10.006	7.516	8.684
Lead.....	New York.	Cents per lb.	5.517	4.243	3.180	3.636
	Montreal..	" " "	5.496	4.168	3.511	3.705
	London....	£ per long ton	18.007	12.958	11.913	11.670
Zinc.....	St. Louis...	Cents per lb.	4.556	3.640	2.876	4.029
	Montreal..	" " "	5.084	3.961	3.724	4.488
	London....	£ per long ton	16.570	12.215	13.545	15.666

Metallic products account for 58 per cent of the total value of the Quebec mineral production for 1933, greatly exceeding each of the two other subdivisions, non-metallics and building materials. Their value totalled $16,360,011, as compared with $13,914,089 in 1932, an increase of 17 per cent.

Gold is easily the most important item, in value, in the list of our mineral products. Second place is taken by copper, with a value, in 1933, slightly higher than that of the asbestos production.

Neither lead nor zinc appear in the table, although a few years ago the production of these two metals greatly exceeded that of both gold and copper in value.

The silver which appears in the table of production results from the treatment of complex sulphide ores, namely, the copper-gold of western Quebec and the copper-sulphur ores of the Eastern Townships.

There was a small production of chromite, from limited operations in Coleraine township, and of selenium metal, recovered from the refining of the anode copper of the Noranda smelter.

METAL PRODUCTION OF WESTERN QUEBEC 1927-33

YEAR	ORE MILLED (Tons)	SHIPMENTS				
		COPPER (Pounds)	GOLD (Ounces)	SILVER (Ounces)	ZINC (Pounds)	VALUE $
1927	7,570	463,471	741	2,611	.....	$ 76,674
1928	271,614	33,019,311	53,397	185,579	.....	6,022,692
1929	498,280	51,101,054	86,162	333,792	.....	11,210,882
1930	980,419	75,435,415	141,747	555,578	9,754,160	13,286,327
1931	1,100,121	62,018,221	299,869	509,571	.....	* 11,814,979
1932	1,331,104	60,584,116	401,005	605,258	.....	* 13,472,311
1933	1,886,617	63,417,206	382,834	451,732	.....	* 15,847,582
TOTAL	6,075,725	346,038,794	1,365,755	2,644,121	9,754,160	* 71,731,447

* See footnote, page 6.

DIVIDENDS PAID BY MINING COMPANIES OPERATING IN WESTERN QUEBEC (TO JANUARY 1ST, 1934)

COMPANY	AUTHORIZED CAPITAL (shares)	DATE OF FIRST DIVIDEND	DIVIDENDS, 1933		TOTAL DIVIDENDS (To end of 1933)
			TOTAL	RATE PER SHARE	
Noranda Mines Limited	2,250,000	Jan. 2nd, 1930	$3,457,314.77	$1.50	$13,021,545.13
Siscoe Gold Mines, Ltd.	5,000,000	March 31st, 1932	644,545.08	0.14	1,145,165.54

NON-METALLICS

The chief item in the list of non-metallic substances is asbestos, which has recovered to a very appreciable degree from the slump which so markedly affected this branch of the industry during the last quarter of 1932 and the first three months of 1933.

Both tonnage and total value are much ahead of the figures for the previous year. The improvement which took place during the year in the demand for asbestos is well shown by the fact that shipments of fibre during the first quarter of 1933 amounted to 16,887 tons, whereas for the last three months of the year they reached 57,313 tons.

It is also gratifying to record increases in the shipments of other non-metallic substances, including feldspar, mica, ochres and natural iron oxides, pyrite, and quartz.

BUILDING MATERIALS

Building materials produced in 1933 had a value of only $5,761,-221, whereas two years before the total had reached $18,166,535. It is the lowest value recorded since 1918.

The building industry is usually the last to recover after a period of economic stress, and up to the end of 1933 the curve of activity had not commenced to turn upward. The production of cement is a fair index of building activity. It totalled 1,517,555 barrels in 1933, as compared with 2,210,233 barrels in 1932 and nearly 5,000,000 in 1931. From these figures, it is apparent that construction in the Province of Quebec has been running behind at the rate of many million dollars a year for the past two years. As a consequence, there is now accumulating a great shortage of both industrial and residential buildings, which will have to be filled eventually.

MINING OPERATIONS IN 1933

METALS

COPPER

The production of refined copper in 1933 amounted to 69,943,882 lb., valued at $5,214,177. Compared with 1932, this is an increase of 3.9 per cent in quantity, and of 21.1 per cent in value.

The great bulk of our copper metal is now marketed in London, and its price is ruled by the London market. The price improved very appreciably throughout the year. From an average of 5.079 cents per pound (Canadian funds on London market) in January, 1933, it reached a maximum of 9.140 cents in July, and the average for the year was 7.455 cents.

Practically 90 per cent of the Quebec production of copper comes from the ores of the Rouyn region, which are treated at the Noranda smelter, a modern plant of great efficiency. There is an anode casting plant at the smelter. The molten blister-copper, on coming out of the converters, is poured into an anode refining furnace, where it is 'fire refined' by blowing and 'rabbling'. It is then poured into the moulds of a casting wheel of the Walker type. The anodes, which weigh 700 pounds each, are transferred from the wheel to the bosh, and then, after being weighed, inspected, and trimmed, to a rack for shipping.

The electrolytic refining is done at the plant of *Canadian Copper Refiners, Limited*, at Montreal East, in which Company Noranda Mines, Limited, has a controlling interest.

In 1933, returns of production of copper were received from Noranda Mines, Limited, the Consolidated Copper and Sulphur Company, Limited, and Aldermac Mines, Limited.

Noranda Mines, Limited, operated the Horne mine and the Noranda smelter continuously throughout the year. The Horne mine is one of Canada's largest producers of copper and of gold.

The Consolidated Copper and Sulphur Company, Limited, operated the Eustis mine and mill, near Sherbrooke, without interruption. On December 31st, 1933, the inclined shaft of the mine was down 5,780 feet.

A small shipment of copper concentrate was made by *Aldermac Mines, Limited*, from the Aldermac mine, in Beauchastel township, northern Témiscamingue county. The concentrate was treated at the Noranda smelter, in Rouyn township.

GOLD AND SILVER

Gold

The gold production of Quebec in 1933 was 382,886 ounces, valued at $10,950,540 in Canadian funds. Compared with the previous year, for which the figures were 401,105 ounces, valued at $9,417,576, this is a decrease of 18,219 ounces, but an increase in value of $1,532,964, or 16.3 per cent, due to a higher average equalization exchange in 1933 than in 1932.

Returns of gold production were received from nine operators—eight in western Quebec, and one, working on alluvial deposits, in Beauce county. The Western Quebec operators were Beattie Gold Mines, Limited; Bussières Mining Company, Limited; Granada Gold Mines, Limited; Greene-Stabell Mines, Limited; Matthews Gold Mines, Limited; O'Brien and Fowler; Siscoe Gold Mines, Limited; and Noranda Mines, Limited.

In addition to these producing mines, there are a number of properties on which development work has proceeded throughout the year. It is therefore probable that several names will be added to the list of producing gold mines in Quebec in the course of the year 1934.

In detailed notes which appear further on in this report, R. H. Taschereau, Inspector of Mines, gives an account of the progress of mining in Témiscamingue and Abitibi counties, under the title *Mining Operations and Development in Western Quebec in 1933.*

QUEBEC GOLD PRODUCTION, 1921-1933

Year	Ounces	Value	Year	Ounces	Value
1921...	648	$ 12,317	1928....	60,006	$ 1,240,435
1922...	none	none	1929....	90,798	1,876,900
1923...	667	13,340	1930....	141,747	2,930,480
1924...	881	18,372	1931....	300,075	* 6,476,103
1925...	1,834	37,909	1932....	401,105	* 9,417,576
1926...	3,679	76,070	1933....	382,886	* 10,950,540
1927...	8,331	172,214			

* See footnote, page 6.

ALLUVIAL GOLD.—In southeastern Quebec, both in Beauce county and in Ditton township, Compton county, some work on alluvial deposits was carried on throughout the summer.

In Ditton township, the *Gold River Mining Company* resumed work in July, prospecting, testing, and working alluvial deposits on Little Ditton river, on lots 42 and 43 of range VIII, and lots 39 and 40 of range IX. The work continued until the middle of December, the number of men employed varying from 5 to 25. Although no production was reported, the results obtained are stated to have been satisfactory.

In the basin of the Gilbert river, in the Rigaud-Vaudreuil seignory, prospecting, and some washing, were carried on during the summer by *W. W. Cooke* and *L. K. Lloyd*, which resulted in a small production of gold. Their main operations were in Saint Gustave range, and it is stated that the work was impeded by the drought and lack of water in the streams.

Carl Sekyer worked on the Des Meules river, in the Rigaud-Vaudreuil seignory, during the fall of the year, from early in October until winter set in.

SILVER

The production of silver in 1933 was 471,419 ounces, valued at $178,351, as compared with 678,902 ounces, valued at $199,184, in 1932.

There are no silver mines proper in Quebec. The sources of the metal are the complex gold-copper ores and gold-quartz ores of western Quebec on the one hand, and the copper-sulphur ores of the Sherbrooke district on the other. The producers of silver are, therefore, the same as those listed for lode gold and copper.

Prior to 1930, the zinc-lead ores of Portneuf county were important contributors to our silver production, but there have been no shipments of these ores since 1929.

QUEBEC PRODUCTION OF SILVER, 1921-1933

Year	Ounces	Value	Year	Ounces	Value
1921...	39,327	$ 21,339	1928....	908,960	$ 528,910
1922...	none	none	1929....	813,821	413,268
1923...	31,119	19,916	1930....	517,164	217,922
1924...	73,251	48,833	1931....	530,345	158,414
1925...	250,298	165,974	1932....	628,902	199,184
1926...	375,986	233,513	1933....	471,419	178,351
1927...	740,864	417,777			

MISCELLANEOUS METALS

CHROMIUM

Shipment of a carload of chromite, totalling 30 tons and valued at $343, was reported. This material was mined by *Ernest Gray*, from his property on lot 17, range *A*, of Coleraine township, and was consigned to the United States.

SELENIUM

In our report for 1931 ①, it was mentioned that selenium occurs in appreciable quantity in the copper-gold ores of western Quebec, and notably in the ores of the Horne mine, operated by Noranda Mines, Limited.

① Que. Bur. Mines, Ann. Rept., Part A, 1931, p. 22.

There is at present no plant for the production of metallic selenium at the copper refinery of Canadian Copper Refiners, Limited, at Montreal East, but a shipment of selenium-bearing sludge, containing 22,131 pounds of the metal and valued at $16,600, was made by the refinery to the United States. This sludge resulted from the refining of Noranda blister copper.

Selenium is used largely in the glass industry and in the manufacture of pottery, both as a colouring agent and to eliminate objectionable colours or tints. It is also used in vulcanizing rubber, to increase its resistance to abrasion. Selenium enters into the manufacture of the photo-electric cell, or 'electric eye'.

The consumption of selenium metal in the United States is at present of the order of 300,000 pounds annually, and its price is nominally quoted $1.80 to $2.00 per pound.

SULPHIDE DEPOSITS AT CAPE SMITH AND SMITH ISLAND

Upper East Coast of Hudson Bay

A prospecting expedition to cape Smith, on the upper east coast of Hudson bay, jointly financed by the *Cyril Knight Prospecting Company* and the *Huronian Mining and Financing Company*, both of Toronto, and the *Newmont Corporation*, of New York, returned in the autumn of 1932 after spending sixteen months in the area. The main purpose of the expedition was the examination of the belt of greenstones that strikes inland from cape Smith ①. The engineer in charge of the party, W. B. Airth, of Toronto, reported, in part, as follows:

> "Five days after landing at the Hudson's Bay Post on Smith island in September, 1931, we discovered a deposit of massive sulphides on the south shore of the island. The following day we found a nest of these extensive bodies on the mainland, twelve miles east of the first discovery.

① A good account of this expedition, by W. B. Airth, appeared in the *Canadian Mining Journal* for February, 1933. The other members of the party were M. J. McCart, M. E. Watts, and W. J. Whorley.

"Subsequent prospecting disclosed the presence of no less than ten bodies of massive sulphides outcropping in an area roughly two miles by three and a half, situated within one half to about two miles from the sea on the mainland near cape Smith. A large block of claims was staked...

"Mineralization is predominantly pyrrhotite with minor amounts of pyrite, arsenopyrite, and chalcopyrite. Characteristic specimens from surface have indicated low, non-commercial, tenors in gold, nickel, and copper.

"The rocks in the area are presumably all pre-Cambrian. The most predominant types are lava flows, in which the sulphide bodies occur. These lavas, which resemble the Keewatin series, show in places pillow structure, but in the vicinity of the sulphide masses this is not so noticeable...

"A huge mass of gabbro, some 1,500 feet wide and traced for over four miles, outcrops along the south shore of two long narrow lakes lying between the massif of gabbro and the lavas. The central portion of this mass is coarse grained, grading to fine as the southern edge is approached, which is in contact with basalt and diorites. The contact with the lavas, on the north, underlies the lakes. It would appear that this gabbro mass has been the cause of the sulphide mineralization. That the mineralization is post-gabbro is supported by the finding of disseminated sulphides in a shearing along the southern edge of the gabbro.

"Fracturing of the lavas is very marked, conforming to the northeast strike of the formation. The most pronounced of these fractures, occurring at an elevation of approximately 150 feet above sea-level, may be sighted as virtually a straight line for a length of over three miles... Five of the discoveries occur either in this fracture-zone or in parallel fractures roughly within 700 feet of either side of it...

"Three bodies, known as *D*, *F*, *K*, occur as extensive lenticular-like deposits, the first being in line with, but extending on either side of, the above main fracture, and the latter two as offsets lying close to it...

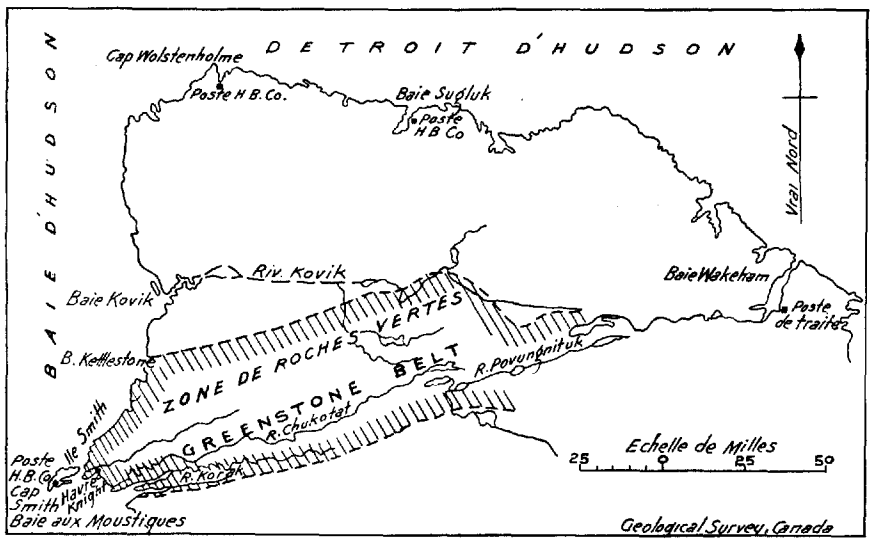

Figure 1.—Approximate boundaries of greenstone belt, Cape Smith, east coast of Hudson Bay (after M. E. Watts and H. C. Gunning).

"The area in the vicinity of the deposits is almost free of drift, and any surface work required will consist chiefly of extending the limits of exposed mineralization covered by talus. Preliminary work should be centred on geological mapping and extensive sampling, to be followed by diamond drilling."

The prospecting and claim-staking done in 1931 and 1932 was followed in 1933 by the despatch of a party of engineers and an assayer, for the purpose of examining and sampling the discoveries of W. B. Airth's party.

The 1933 party, which consisted of Charles W. Workman (in charge), J. E. Anderson, W. H. Whorley, and M. J. McCart, arrived at cape Smith, by aeroplane, early in April, 1933, and returned in September. Extracts from Mr. Workman's report to his principals are given herewith, by kind permission of the Cyril Knight Prospecting Company.

"We channel-sampled the showings where we could, cutting a total of 124 samples. The fresh sulphides were blasted into before the channels were cut. Showing *H* was difficult to sample,

as a large portion of it is filled with boulders washed in by the sea—sea beaches, with sea shells and water-sorted gravel, occurring up to 200 feet above the present level of Hudson bay.

"Our samples were assayed by Mr. Anderson (a member of the party) at cape Smith. The assay results showed that the deposits carried a little gold, but of low value, from 10 cents to 60 cents per ton. The highest value we found was $1.00, but this sample, No. 133, should be disregarded, as it was taken in a pocket of decomposed material.

"The mineralization in the samples cut was mainly pyrrhotite, generally very fine grained and showing the banded structure of the original sediments or tuffs. The sulphides are highly magnetic, and a dip-needle was used to trace their location under moderate overburden. In some places, the fine-grained pyrrhotite is cut by later coarser-grained pyrrhotite and extremely narrow veinlets of chalcopyrite. No copper or nickel staining was observed on the rocks at any of the showings.

"The work of our party in 1933 was confined to the block of claims staked by Mr. Airth's party in 1931; and I do not feel that the low gold assays obtained by us justify further work at this time. There are, however, according to Mr. Airth's report, many other sulphide occurrences to the east; but as to the possibility of finding payable shoots of copper or gold in these inland deposits (which I did not examine), the undersigned does not care to commit himself.

"The sulphide deposits on the claims we examined are generally about twenty to twenty-five feet in thickness, which is also apparently the thickness of the sediments. The replacement of these sediments by pyrrhotite and other sulphides seems to be confined largely to areas of intense folding, since the deposits occur in anticlines. In some cases, notably on Smith island, these anticlines are so tightly folded as to show double the thickness of the sediments, that is to say, from forty-five to fifty feet.

"....the deposits occur as replacements, by pyrrhotite and other sulphides, of sediments or possibly water-laid tuffs. These sediments or tuffs are interbedded with lavas, generally pillow

lavas, the oldest rocks in this area. The lavas apparently have been intruded by gabbro diorites in long, rather narrow bodies. Generally, these intrusions have emerged where the sediments lie in the lavas—sometimes they are above the sediments and sometimes they are below them.

"We saw very little copper pyrites; and, as already stated above, we found no nickel stains. However, on my return to Toronto, two of the most likely-looking samples, Nos. 120 and 215, were submitted to Thomas Heys & Sons for assay. No. 120 gave 0.10 per cent of nickel and 0.10 per cent of copper, while No. 215 yielded 0.10 per cent of nickel and 0.05 per cent of copper. In view of these low results, no other assays have been made for these two base-metals".

Dr. H. C. Gunning, of the Geological Survey, as geologist to the 1933 Arctic expedition of the Department of the Interior, examined these deposits in August, 1933, and reported on them in the *Summary Report* of the Geological Survey for 1933, Part *D*. His conclusions are as follows:

"All the rocks at cape Smith are presumably pre-Cambrian; they form part of the Canadian Shield. The lavas and sediments of the greenstone belt are intensely folded and greatly altered, and are bordered, for many miles east of Hudson bay, by younger intrusive granitic rocks that are themselves in part gneissic. It seems possible, therefore, that the lavas and sediments are of Early pre-Cambrian age. The relation of the augite diorite intrusives in the greenstone belt to the bordering granites is not known. Until additional evidence is obtained, they may be assumed to be older than the granites.

"These presumably Early pre-Cambrian lavas, sediments, and basic intrusives form a belt some 40 miles wide running eastward for at least 150 miles from cape Smith. There is thus a large area that, on the basis of experience elsewhere in the Canadian Shield, may be considered as potentially favourable for prospecting.

"Some 5,000 square miles of this belt have already been prospected in a rough, exploratory way by four men. Sulphide mineralization and quartz veins were encountered at many

places. As yet, none of the quartz veins has been found to contain important amounts of gold. Extensive testing of sulphide bodies near the coast of Hudson bay has revealed only traces of copper, nickel, and gold in these deposits.

"The nature and occurrence of the sulphide deposits suggest that they are related in origin to the augite diorite, although they were formed after that rock had been intruded. The deposits examined by the writer, and sampled during 1933, represent but a small part of a long zone in which similar mineralization is known to occur. It is obvious, therefore, that the disappointing results obtained do not necessarily apply to the whole zone. Nevertheless, the work done shows that, within a length of some 20 miles along the mineralized zone, all the sulphide bodies examined are much too low-grade to encourage development. Further, all the mineralization examined by the writer within this 20-mile stretch is remarkably uniform in grade, appearance, and occurrence. We have to do, therefore, not with a series of deposits that are, *on the average*, very low grade, with some minor encouraging enrichments, but that are *all* uniformly poor with no known enrichments of any importance whatever. Possibly these deposits are products of a magma that contained only very minute amounts of copper and nickel and was incapable of producing deposits that contained commercial quantities of these metals. At least, such a possibility should be borne in mind in considering the likelihood of finding commercially valuable deposits elsewhere in the lengthy zone in which similar mineralization is known to occur.

"The preceding statement applies only to sulphide deposits that occur within a relatively narrow zone trending about north 60 degrees east from the south side of Smith island, and should not be taken as constituting a condemnation of the mineral possibilities of the whole greenstone belt running east from Hudson bay. The belt has been barely explored, not to say prospected, and it compares favourably in size with any of the larger areas of similar rocks that, throughout the Canadian Shield, are generally conceded to constitute favourable ground for prospecting".

NON-METALLICS

ASBESTOS *

Statistics of Production, Exports, Etc.

Sales of asbestos in the Province during 1933 totalled 158,367 tons, valued at $5,211,177, as compared with 122,977 tons valued at $3,039,721 in 1932, and 164,296 tons valued at $4,812,886 in 1931. This is an increase of 28.8 per cent in volume and 71.4 per cent in value over the corresponding figures for 1932. Compared with the figures for 1931 there is a decrease of 5,829 tons, or 3.6 per cent, in volume, but an increase of $398,291, or 8.3 per cent, in value. This increase in tonnage follows continuous annual declines since 1929 and indicates a pronounced recovery in the past calendar year.

The average price of the Quebec asbestos marketed in 1933 was $32.90 per ton, as against $24.72 in 1932, $29.29 in 1931, $34.65 in 1930, and $43.04 in 1929.

TABLE 1

Production of Asbestos in the Province of Quebec for 1933

Grouping of Grades	Shipments and Sales		Average Value per ton
	Tons	Value	
Crudes	1,306	$ 341,734	$ 261.66
Fibres	82,605	3,843,887	46.53
Shorts	74,456	1,025,556	13.77
Totals	158,367	$5,211,177	$ 32.90
Sand, gravel, and stone (waste rock only)	6,445	$ 3,215	$ 0.50
Totals	164,812	$5,214,392	

Quantity of rock mined during the year 1933: 1,566,919 tons.
Quantity of rock milled during the year 1933: 1,329,814 tons.
Quantity of tailings re-treated during the year 1933: 521,930 tons.

* By Eugène Larochelle, Inspector of Mines.

TABLE 2

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1932

GROUPING OF GRADES	SHIPMENTS AND SALES		AVERAGE VALUE per ton
	Tons	Value	
Crudes	471	$ 119,221	$ 253.12
Fibres	45,323	1,885,841	41.61
Shorts	77,183	1,034,659	13.40
TOTALS	122,977	$3,039,721	$ 24.72
Sand, gravel, and stone (waste rock only)	3,473	$ 3,369	$ 0.97
TOTALS	126,450	$3,043,090	

Quantity of rock mined during the year 1932: 1,145,340 tons.
Quantity of rock milled during the year 1932: 1,029,709 tons.
Quantity of tailings re-treated during the year 1932: 709,094 tons.

The quantity of rock mined and hoisted during the year totalled 1,566,919 tons; of this, 237,105 tons, or 15.1 per cent, was sent direct to the dump as barren rock. The mill-rock amounted 1,329,814 tons. In addition, a total of 521,930 tons of tailings were re-treated. The rock hoisted and the tailings re-treated, totalling 2,088,849 tons, yielded 151,842 tons of asbestos or 145.38 pounds per ton of rock and old tailing handled, which had a value of $2.39 per ton at the prices prevailing during the year. Corresponding data for the years 1911 to 1933 are given in Table 3.

Table 4 shows the shipments of asbestos for each year, from 1925 to the present time.

TABLE 3

Table of Data of the Quebec Asbestos Industry for the Years 1911-1933

Year	Fibre Shipped Tons	Total Value	Average Value Per ton	Fibre Produced Tons	Asbestos Content per Ton of Rock (pounds)	Average Value of Content of Rock	Rock Mined Tons
1911...	102,224	$3,026,306	$29.60	94,816	107.80	$1.53	1,583,076
1912...	111,175	3,050,084	27.52	101,600	108.60	1.38	1,870,608
1913...	136,609	3,830,504	28.04	133,174	105.40	1.45	2,527,410
1914...	107,401	2,895,935	26.96	118,452	111.40	1.43	2,127,395
1915...	113,115	3,544,362	31.33	103,361	96.90	1.46	2,134,073
1916...	133,339	5,182,905	38.87	117,577	102.60	2.12	2,291,087
1917...	137,242	7,198,558	52.45	138,174	108.70	3.08	2,634,410
1918...	142,375	9,019,809	63.35	143,401	117.30	4.08	2,445,745
1919...	135,862	10,932,289	80.47	154,380	100.80	3.88	3,601,690
1920...	179,891	14,749,048	81.89	170,500	109.10	4.53	3,123,370
1921...	87,475	5,199,789	59.44	117,458	107.20	4.28	2,224,138
1922...	160,339	6,053,068	37.75	149,195	102.00	1.70	2,920,280
1923...	216,804	7,364,260	33.97	218,959	117.00	1.42	3,747,576
1924...	208,762	6,561,659	31.37	205,764	124.00	1.83	3,324,727
1925...	273,522	8,976,645	32.82	267,328	129.70	1.95	4,121,258
1926...	279,389	10,095,487	36.13	301,044	134.30	2.35	4,483,361
1927...	274,778	10,621,013	38.65	274,763	113.70	2.13	4,834,761
1928...	271,637	11,181,143	41.16	266,227	103.20	2.17	5,141,263
1929...	306,055	13,172,581	43.04	309,746	99.76	2.21	6,208,970
1930...	242,113	8,390,164	34.65	244,114	99.61	1.90	4,901,206
1931...	164,297	4,812,886	29.29	154,872	136.20	1.99	2,274,048
1932(1)	122,977	3,039,721	24.72	119,968	129.38	1.60	1,145,340
1933(2)	158,367	5,211,177	32.90	151,842	145.38	2.39	1,566,919

(1) Calculated on 1,854,434 tons, *i.e.*, 1,145,340 tons of rock mined and 709,094 tons of tailings re-treated.

(2) Calculated on 2,088,849 tons, *i.e.*, 1,566,919 tons of rock mined and 521,930 tons of tailings re-treated.

TABLE 4

Annual Shipments of Asbestos, 1925-1933 *

(In tons of 2,000 lb.)

Year	Crude No. 1	Crude No. 2	Other Crudes	Spinn'g Fibre	Shingle Fibre	Mill-board & Paper Fibre	Fillers, Floats, & Other Short Fibre	Total Asbestos Shipped	Asbestic
1925.....	1,044	3,777	348	16,070	30,010	93,935	128,338	273,522	16,865
1926.....	1,094	3,494	446	15,182	30,497	86,746	135,930	279,389	15,672
1927.....	1,107	3,014	667	14,348	44,573	60,396	150,673	274,778	18,974
1928.....	893	2,713	516	13,504	34,556	78,123	141,332	271,637	22,788
1929.....	802	2,625	931	17,545	34,177	91,157	158,818	306,055	18,976
1930.....	720	1,440	161	10,411	19,909	79,738	129,734	242,113	40,309
Totals... (1925-1930)	5,660	17,063	3,069	87,060	199,722	490,095	844,825	1,647,494	133,584

(*Table continued on next page*)

TABLE 4—(*Continued*)

Year	Crude No. 1	Crude No. 2	Other Crudes	Spin'g Fibre	Shin'le Fibre	Paper Fibre	Waste Stucco or Plast'r	Refuse or Shorts	Total Asbestos Shipped	Asbestic
1931.....	206	543	...	8,560	15,988	39,867	6,309	92,823	164,296	7,209
1932.....	144	313	14	6,004	6,626	32,694	3,984	73,199	122,977	3,473
Totals (1931-1932)	350	856	14	14,564	22,613	72,561	10,293	166,022	287,273	10,682
Totals (1879-1932)	76,203	111,027	71,698	.....	.....	.....	.....	.....	4,754,030	645,100

Year	Crudes	Fibres	Shorts	Total Asbestos Shipped	Sand, Gravel, and Stone (Waste rock only)
1933.....	1,306	82,605	74,456	158,367	6,445

* For figures for 1879-1924, see report for the calendar year 1932.

As will be seen in Table 5, the great bulk of our asbestos, amounting to 75.3 per cent in tonnage and 64 per cent in value, was exported to the United States of America. Next in order were Japan, United Kingdom, Germany, and Belgium. As the United States is the chief purchaser of our asbestos, it is of interest to note which are the countries contributing to her requirements. This is shown in Table 6, which is reproduced from *Asbestos, 1933*, published by the Dominion Bureau of Statistics, Ottawa.

TABLE 5

Exports from Canada of Unmanufactured Asbestos during the Calendar Year 1933

(From *Trade of Canada, Calendar Year 1933*, Dom. Bur. of Statistics)

Importing Country	Crude and Fibre		Short Fibre, Shorts, and Waste		Total	
	Tons 2,000 lb.	Value $	Tons 2,000 lb.	Value $	Tons 2,000 lb.	Value $
United Kingdom	4,633	$ 303,492	2,816	$ 54,979	7,449	$ 358,471
United States	48,469	2,324,246	63,744	869,994	112,213	3,194,240
Australia	744	39,162	4	90	748	39,252
Belgium	5,051	275,046	913	15,011	5,964	290,057
France	2,620	167,832	559	9,235	3,179	177,067
Germany	4,572	306,713	1,666	32,222	6,238	338,935
Italy	1,647	94,047	60	688	1,707	94,735
Japan	9,530	422,252	52	883	9,582	423,135
Netherlands	1,088	50,333	306	5,790	1,394	56,123
Spain	266	14,976	.....	.....	266	14,976
Columbia	2	187	.....	.....	2	187
Sweden	78	61	.....	.....	78	61
New Zealand	1	30	.....	.....	1	30
British India	.....	.....	60	600	60	600
Porto Rico	.....	.....	101	1,760	101	1,760
Argentina	.....	.....	15	165	15	165
Totals	78,701	$3,998,377	70,296	$ 991,417	148,997	$4,989,794

TABLE 6

Asbestos (Unmanufactured) Imported into the United States in 1933, by Countries and Classes *

(General Imports)

Exporting Country	Crude (Including Blue Fibre)		Mill Fibre		Stucco and Refuse		Total	
	Short tons	Value $	Short tons	Value $	Short tons	Value $	Short tons	Value $
Africa:								
British:								
Union of S. Africa	233	$ 20,173	.....	.....	.....	.....	233	$ 20,173
Other	2,091	214,384	.....	.....	.....	.....	2,091	214,384
Canada	804	167,795	48,112	$ 2,170,151	63,999	$ 854,647	112,915	3,192,593
Germany	6	669	.....	.....	36	1,064	42	1,733
Italy	17	8,929	.....	.....	939	7,764	956	16,693
Malta, Gozo, Cyprus	.....	.....	.....	.....	2,274	37,395	2,274	37,395
Sov't Russia in Europe	.....	.....	176	17,339	795	39,439	971	56,778
United Kingdom	1	587	.....	.....	11	339	12	926
Totals	3,152	$ 412,537	48,288	$ 2,187,490	68,054	$ 940,648	119,494	$ 3,540,675

* Figures on imports and exports compiled by C. Galiher, of the Bureau of Mines, Washington, D.C., from records of the United States Bureau of Foreign and Domestic Commerce.

Table 7 shows which are the countries contributing to the asbestos requirements of the United Kingdom. Of her total imports in 1933, Canada supplied 26 per cent in tonnage and 19.61 per cent in value; Rhodesia, 29.12 per cent in tonnage and 34.33 per cent in value; Union of South Africa, 29.55 per cent in tonnage and 29.34 per cent in value; Cyprus, 7.33 per cent in tonnage and 7.17 per cent in value; and Soviet Union, 5.52 per cent in tonnage and 5.65 per cent in value.

TABLE 7

UNMANUFACTURED ASBESTOS IMPORTED INTO THE UNITED KINGDOM, 1932-33 *

EXPORTING COUNTRY	YEAR 1932		YEAR 1933	
	Tons 2,240 lb.	Value £	Tons 2,240 lb.	Value £
Africa (Rhodesia)	7,182	£ 165,094	7,257	£ 151,896
Africa (Union of South)	5,612	114,787	7,384	129,845
Africa (Port. E.)	49	14	89	1,512
Australia	14	1,759	4	102
Austria	25	160	20	150
Belgium	2	30	.....	.....
Canada	2,353	30,382	6,477	86,779
China	.....	9	.....	.....
Cyprus	1,451	26,707	1,826	31,720
Egypt	1	22	.....	.....
Finland	121	955	71	497
France	77	1,052	.....	78
Germany	322	2,862	62	1,291
Italy	60	2,617	36	2,330
Netherlands	.....	.....	17	581
New Zealand	.....	.....	5	129
Soviet Union (Russia)	306	8,524	1,376	24,986
United States of America	552	6,391	281	10,518
Venezuela	.....	.....	14	80
TOTALS	18,127	£ 361,365	24,919	£ 442,494

* From *Asbestos*, February, 1934; Dominion Bureau of Statistics, Ottawa.

Table 8 shows the imports of asbestos into the principal countries of the world for the years 1930, 1931, and 1932. The total world production of asbestos, by countries, for the years 1930 to 1932, is shown in Table 9.

TABLE 8

IMPORTS OF UNMANUFACTURED ASBESTOS INTO PRINCIPAL COUNTRIES OF WORLD, 1930-32—(Less Re-exports, 1930-32)

(Taken from the Imperial Institute's publication, *The Mineral Industry of the British Empire and Foreign Countries: Statistical Summary, Production, Imports, and Exports, 1930-1932*)

(Long tons)

IMPORTING COUNTRY	1930	1931	1932
BRITISH EMPIRE:			
United Kingdom	23,561	19,433	17,222
Australia	(a)	1,200	.....
FOREIGN COUNTRIES:			
Austria	5,031	4,992	3,381
Belgium-Luxemburg E. U.	18,750	12,411	5,543
Bulgaria	(a)	8	5
Czechoslovakia	4,779	5,263	7,330
Denmark	1,013	693	724
Finland (including mica)	339	61	42
France	(a)	(a)	6,583
Germany	13,885	9,653	7,462
Greece	(a)	139	47
Hungary	1,932	2,356	(a)
Italy	6,472	5,194	4,629
Latvia	106	49	69
Lithuania	73	79	10
Netherlands	248	267	155
Norway	(c) 1,430	978	769
Poland	1,216	395	319
Portugal	58	79	39
Roumania	67	64	64
Spain (total imports)	6,547	3,225	4,067
Sweden	1,045	953	1,174
Switzerland (including mica)	800	1,135	584
U.S.S.R. (Russia)	264	86	13
Yugoslavia	1,029	1,281	457
Egypt	292	100	72
Mexico	384	400	(a)
Panama	25	17	(a)
United States (total imports) (b)	186,323	121,751	86,387
Brazil (total imports)	134	33	22
Chile	125	49	1
Colombia	76	(a)	(a)
Venezuela	29	4	8
Japan (total imports)	10,017	7,127	7,502
Netherlands East Indies	6	12	(a)

(a) Information not available.

(b) Re-exports of unmanufactured were: 111, 762, and 820 long tons in 1930, 1931, and 1932, respectively.

(c) Total imports.

TABLE 9

WORLD PRODUCTION OF ASBESTOS, 1930-1932

(Taken from the Imperial Institute's publication, *The Mineral Industry of the British Empire and Foreign Countries, 1930-1932*)

(Long tons)

PRODUCING COUNTRY	1930	1931	1932
BRITISH EMPIRE:			
Southern Rhodesia	33,720	21,466	14,077
Swaziland	.....	.....	4
Union of South Africa (*b*)	23,083	11,480	7,844
CANADA:			
Chrysotile	251,019	141,470	(*c*) 112,902
Actinolite	30	31	.....
Cyprus	7,256	1,138	1,520
India	33	6	90
Australia	82	128	130
Total, British Empire	315,000	176,000	136,000
FOREIGN COUNTRIES:			
Finland (Amphibole)	1,061	572	(*a*)
France	495	500	(*a*)
Greece	2	10	(*a*)
Italy	710	571	(*a*)
U. S. S. R. (Russia)	53,228	63,653	(*a*)
Mozambique	16	(*a*)	(*a*)
United States (sales):			
Amphibole	526	331	3,178
Chrysotile	3,262	2,551	
China	310	260	(*a*)
Japan (estimated)	1,000	1,000	1,000
Turkey	.....	4	.....
Total, Foreign Countries	61,000	69,000	(*a*)
WORLD'S TOTAL	376,000	245,000	(*a*)

(*a*) Information not available.

(*b*) Production is not available by kinds, but sales were as follows:

	1930	1931	1932
Amosite	2,930 long tons	1,863 long tons	1,242 long tons
Blue	4,894 " "	3,259 " "	2,647 " "
Chrysotile	9,392 " "	8,873 " "	6,888 " "

(*c*) Sales and shipments.

TABLE 10

EXPORTS OF UNMANUFACTURED ASBESTOS FROM VARIOUS COUNTRIES, 1930-1932

(Domestic Produce)

(Taken from the Imperial Institute's publication, *The Mineral Industry of the British Empire and Foreign Countries: Statistical Summary, Production, Imports, and Exports, 1930-1932*)

(Long tons)

EXPORTING COUNTRY	1930	1931	1932
BRITISH EMPIRE:			
United Kingdom	710	770	370
Southern Rhodesia	31,543	25,007	12,385
Union of South Africa	10,756	13,526	10,287
Canada	210,268	142,355	100,384
Cyprus	5,399	3,571	1,600
FOREIGN COUNTRIES:			
Austria	114	81	110
Belgium-Luxemburg E.U.	314	237	198
Czechoslovakia	264	461	398
Germany	392	553	283
Hungary	2	.....	(a)
Italy	349	141	898
Netherlands	227	5	6
Poland	.....	6	2
Spain (including re-exports)	30	180	1
Sweden	1	2	3
Switzerland (including mica)	8	9	30
U.S.S.R. (Russia)	15,500	13,030	15,664
United States	688	1,530	1,524

(a) Information not available.

MINING OPERATIONS IN 1933

Returns of sales and shipments of asbestos were received from six companies, *viz*:

Asbestos Corporation, Limited, Thetford Mines.
Canadian Johns-Manville Company, Limited, Asbestos.
Keasbey & Mattison Company, Thetford Mines.
Johnson's Company, Thetford Mines.
Nicolet Asbestos Mines, Limited, Norbestos.
Quebec Asbestos Corporation, Limited, East Broughton.

Shipments of asbestos were also made by the Northern Asbestos Company, at Thetford Mines. This Company works over some of the tailings or refuse of one of the large mills, to reclaim the short fibre left in the serpentine sands.

Asbestos Corporation, Limited.—The King mine of the Asbestos Corporation, Limited, was in operation steadily throughout the year. The development work started in 1932 for the exploitation of the mine by the block-caving method of mining was very actively pushed during 1933. In fact, at the end of June, the block or stope No. 1 was in full exploitation, and at the end of the year the development of two additional blocks had been started. On the 15th of June, 1933, also, the three-compartment combine incline and vertical shaft, construction of which had commenced in July, 1932, was completed.

A paper describing in detail the block-caving method was presented at the Annual Meeting in 1934 of the Canadian Institute of Mining and Metallurgy. This paper, entitled *Block-Caving at the King Mine,* by J. G. Ross and Staff, is to be found in the Canadian Mining and Metallurgical *Bulletin* for April, 1934, and in the *Transactions,* Vol. XXXVII, pp. 184-218.

Another property of the Asbestos Corporation, Limited, the Vimy Ridge mine, in Coleraine township, was operated day and night from August 18th to November 8th. Prior to and following this, the mine remained closed with the exception that a small crew of men were employed for the recovery of crude. The Company's Beaver-Consolidated mine, at Thetford Mines, was also worked on a small scale for the recovery of crude. All the other properties of the Asbestos Corporation, Limited, remained closed throughout the year.

Canadian Johns-Manville Company, Limited.—Milling operations were carried on throughout the year at the property of the Canadian Johns-Manville Company, Limited, at Asbestos, the mill being engaged until April 17th with re-treatment of tailings from previous years' operations. The mine was not opened until the 17th of April, after which operations were carried on actively until the end of the year.

Keasbey & Mattison Company.—From January to August, the Bell mine was operated on a basis of forty per cent capacity. From August to the end of the year, both mine and mill were working at sixty per cent capacity.

In December 1933, the merging of the Ambler Asbestos Shingle and Sheathing Company with the Keasbey & Mattison Company, both of Ambler, Pa., and the acquisition of a controlling interest in the latter company by Turner & Newall, Limited, of Great Britain, was announced by A. A. Blagden, president of the American companies.

Johnson's Company.—The Johnson's mine at Thetford was operated during the month of January on the basis of one shift of ten hours a day. From February to May 15th the mine was closed. Operations were then resumed and carried on to the end of the year. The Johnson's mine at Black Lake remained closed throughout the year.

Nicolet Asbestos Mines, Limited.—The Nicolet mine remained closed throughout the year.

Quebec Asbestos Corporation, Limited.—The Quebec Asbestos Corporation, Limited, was in active operation from the 15th of May to the 25th of November. Actual mining was then suspended, and development work started in the mine. The construction of an extension to the mill was also begun.

Tables 11 and 12, taken from a pamphlet entitled *Asbestos, 1933*, published by the Dominion Bureau of Statistics, present some interesting and informative statistics on the asbestos industry.

TABLE 11

PRINCIPAL STATISTICS OF THE ASBESTOS MINING INDUSTRY IN CANADA, 1932 AND 1933

	1932	1933
Number of firms	7	7
Capital employed	$ 30,081,362	$ $31,173,325
Number of employees—On salaries	136	140
On wages	1,273	1,489
Total	1,409	1,629
Salaries and wages—Salaries	$ 279,950	$ 261,684
Wages	876,365	1,017,409
Total	$ 1,156,315	$ 1,279,093
Cost of fuel and electricity	$ 827,303	$ 771,327
Selling value of products	$ 3,043,090	$ 5,214,392

TABLE 12

FUEL AND ELECTRICITY USED IN THE ASBESTOS MINING INDUSTRY IN CANADA, 1932 AND 1933

	1932		1933	
	QUANTITY	VALUE	QUANTITY	VALUE
Bituminous coal—Canadian—short tons	19,763	$125,443	14,825	$99,348
Bituminous coal—Foreign—short tons	1,709	12,915	110	945
Anthracite coal—short tons	5,086	35,179	6,159	41,448
Coke—short tons	630	7,500	126	1,502
Gasoline (exclusive of vehicles)—Imp. gal.	17,500	2,877	18,289	3,201
Kerosene—Imp. gal.	2,701	525	3,195	490
Fuel-oil—Imp. gal.	78,719	5,651	6,402	732
Electricity purchased—K.W.H.	44,519,239	637,213	53,024,096	623,661
TOTAL	.....	$827,303	.....	$771,327

NOTES ON ASBESTOS RESEARCH BEING DONE AT THE NATIONAL RESEARCH LABORATORIES, OTTAWA *

"1.—*Active Silica and Magnesium Salts from Serpentine Rock.*—Patents have been obtained for a process of manufacturing active silica and salts of magnesium from serpentine rock obtained as waste or tailings from the milling of asbestos-bearing serpentine rock. The active silica has valuable absorptive properties which make it useful industrially, and of the salts of magnesium which are obtained by this process, the more important are magnesium sulphate, or epsom salts, and magnesium chloride.

"2.—*Asbestos Cements.*—A comprehensive study of asbestos cements has been undertaken, and considerable data concerning the properties of the various grades being used has already been obtained.

"In this connection, the physical composition of milled asbestos, as revealed by mineralogical and microscopic examination, is also being studied. Information obtained in this way may throw further light on the relation between method of treatment and quality of fibre.

* From *Asbestos, 1933*, p. 2; Dominion Bureau of Statistics, Ottawa.

"3.—*Magnetic Iron in Asbestos.*—The mode of occurrence and amount of magnetic iron in asbestos is being studied with the view of eliminating this impurity.

"4.—*Moulded Composition from Asbestos.*—Patents have been obtained on a new method of moulding asbestos products whereby a wide range of physical properties can be obtained.

"The specifications for a *Standard Testing Machine* as developed by the National Research Council and which had been approved last year by the Associate Committee on Asbestos Research, have now been accepted by the asbestos producers; these producers have agreed to bring all their old testing machines up to these specifications by July, 1934. Specifications for standard testing-screens as recommended by the National Research Council have also been accepted by the producers.

"The National Research Laboratories are making a study with the object of preparing special short-grade fibres to be used as fillers for synthetic resins".

Notes on Production of Asbestos in Foreign Countries

Southern Rhodesia:

The Southern Rhodesia Chamber of Mines gives the production of asbestos for 1933 as 30,182 short tons, valued at £555,993, as against 15,766 short tons valued at £197,092 in 1932, or an increase of 91.4 per cent in quantity and of 182 per cent in value.

Annual productiom of asbestos in Southern Rhodesia since the inception of the industry is shown in Table 13.

The following extract from the address of Mr. Samuel Turner, Chairman, at the annual general meeting of Turner & Newall, Limited, held on the 18th of January, 1934, gives a clear conception of the situation in the asbestos industry in Southern Rhodesia:

"As regards our mining companies, I am glad to be able to tell you that an improvement in demand has made it possible, during recent months, to increase our production in Southern Rhodesia. This increase is relatively small, but it is a step in the right direction, as it permits the removal of the restrictions on development work which last year's minimum production had rendered necessary".

TABLE 13

ANNUAL PRODUCTION OF ASBESTOS IN RHODESIA, 1908-33 *

YEAR	SHORT TONS	VALUE	YEAR	SHORT TONS	VALUE
1908.....	55	£ 552	1921....	19,528	£ 795,698
1909.....	272	2,722	1922....	14,249	577,699
1910.....	332	3,320	1923....	20,364	626,898
1911.....	460	6,397	1924....	26,141	603,423
1912.....	.....	.....	1925....	34,349	765,926
1913.....	290	5,224	1926....	33,344	726,835
1914.....	487	8,612	1927....	33,176	794,215
1915.....	2,010	32,190	1928....	39,960	.970,327
1916.....	6,157	99,059	1929....	42,634	1,186,627
1917.....	9,562	189,890	1930....	37,765	1,070,847
1918.....	8,574	158,684	1931....	24,042	386,494
1919.....	9,798	425,240	1932....	15,766	197,092
1920.....	18,823	459,572	1933....	30,182	555,993

* From *Asbestos—Domestic and Foreign Deposits*, by Oliver Bowles; United States Bureau of Mines, I.C. 6790, June, 1934, p. 11.

UNION OF SOUTH AFRICA:

The production of asbestos in the Union of South Africa in 1933 amounted to 15,886 short tons, valued at £197,120. This is an increase of 31.6 per cent in tonnage and of 50.8 per cent in value compared with the previous year. In the Transvaal, shipments of amosite increased 122 per cent in tonnage and 123.6 per cent in value, and those of chrysotile asbestos increased 124.1 per cent in tonnage and 75.6 per cent in value. Production of blue Cape asbestos increased 12.1 per cent in tonnage and 6.5 per cent in value.

TABLE 14

ASBESTOS PRODUCTION IN THE UNION OF SOUTH AFRICA *

	1932		1933	
	Tons (2,000 lb.)	Value	Tons (2,000 lb.)	Value
TRANSVAAL:				
Amosite	1,391.45	£ 13,906	3,089.75	£ 31,099
Chrysotile	7,715.00	60,194	9,572.20	105,715
CAPE:				
Blue	2,964.22	56,604	3,224.66	60,306
TOTAL	12,070.67	£ 130,704	15,886.61	£ 197,120

* Reprinted from *Asbestos*, April, 1934; Dominion Bureau of Statistics.

TABLE 15

ASBESTOS PRODUCTION IN THE UNION OF SOUTH AFRICA, 1921-1933 *

(Short tons)

YEAR	TRANSVAAL	CAPE PROVINCE	NATAL	TOTAL QUANTITY	TOTAL VALUE
1921	1,593	3,467	62	5,122	£103,067
1922	1,392	2,991	6	4,389	81,230
1923	4,076	4,317	..	8,393	121,453
1924	4,240	3,001	..	7,241	110,075
1925	7,628	2,540	..	10,168	152,115
1926	10,104	3,993	..	14,097	216,466
1927	17,313	4,827	..	22,140	343,301
1928	18,976	5,078	..	24,054	399,550
1929	26,984	6,030	23	33,037	497,393
1930	13,800	5,481	..	19,281	340,795
1931	12,025	3,656	..	15,681	249,868
1932	9,106	2,964	..	12,070	130,704
1933	12,662	3,224	..	15,886	197,120

* Statistics published by the Department of Mines and Industry of the Union of South Africa.

RUSSIA (U. S. S. R.):

Soviet exports of asbestos for the years 1931-33 have been as follows:

	METRIC TONS	VALUE (RUBLES)
1931	13,239	2,485,000
1932	16,551	2,381,000
1933	21,458	2,651,000

ITALY:

TABLE 16

ANNUAL PRODUCTION OF ASBESTOS IN ITALY, 1898-1932 *

(Metric tons)

YEAR	TONS	YEAR	TONS	YEAR	TONS
1898	131	1910	175	1922	540
1899	81	1911	170	1923	1,538
1900	126	1912	169	1924	2,160
1901	243	1913	175	1925	2,105
1902	243	1914	171	1926	2,900
1903	202	1915	163	1927	3,840
1904	182	1916	82	1928	4,950
1905	220	1917	85	1929	2,847
1906	209	1918	60	1930	851
1907	359	1919	98	1931	632
1908	359	1920	165	1932	1,284
1909	190	1921	420		

* From *Asbestos—Domestic and Foreign Deposits*, by Oliver Bowles; United States Bureau of Mines, I. C. 6790, June, 1934.

TABLE 17

CYPRUS:

ASBESTOS EXPORTED FROM CYPRUS, 1922-33 *

YEAR	LONG TONS	VALUE	YEAR	LONG TONS	VALUE
1922....	2,285	£ 22,899	1928.....	11,579	£ 231,692
1923....	2,115	57,115	1929.....	13,796	292,971
1924....	4,372	80,070	1930.....	5,400	116,092
1925....	3,290	54,639	1931.....	3,571	66,381
1926....	6,331	121,857	1932.....	1,600	27,214
1927....	10,904	207,562	1933.....	(a) 1,158	.....

* From *Asbestos—Domestic and Foreign Deposits*, by Oliver Bowles; United States Bureau of Mines, I. C. 6790, June, 1934.

(a) First 6 months of 1933, as reported in Bull. Imp. Inst., London, Vol. 31, No. 3, 1933, p. 423.

FELDSPAR *

Sales of Quebec feldspar during the year amounted to 6,183 tons, valued at $59,283, a very substantial increase of 82 per cent in quantity and 52 per cent in value over the sales for 1932, which were 3,390 tons, valued at $39,062.

The whole of last year's production came from the Buckingham district, in Papineau county. Steady operations were maintained at three mines. Five others yielded a small tonnage, which was mostly taken by the *Canadian Flint and Spar Company, Limited*, for their grinding mill in Buckingham. Preliminary work was also carried out in the Buckingham district on a number of other deposits, some of which may be in operation during 1934.

The following are the locations of feldspar deposits which were worked during 1933: Derry township, range I, lot 8; range I, lot 9; range I, lot 11; range V, lot 1; Buckingham township, range VII, lots 23 and 24; Portland East township, range V, lot 7; range I, lot 2, E½; Villeneuve township, range I, lots 30 and 31.

* By Marc Boyer, Inspector of Mines, who also wrote the notes on Garnet, Graphite, Kaolin (China-clay), Magnesitic-dolomite, Marl, Mica, Natural gas, Ochres, Peat, Phosphate, and Quartz.

A small amount of work was also performed on lot 25, range IV, of Arundel township, in Argenteuil county, but no production was reported from this locality.

Crude spar, No. 1 grade, sold at around $5.50 per ton during 1933, with a tendency towards higher prices at the close of the year. Canadian ground feldspar averaged $16.00 per ton, *f.o.b.* mill. Of the total sales last year, 2,130 tons, or 34.5 per cent, was exported to the United States in the crude form, including a small lot of high-grade dental spar, selling at $30.00 per ton.

The mill of the *Canadian Flint and Spar Company, Limited,* in Buckingham, operated throughout the year, mostly from supplies of crude feldspar on hand. The grinding unit of *Bon Ami, Limited,* manufacturers of scouring compounds, in Montreal East, was operated to supply ground feldspar for their own requirements. This feldspar was drawn from the Buckingham district, whereas, up to 1932, the Company owned and operated a deposit in Aylwin township, Hull county, some fifty miles north of Hull along the Ottawa-Maniwaki branch of the Canadian Pacific railway.

The feldspar mined in the Buckingham district is generally high in potash and alumina and is classed as 'hard spar', having a high fusion temperature. Its potash content averages above 13 per cent, whereas the general average for potash spars produced in the United States is only about 10 per cent. In the manufacture of white wares, floor tile, electrical porcelain, and certain glasswares, where a high-potash spar is required, there is a good demand for the Canadian material.

In recent years, successful experiments have been conducted in England, in the United States, and in Canada, on the use of nepheline in the mix for various ceramic bodies, including vitreous enamels, and for bottle glass. Any widespread substitution of nepheline for feldspar would, of course, seriously affect the demand for feldspar for these particular uses. Nepheline contains more than 30 per cent of alumina and some 20 per cent of alkalis, chiefly soda. It thus has a considerably higher content, both of alumina and alkalis, than feldspar, and it has a lower softening temperature. On the other hand, high percentages of iron-bearing minerals are apt to be associated with nepheline, and these have to be removed by an elaborate mag-

netic separation process, which would tend to increase the cost of the substance, thus setting it back on a cost comparison between it and feldspar. In Ontario, the *Nepheline Company*, of Toronto, plans to exploit the nepheline syenites of Methuen township, Peterborough county, for their nepheline content.

Nepheline, ready for market use, occurs in Russia, where it is reclaimed during the process of concentration of apatite ores.

For the whole Dominion, production of feldspar in 1933 amounted to 10,569 tons, valued at $104,633, as compared with 7,047 tons, valued at $81,982, in 1932. Imports totalled 560 tons, valued at $7,970, as against 1,487 tons, valued at $24,875, in the previous year.

The tariff on crude feldspar entering the United States is 50 cents per ton, and on ground feldspar 30 per cent *ad valorem*. There is a similar tariff on ground feldspar entering Canada, but crude is on the free list. Small quantities of soda spar are imported annually by the Canadian grinders for blending with the high-potash Canadian spar to secure a ground product of requisite composition.

GARNET

No production of garnet was recorded during the year.

Some prospecting work was carried out in Joly township, Labelle county, on lot 10 of range *i* and lot 25 of range *B*. Samples of garnet rock from these prospects were shipped to the Ore Dressing Laboratories of the Mines Branch, Department of Mines, Ottawa, for tests on concentration. The reports on these tests show that the rock will yield a clean garnet concentrate, either by tabling alone or by jigging and tabling, followed by passing the dried concentrate over a high-power magnetic separator. No tests were made of the suitability of the garnet grain for abrasive purposes, but the reports recommend that such tests be carried out before an attempt is made to develop the deposits, and also that enquiry should be made as to whether sizes of 8-mesh and smaller are used by makers of garnet abrasives.

GRAPHITE

No graphite has been mined in the Province since 1930. The small tonnage recorded in the table of mineral production was sold from stocks on hand.

"Madagascar and Ceylon now hold a controlling position over the world graphite supply, and it is considered out of the question that the Canadian flake industry can hope, under present conditions, to become re-established in the face of competition from these sources" ①.

KAOLIN (CHINA-CLAY)

No sales of kaolin were recorded during the year.

The *Canadian Kaolin Silica Products, Limited,* who own the mining rights on lots 9, 10, 11, and 12 of range VI South, Amherst township, Argenteuil county, carried on operations throughout the year. The deposits are of quartzite carrying kaolin, but the demand last year was mostly for quartz, which constitutes the greater proportion of the rock mined.

Some kaolin finds its way to the market in the form of a kaolin-silica mixture, used principally in iron foundries, but, as the proportion of admixed kaolin is low, this material is reported to the Bureau as quartz and is included as such in the table of mineral production.

MAGNESITIC-DOLOMITE

Sales of basic refractories, caustic magnesia, and oxychloride cement, made from the magnesitic-dolomites of Argenteuil county, had a total value of $360,128, an increase of 37 per cent over the previous year's sales, which totalled $262,860.

The joint operations of the *Scottish Canadian Magnesite Company, Limited,* and *North American Magnesite Producers, Limited,* at Kilmar, in Grenville township, are now carried on under the name of *Canadian Refractories, Limited.* This Company is the largest producer of magnesitic-dolomite in the Province. Another concern, the *International Magnesite Company,* operates a property in Harrington township, also in Argenteuil county.

The major production consists of a basic refractory clinker, which is largely used in open-hearth steel furnaces and which has also been successfully applied in the copper anode furnace of the Noranda smelter.

① Spence, H. S., in *The Canadian Mineral Industry in 1933*; Mines Branch, Dept. of Mines, Ottawa.

Caustic calcined magnesia, another product, is marketed under the trade-name 'Grenite' and used in monolithic magnesite flooring.

During 1933, Canadian Refractories, Limited, erected a small plant at Kilmar for the manufacture of a new line of refractory products in the form of a chrome-magnesia brick. The plant will probably be in operation in 1934.

Systematic research which, since 1924, has been conducted by the National Research Council and the Ceramic Division of the Mines Branch, Ottawa, with the close co-operation of the operating companies, has resulted in a marked development of these various magnesia products. As a result, magnesitic-dolomite stands today as one of the most important industrial minerals of the Province.

MARL AND 'BOG LIME'

'Bog lime', or marl, is used extensively in the counties of Bonaventure, Gaspé, and Matapédia for agricultural purposes, and the quantity of this substance extracted from local lakes and bogs during 1933 was reported as 23,875 tons, appraised at a nominal value of forty cents a ton. Production for the year 1932 was reported as 25,510 tons.

Several deposits of similar material are known to exist also in the county of Argenteuil, but investigation has indicated that their successful exploitation is not feasible, at least for use as a filler or as whiting, due to the high cost of the necessary operation of bleaching the substance.

MICA

An improved tone reigned in the market for Canadian mica throughout the year and sales reached the very satisfactory total of 511,467 lb., valued at $39,061, as compared with only 81,137 lb., valued at $4,076, in 1932. Sales in 1933 were made up as follows:

Splittings	73,150 lb.,	valued at	$ 27,096.30
Trimmed mica	17,642 "	" "	9,359.00
Ground and scrap	20,675 "	"	2,605.70
Total	511,467 lb.,	valued at	$39,061.00

The proportion of ground to scrap mica was about one to five, by weight.

Dealers reported a growing demand for Canadian amber mica during 1933, possibly due to a falling off in production from Madagascar, which country, for the past five years, has struck a hard blow at the Canadian mica industry, by placing on the world market large stocks of more cheaply produced mica of excellent quality and neatly trimmed. Canadian producers and dealers have found it very difficult to compete with the more favourable conditions prevailing in Madagascar, and the domestic industry has gradually slumped since 1928. However, if present conditions still prevail during 1934, a revival of activity in mica mining will probably be witnessed. Last year, there was little actual mining, most of the material sold being taken from stocks on hand.

Canada and Madagascar are the two most important world sources of phlogopite, or amber mica. In the Province of Quebec, phlogopite is mined principally in the region of the Gatineau and Lièvre River valleys. The mica-bearing pyroxenites, however, extent westward into Pontiac county and eastward into Argenteuil, where some mica was mined in 1933.

Ruling prices for prepared Canadian amber mica during 1933 were as follows:

SPLITTINGS:	
½ in. by ½ in.	$0.23 per lb.
1 in. by 1 in.	0.40 "
KNIFE TRIMMED:	
1 in. by 1 in.	$0.12 to 0.15 per lb.
1 in. by 2 in.	0.15 to 0.25 "
1 in. by 3 in.	0.25 to 0.30 "
2 in. by 2 in.	0.30 to 0.35 "
2 in. by 3 in.	0.35 to 0.45 "
2 in. by 4 in.	0.50 to 0.60 "
3 in. by 5 in.	0.85 to 1.10 "
4 in. by 6 in.	1.35 to 1.50 "
GROUND MICA:	
20-mesh	$25 per ton
120-mesh	40 "
SCRAP MICA	$8 to $9 per ton

Thumb-trimmed would sell at 15 to 20 per cent of the price quoted for knife-trimmed.

Muscovite Deposits of Bergeronnes Tp., Saguenay Co.

Muscovite, or white mica, occurs in Quebec, but more sparingly than amber mica (phlogopite). Small tonnages, only, have been mined since the inception of mica mining in this Province, around 1880. However, during 1933, an attempt was made to re-open the old muscovite mines in the township of Bergeronnes, Saguenay county, and a few hundred pounds of mica were extracted.

In a number of places, the muscovite is abundant and of merchantable size, and if several of the deposits were mined collectively it seems that a fair output of mica could be maintained. The properties examined by the writer included the following:

McGie Mine:

This mine is situated in Block *G*, in the northern part of Bergeronnes township, at about eleven miles from the nearest shipping point, Les Escoumains, on the St. Lawrence river.

The pegmatite outcrops on the surface for about a quarter of a mile, striking northeast and dipping at about 49°N.W. The width, on the surface, measures up to 50 feet. The pegmatite has been opened in a trench which runs southward into the side of a hill that overlooks lake Charlotte. This trench has a length of 140 feet and a width varying between 10 and 20 feet, and at its far end a face of pegmatite 25 feet high is exposed. The deposit was worked in 1892 and 1893 and during that time fifteen tons of mica from this property yielded two and a half tons of cut mica averaging 3 to 4 inches but with some sheets as much as 7 to 10 inches.

In 1933, Mr. Albert Chartier, of Quebec city, acquired the mining rights on this property and the *North Shore Mica Mines, Limited*, was incorporated to carry on mining operations. Comfortable camps were erected on the south shore of lake Charlotte and the old excavation was cleared of accumulated débris. Several hundred pounds of mica had been taken out before the Company abandoned operations in the spring of 1934.

This deposit could be worked on a small scale, with an annual output of probably three or four tons of good quality mica, although operations would prove more costly in depth, owing to the inclined

dip of the dyke. Throughout the inclined dyke can be seen large crystals of muscovite which would yield cut mica of merchantable size. However, a regular market for a small output is difficult to secure, owing to large stocks of Indian muscovite, which is offered on the world market at very low prices.

The mica from the McGie mine is brown to reddish-brown as seen in thick sheets. It is remarkably free from stains, and is more rigid than the amber (phlogopite) variety of mica.

About a quarter of a mile east of the McGie mine, a pegmatite dyke about nine feet wide and striking N.30°E. carries numerous crystals of muscovite of pinkish to deep red colour. Two shallow pits were sunk on this deposit in 1933. The crystals are rarely larger than 2 by 3 inches, but the mica is of a very fine quality, being exceptionally clean and easily split.

BEAVER LAKE MINE:

In the reports of the Commissioner of Crown Lands, Quebec, for the years 1892 to 1895, and in the publication *Mica* (1901), by J. Obalski, at that time Provincial Mining Engineer, the Beaver Lake mine is erroneously assigned to Block *H* in Bergeronnes township, adjoining Block *G*. The mine is actually situated about one mile northeast of Lac des Sables, and six miles southwest of the McGie mine. It is about ten miles from the nearest shipping point on the St. Lawrence river.

A very small amount of work was done on the deposit in 1893 by an English company which had acquired the mining rights on the property, but activities ceased the same year.

The pegmatite body outcrops over widths up to 150 feet and has been traced for a length of more than one mile in a N.E.-S.W. direction. The best surface showings occur in the northeast section of the dyke. One exposure, in the form of an abrupt face, is about 140 feet wide by 50 feet high and shows numerous crystals of muscovite measuring up to 4 and 5 inches by 6 inches. All along the dyke, on surface, mica crystals can be seen imbedded in the matrix of quartz and feldspar.

This is, without question, the most important deposit known in the district, and it seems to offer fair possibilities for successful exploitation.

IMBEAULT MINE:

About one mile to the northeast of the Beaver Lake mine, an occurrence of mica, locally known as the Imbeault mine, has been worked recently by Albert Chartier, of Quebec. The dyke averages 11 feet in width over an exposed length of 600 feet, and carries numerous crystals of pinkish to brownish-red mica up to five inches in length. The mica is quite similar to that occurring in the small dyke to the east of the McGie mine, but it seems more abundant here and is in larger crystals. Several hundred pounds were taken out during the winter months early in 1934, some of it of good quality.

LAC DUCLAIR MINE:

This prospect was worked in a small way in 1897, and in 1932, and finally, early in 1934, by Albert Chartier, of Quebec. It is on lots 38 and 39 of range VI, Bergeronnes township. Here, an irregularly shaped pegmatitic mass forms a high knoll with a steep face towards the southwest, where an enriched zone carrying large crystals of mica has been opened up.

The original workings consisted of a shallow pit sunk on the hill-top on the edge of the steep face, and it is reported that several crystals of mica of large dimensions were taken out. Early in 1934, Mr. Chartier acquired the mining rights on the property and the excavation was enlarged to cut into the hillside. It now measures some 30 feet in length by 12 feet wide, and is about 28 feet in height at the face, where most of the mica is found.

Several hundred pounds of mica were taken out, some of which had suffered badly from the action of surface water, which had penetrated through small crevices in the rock.

The enriched zone referred to is of small dimensions, and a fair amount of large, clean muscovite is regularly encountered in the pure quartz bordering a zone of mixed feldspar and quartz. The mica resembles that of the McGie mine and is free from iron stains.

POSSIBILITIES OF REGION:

Other prospects were visited by the writer, including a deposit of biotite mica about midway between the McGie and Lac Duclair mines, and several small occurrences of muscovite mica in the vicinity

of lake Raymond and lake la Truite, in the centre portion of the township; but none of these proved to be of economic importance. Little prospecting has been done in the district, however, and it is possible that other deposits of muscovite of economic interest are still to be found.

It would seem that the region holds fair possibilities, but the prospects for successful operations are somewhat clouded by the difficulties that might be encountered in securing an assured and adequate market for the product, in the face of severe competition from India, which is the largest producer of muscovite mica.

NATURAL GAS

Drilling for natural gas in the St. Lawrence lowlands continued throughout the year.

South of the St. Lawrence, one deep well was bored on lot 160 of Petit Bois range, in the parish of Ste. Angèle de Laval, Nicolet county, by the *Canadian Seaboard Oil and Gas, Limited.* Small flows of gas under low pressure were encountered at depths of 4,835 feet and 4,955 feet in the lower Utica shale and upper Trenton limestone horizons. Most unexpectedly, however, pre-Cambrian rocks were entered at a depth of 5,100 feet, the Trenton limestone having a thickness of only 170 feet, whereas upwards of 450 feet was expected.

Drilling was continued to a depth of 5,280 feet with no change in formation, proving conclusively that the boring had entered the pre-Cambrian basement rock underlying the Palæozoic strata. The well was shot at the 4,955-foot horizon with thirty gallons of nitroglycerine on August 5th, with no increase in the flow of gas, and it was subsequently plugged and abandoned. Although the flow was small in volume, it was of some significance if it is to be interpreted as proving the ability of the Utica shales and Trenton limestones to act as reservoir rocks in this region.

An interesting feature of this well was a flow of highly saline water at a depth of 5,100 feet. An analysis of this brine showed that it contained 28.8 per cent solids, consisting of 17.4 per cent calcium chloride, 8.1 per cent sodium chloride, the balance undetermined.

The following is the log of the Ste. Angèle well, as determined in the Boring Division of the Geological Survey of Canada:

CANADIAN SEABOARD OIL & GAS, LTD., STE. ANGÈLE WELL

Lot 160, range Petit Bois, Ste. Angèle de Laval, Nicolet county

FORMATION	FOOTAGE
Surface deposits	0 — 20
Lorraine shales	20 — 3,270
Lower Lorraine or/and Upper Utica	3,270 — 3,520
Utica shales	3,520 — 4,930
Trenton limestone	4,930 — 5,100
Grey igneous rock, pre-Cambrian	5,100 — 5,280+

Following abandonment of this well, the Company engaged in a programme of geophysical exploration in an attempt to locate the best possible site in the district for another well. It was decided to drill near the village of St. Grégoire, some four miles south of the Ste. Angèle well, and drilling was in progress early in 1934.

North of the St. Lawrence, three shallow borings were put down in the counties of L'Assomption and Joliette.

The St. Paul Oil & Gas Corporation, Limited, drilled two of these wells in the parish of St. Henri de Mascouche, L'Assomption county, on lot 531 of St. Philippe range and lot 3 of Cabane Ronde range. A small flow of gas was encountered in both wells. The Cabane Ronde well is less than one hundred feet in depth and it is proposed to deepen it in 1934. The St. Philippe well was drilled to 230 feet, passing through 90 feet of surface deposits and 140 feet of calcareous shale belonging either to the lower Utica or upper Trenton formation.

The third well was drilled by the *Lanoraie Oil and Gas Syndicate, Limited,* on lot 342 of range Sud La Chaloupe, St. Thomas Parish, Joliette county. It was taken to a depth of 608 feet and gas was reported at 120 feet and at 504 feet. Surface deposits extended to 130 feet and were followed by calcareous shales of either the lower Utica or upper Trenton formation.

Several other companies hold leases on potential gas and oil lands in the St. Lawrence lowlands, both south and north of the St. Lawrence river.

OCHRES AND IRON OXIDES

Sales of iron oxides during the year totalled 4,192 tons, valued at $51,965, as compared with 5,017 tons, valued at $44,161, in 1932; this is a decrease of 16.4 per cent in quantity, but an increase of 17.6 per cent in value. This anomaly arises from the fact that sales in 1933 included a larger amount than in 1932 of prepared material, which sells at around $40 per ton. More than 75 per cent of the output, however, was made up of crude oxide, selling at between $3 and $4 per ton, and which is used principally for the purification of coal gas.

Crude oxide was sold by *Thomas H. Argall* from deposits at La Pointe du Lac, some ten miles west of Trois Rivières. Iron-oxide pigments were mined and prepared by the *Sherwin Williams Company of Canada, Limited*, from their deposits at Red Mill, nine miles east of Trois Rivières, and by the *Montmorency Paint Products Company, Limited*, who operate a deposit and a small mill at Les Forges, about ten miles northwest of Trois Rivières.

As shown in the accompanying table, production of ochres and iron oxides in the Province has maintained a fairly steady rate during the past decade. It has been sufficient to meet most of Canada's needs for the cheaper grades of iron-oxide colours and small amounts have been exported to England and to the United States. The Province of Quebec accounts for more than 96 per cent of Canada's total production of these materials, small quantities being mined also in British Columbia and utilized for the purification of illuminating gas.

PRODUCTION OF OCHRES AND IRON-OXIDES, 1924-1933

YEAR	QUANTITY (tons)	VALUE	YEAR	QUANTITY (tons)	VALUE
1924....	7,129	$88,540	1929....	6,220	$113,932
1925....	6,984	89,173	1930....	6,590	83,753
1926....	6,517	100,923	1931....	5,410	48,205
1927....	5,931	102,186	1932....	5,017	44,161
1928....	5,227	109,383	1933....	4,192	51,965

PEAT

Sales of peat fuel from the St. Hyacinthe bogs in 1933 amounted to 681 tons, valued at $2,549. The bogs, however, were not operated, as stocks on hand from 1932 operations were sufficient to meet the local demand.

The mechanical equipment at these bogs is capable of turning out 240 tons of peat fuel a day during the peat-harvesting season, *i.e.*, from June to October. However, other fuels seem to be more favourably regarded, and it has been difficult to secure an adequate market for this commodity. Conservative estimates show that, from the 500 square miles of accessible peat bogs in this Province, over 76,000,000 tons of peat fuel of 25 per cent moisture could be harvested.

PHOSPHATE

A small output—105 tons—of apatite from the Buckingham district, valued at $805, is recorded for the year 1933. This contrasts with 1,316 tons mined in the previous year, when a mild rush was staged in the phosphate-mining district and mines which had been idle for the past forty years were re-opened.

The apatite is associated with the mica-bearing pyroxenite rocks north of Buckingham. The deposits are of an erratic nature, and they can hardly be mined profitably for their phosphate content alone at prevailing market prices for the mineral. However, should Canadian mica mining regain a stronger foothold, apatite mining would benefit correspondingly, and selected grades of the mineral might find an outlet on the Canadian market.

PYRITE

The production of iron pyrites in 1933 was 39,320 tons, compared with 36,249 tons in the previous year, an increase of the order of 10 per cent.

Practically the whole production of pyrite in 1933 came from the Eustis mine, the ore of which is iron pyrites accompanied by small proportions of chalcopyrite. The mill produces a high-copper concentrate, and a high-sulphur one; the former is shipped to a copper smelter, and the latter is used for the manufacture of sulphuric acid.

QUARTZ AND INDUSTRIAL SAND

Production of quartz and industrial sand, for other than building purposes, amounted to 28,294 tons, valued at $109,533, an increase of 40.6 per cent in quantity and 52.8 per cent in value as compared with the output of 20,123 tons, valued at $71,645, in 1932.

VEIN-QUARTZ:

Vein-quartz is mined in the counties of Papineau and Roberval. That from the Buckingham region, in the former county, finds a ready market as a flux in the manufacture of phosphorus and phosphorus salts at the plant of the *Electric Reduction Company*, in Buckingham. A small amount of quartz is also obtained as a by-product from feldspar mining in this district.

In Roberval county, the *Silica Products of Canada, Limited*, have started operations on a large mass of white vein-quartz which occurs in Dequen township, on lots 2 and 3 of range III.

The deposit, some 650 feet in length with an average width of 80 feet, is well situated as regards hauling facilities to a railway point, being only one mile distant, over a good road, from the railway at mileage 161 on the Quebec-Chicoutimi branch of the Canadian National railway. This point is 240 miles from Montreal. At the railway, the Company has erected a milling plant to turn out all grades of quartz, from coarse sands to the finely pulverized material used as a filler or in ceramics.

The mill is of light construction—corrugated iron sheeting on wooden frame. The buildings are high and spaciously constructed, and there is a large annex for the storage of crude rock. The following equipment, given in approximate flow-sheet sequence, is installed at the mill, where a closed-circuit, dry-process of grinding is used: Primary crusher (gyratory)—elevators—screens and bins—secondary crusher (rolls)—magnetic pulleys—Hardinge flint-lined pebble-mill—Gayco air separator.

The deposit was examined and sampled by B. T. Denis, geologist of the Bureau of Mines, in the summer of 1933, and is further described in his report on part of the Lake St. John district, which appears in Part *D* of our Annual Report for 1933.

GRENVILLE QUARTZITE:

The kaolin-bearing Grenville quartzites in Amherst township, Argenteuil county, were actively mined throughout the year. The operating Company, *Canadian Kaolin Silica Products, Limited*, made regular shipments, the major portion of their output consisting of silica-sand, which was used by glass manufacturers. A well equipped, modern mill was erected on the property in 1932. A power shovel is used in the quarry, the rock being shattered and friable. A drag-line scraper conveys the loosened rock over a one-inch grizzly. The undersize is binned, ready for trucking to the mill, some three-quarters of a mile down grade from the deposit, while the oversize is shovelled to a gyratory crusher, grinding below one-inch, the product from which is returned to the undersize bin. The Company has progressed steadily since its inception in 1931.

POTSDAM SANDSTONE:

Potsdam sandstone, which outcrops in places along the southern margin of the Laurentian plateau, was quarried at St. Canute, about thirty miles northwest of Montreal, by the *Canadian Carborundum Company*, and at East Templeton, about ten miles east of Hull, by *Ottawa Silica and Sandstone, Limited.* The output from these deposits comprises glass sand, foundry sand, and sand suitable for the manufacture of carborundum at Shawinigan Falls. The friable sandstone is crushed, washed, dried, and screened to recover the several sizes.

A deposit of the same sandstone, on lot 25, range II, of Templeton township, about five miles west of the quarry of Ottawa Silica and Sandstone, Limited, was investigated in 1932 by L. H. Cole and R. K. Carnoch, of the Mines Branch, Department of Mines, Ottawa. Their report appears in publication No. 735 of the Mines Branch, entitled *Investigations of Mineral Resources and the Mining Industry, 1932.*

GENERAL SITUATION:

Reviewing the general situation and market conditions for the year 1933, L. H. Cole states:

> "The demand for high-grade silica-sand remained steady, and while there are still large quantities of Belgian sand being brought into Montreal as ballast at a comparatively low cost, it is gratifying to note the willingness of the consumers of this grade

of silica to use the Canadian product whenever suitable Canadian material is offered. The Canadian producers of silica-sand are steadily improving their position, and each year sees an increasing use of their products.

"The use of Canadian sand for sand-blasting is increasing, and the prospects are promising for a still further use of Canadian material for this purpose" ①.

SOAPSTONE AND TALC

The *Broughton Soapstone and Quarry Company, Limited,* operated its quarry on lots 12 of ranges X and XI, Broughton township. The production of this operator consists mainly of sawn blocks of soapstone, which are used for lining alkali recovery furnaces in the kraft and soda pulp industries.

Charles Fortin, of Robertsonville, did a great deal of work on opening up a soapstone quarry on lot 2, range V of Thetford township. A sawmill was put up for the production of soapstone blocks, and was operating and shipping soapstone blocks towards the end of the year.

L. C. Pharo, of Thetford Mines, opened up a deposit of soapstone on lot 11, range XI of Broughton township. At the end of the year he had erected a block-sawing plant.

It may be mentioned that some prospecting for talc was carried out on lot 1, range VII of Ireland township. Numerous veins of talc, up to 15 inches in width, were uncovered. While none of workable size were found, the indications would justify further search for larger deposits.

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① L. H. Cole in *The Canadian Mineral Industry in 1933,* Mines Branch, Department of Mines, Ottawa.

BUILDING MATERIALS*

For statistical purposes, the quarrying industry includes the extraction of stone, clay, sand, and gravel, together with the dressing and manufacturing operations carried out at their plants by the quarry operators prior to the marketing of their products. Quarry products extracted in the Province and used or sold in 1933 were valued at $5,761,221, as compared with $8,097,343 in 1932. The average annual value of the production for each of the ten-year periods 1923-32 and 1913-22 was $14,598,300 and $8,006,900, respectively.

Activity in the construction industry has declined gradually but continuously since 1929, which was the record year. Statistics compiled by MacLean Building Reports, Ltd., show that the building and engineering contracts awarded in the Province of Quebec in 1933 totalled $32,500,000, against an annual average of $124,600,000 for the period extending from 1923 to 1932; as a consequence, quantity and value of all quarry products used for building purposes have dropped in approximately the same proportions. On the other hand, it is gratifying to note that the demand for quarry products used in industries other than construction was gradually increasing during the last ten months of 1933, and, for the full year, the tonnage of stone consumed by such industries considerably exceeds that in 1932. The prices of all quarry products were lower than in the preceding year.

A first step towards recovery was made at the end of 1933, when the steady decline in the value of building contracts awarded was halted. The renewal of activity now taking place in general business will probably be followed by an increase in the building trade; it seems, therefore, justifiable to expect in the near future an improvement in conditions in the quarrying industry.

The total quantity of stone quarried in 1933 is estimated at 1,893,599 tons. Of the total output, approximately 575,430 tons were used in the manufacture of lime or cement, 1,088,406 tons were crushed and used as aggregate, and 27,507 tons were marketed as building or ornamental stone. Fifty-three per cent of the dimension stone was dressed in plants operated by the quarry owners.

* By Paul Bourret, Inspector of Mines.

The men employed in the quarrying industry worked for a total of 663,185 days, and were paid, in wages and salaries, $1,563,124. The corresponding figures for 1930 were 1,649,739 days and $5,469,179. The decline since 1930 from $3.31 to $2.35 in the average daily wage received by each employee is notable.

Unemployment was particularly severe last year among skilled quarry workers and stone cutters. This was felt especially in such localities as St. Marc des Carrières, Stanstead, Rivière à Pierre, and Philipsburg, which are almost entirely dependent on activity in the quarrying industry.

CEMENT

In sympathy with the general decline in the production of building materials, cement in 1933 registered a decrease as compared with the previous year. From 2,210,583 barrels sold and shipped in 1932, it fell to 1,517,555 barrels.

Three cement plants, having a combined capacity of 675 barrels per hour, are located in the Province. The largest of these is the No. 1 plant of the *Canada Cement Company*, in Montreal East. It operates by the wet process and has a rated capacity of 10,000 barrels per day. This plant operated continuously for nine months of the year, but was idle the other three. The methods of quarrying and of conveying the stone from the quarry faces to the mill were considerably improved during the year. The Hull mill of the same Company resumed operations last June, after two years of inactivity. The plants of the Canada Cement Company have a very enviable safety record.

The plant of the *National Cement Company*, located east of Montreal, has not been in operation since 1931. However, shipments from stocked material were made last year.

The average market price of cement per barrel, f.o.b. quarry, was $1.40, against $1.42 in 1932.

ANNUAL PRODUCTION OF CEMENT, 1924-1933

Year	Quantity, barrels	Year	Quantity, barrels
1924.....	2,754,979	1929	5,169,408
1925.....	3,365,802	1930	4,865,609
1926.....	3,727,477	1931	4,942,323
1927.....	4,636,751	1932	2,210,583
1928.....	4,915,320	1933	1,517,555

CLAY PRODUCTS

Sales of clay products were reported by nineteen operators. Eleven of these had their plants in operation during the year. The others marketed stocked material carried over from the previous year.

Both clays and shales are used in the production of brick, the latter predominating. In fact, it is estimated that only 16 per cent of last year's brick output was produced by clay-brick manufacturers.

Early in the summer, the clay grinding and processing plant of the *St. Lawrence Brick Company, Limited*, at Laprairie was destroyed by fire. The plant, however, was immediately rebuilt, in accordance with carefully studied plans, at a cost of $200,000, and advantage was taken of the opportunity to introduce the most modern processes. The new plant is remarkable for its compactness and flexibility. It is the first in this Province to embody the de-airing process, which, it is claimed, increases the strength and plasticity of the raw material, extends the range of moisture absorption, and improves the appearance of the finished product. If results are as expected, this process will enable the Quebec clay-brick producers to place on the market a low-absorption brick which should be able to compete successfully with the imported vitrified product. The new plant of the St. Lawrence Brick Company was put in operation for experimental purposes during a period of three weeks, last December. It will reopen on a more permanent basis early in the spring of 1934.

CLAY PRODUCTS IN 1932 AND 1933

CLASSIFICATION	1933		1932	
	QUANTITY	VALUE	QUANTITY	VALUE
BRICK:				
Common brick, soft mud process.....M	1,241	$ 9,862	400	$ 3,800
Face brick, stiff mud process.....M	7,234	153,990	13,155	308,863
Common brick, stiff mud process.....M	17,114	264,385	28,478	436,255
Face brick, dry press.....M	601	18,166	319	9,564
Common brick, dry press...M	.....	.....	8	112
Fancy or ornamental brick.M	.....	.....	89	4,447
Sub-total.....	26,190	$ 446,403	42,449	$ 763,041
OTHER CLAY PRODUCTS:				
Structural tile.....tons	7,677	$ 66,196	20,170	$ 197,336
Drain tile.....No.	533,657	15,421	544,692	20,609
Sewer pipe.....	.....	45,890	.....	83,565
Unclassified.....	.....	6,180	.....	.....
Sub-total.....	.....	$ 133,687	.....	$ 301,510
TOTAL.....	.....	$ 580,090	.....	$ 1,064,551

GRANITE

Shipments of granite from Quebec quarries in 1933 were valued at $408,207. As the average for each of the years 1929 to 1931 was $1,866,000, it will be seen that the decline in this industry has been very marked.

The bulk of the production of granite for building and ornamental uses came from the grey granite quarries of the Stanstead and St. Samuel areas. Few large buildings of granite were constructed in the Province last year. Notable among them is the Roman Catholic church of Armagh, in Bellechasse county, which was built of St. Samuel granite. The Scotstown quarries, which in the past have been important producers of building granite, were inactive in 1933.

At Rivière à Pierre, building granite was produced by only one operator, *La Compagnie de Granit.* The output was used entirely in the construction of the parish church of the town of Giffard, located near Quebec city.

The Chicoutimi-Lake St. John district offers a variety of granitic stone, ranging from a medium to coarse grained black anorthosite to pink granites of various shades and textures. These stones are occasionally used for building purposes, but more generally for monument stone.

The demand for curbstone and paving blocks has declined from 56,300 tons in 1931 to less than 2,400 tons in 1933. As a consequence, producers have decreased in number from 47 to 5 in the same period. The entire production of curbstone in 1933 was shipped from the Stanstead, Guenette, and Rivière à Pierre districts. The decline in the market for curbstone is felt heavily by monument-stone producers, who generally dispose in this way of the stone unsuitable for monument work.

An increase is recorded in the tonnage of crushed granite. This is to be attributed to generally larger outputs by all operators and not to a larger demand from a specific source.

Employees in granite quarries and annexed dressing plants worked a total of 97,254 days and received $175,008 in wages, against 115,444 days of labour and wages totalling $285,426 in 1932.

The Quebec Bureau of Mines has undertaken the publication of a series of reports on the commercial granite areas of the Province. Two of these have been published. The first, by F. R. Burton, was issued as Part E of the Annual Report of the Quebec Bureau of Mines for 1931. It describes the granite areas south of the St. Lawrence river. The second report, by F. F. Osborne, forms Part E of the Annual Report for 1932. It is on the granites of Rivière à Pierre, Guenette, Brownsburg, and others.

QUANTITY AND VALUE OF GRANITE PRODUCTS SOLD IN 1932 AND 1933

CLASSIFICATION	1933		1932	
	QUANTITY (Tons)	VALUE	QUANTITY (Tons)	VALUE
Building stone, rough	472	$ 1,883	6,100	$ 17,232
Building stone, dressed	3,413	110,796	9,082	261,573
Monument stone, rough	3,037	25,794	3,611	25,719
Monument stone, dressed	1,529	111,120	956	73,113
Curbstone	1,554	6,233	5,977	26,420
Paving blocks	837	6,577	1,905	14,435
Rubble and rip-rap	21,784	20,044	37,753	29,333
Crushed stone	99,211	125,760	78,136	93,864
Total	131,837	$408,207	143,520	$ 541,689

LIME

In 1933, lime producers sold or used 110,033 tons of lime, appraised at $645,467. Compared with 1932, this is an increase of 18 per cent in quantity and of 10.6 per cent in value. The increased output is to be credited mainly to greater demand by the chemical and pulp and paper industries, which consumed 25.6 per cent, and 28.6 per cent, respectively, more lime than in the previous year.

The largest producer is the *Standard Lime Company, Limited.* This Company has, at its Joliette plant, two batteries of ten vertical kilns each and a hydrator of the Kritzer type, and, at St. Marc des Carrières, a battery of eight vertical kilns. The Joliette plant operated throughout the year with twelve kilns in use, but the St. Marc des Carrières plant was idle. The *Dominion Lime Company* has, at Limeridge, in Wolfe county, ten kilns, five of which were in operation last year, and a Clyde hydrator; wood was used as fuel in all the kilns. *Shawinigan Chemicals Company, Limited,* quarries an exceptionally pure limestone near Bedford, in Missisquoi county. The stone is crushed and screened at the quarry and then transported by rail to the lime-burning plant located at Shawinigan Falls. At the plant are three horizontal rotary kilns of large capacity. The total output is used for the manufacture of carbide in the Company's own plant. However, a certain tonnage of hydrated lime, recovered as a by-product, is sold to outside consumers.

In all, forty-two kilns of various types were in operation in the Province during 1933. These kilns are all fed with limestone excavated in quarries operated for that purpose, except at St. Marc des Carrières, where, for a number of years, the kilns have been supplied with waste products of the cut-stone industry.

The lime industry provided its employees with 52,180 days of labour, and a total of $106,274 in wages, against 49,209 work-days and wages amounting to $133,241 in 1932.

DISTRIBUTION OF THE PRODUCTION OF LIME IN 1932 AND 1933

(In tons)

CLASSIFICATION	1933		1932	
	Quick-lime	Hydrated lime	Quick-lime	Hydrated lime
Building trade	2,448	242	4,629	421
Chemical works	40,887	45	32,474	112
Glass works	.....	.....	219	.....
Sugar refineries	77	.....	10	.....
Tanneries	624	238	732	200
Pulp and paper mills	39,846	16,422	31,800	11,945
Agricultural uses	110	864	21	461
Foundries	535	263	260	25
Dealers	4,017	1,631	4,552	2,763
Unclassified	895	889	1,584	903
Total	89,439	20,594	76,281	16,830

LIMESTONE

The production of limestone in 1933 amounted to 1,680,793 tons, used as follows: 575,420 tons in the cement and lime industries, 983,555 tons as aggregates in concrete and in road construction, 102,933 tons as filler and in chemical industries, and 18,885 tons as dimension stone.

The most important use of limestone in the Province is in the manufacture of cement and lime. The limestone used by cement and lime producers is obtained almost entirely from quarries owned by the kiln operators. Developments in these industries are dealt with under their respective headings.

CRUSHED STONE:

Next in importance is the crushed-stone industry. There are more than 95 stone crushing plants in the Province, and their combined maximum capacity approaches 3,000 tons per hour. Seventy-eight of these plants, with a total maximum output of 2,800 tons per hour, use limestone as raw material. Only fifty of them were in operation last year, and many of these worked intermittently or for only a short period. Several crushed-stone quarries have been idle for two years or more, but very few are definitely abandoned. On the other hand, if we except one or two small plants put up to supply a local and temporary market, no stone crushing plants were built last year and no enlargements of existing units were made. In a few quarries, where the demand was not as considerable as heretofore, it was found advisable, in order to reduce operating costs and to permit of continuous operation, to modify the stone crushing plants so as to operate with the use of only light machinery. In one instance, economies were effected by building and operating a crushing plant alongside a much larger one, which remained idle throughout the year. Among the technical modifications and developments taking place in the crushed-stone industry are: a more scientific use of explosives than heretofore; greater efficiency in the use and distribution of power; the gradual substitution of transportation by motor trucks from the quarry face to the stone crushing plant, in place of dump-cars and a layout of trackage; the general adoption of closed-circuit secondary crushing; the substitution of vibrating screens for trommels; and the operation of ready-mixed concrete plants in conjunction with those at the quarries.

Prices for crushed stone in 1933 were in general extremely low; a substantial increase is, however, to be noted for the district of Quebec. Quarries located on the Island of Montreal and on Isle Jésus sold approximately 581,686 tons of crushed stone at an average price, f.o.b. quarry, of $0.582 per ton, against 780,000 tons at $0.75 per ton in 1932. In the City of Quebec district, operators reported sales of 54,613 tons of crushed stone at an average price of $0.914 per ton; this compares with 130,000 tons at $0.765 per ton in 1932. The average price of crushed stone for the whole of the Province was $0.695 per ton, a decrease of three and one-half cents per ton in comparison with the preceding year.

BUILDING STONE:

Building limestone is used mainly in the construction of public or business buildings. Few such buildings were erected in 1933, and, as a consequence, most of the building-limestone quarries were idle during the major part of the year. Exceptional activity was, however, displayed in the Cap St. Martin district. The Martineau quarry recently opened-up in this area, at Pont Viau, provided last summer employment for over sixty stone cutters. This quarry supplied the stone used in the construction of the Neurological Building, McGill University, and also for the extension to the City Hall of Montreal. The quarries at St. Marc des Carrières were much less active than in the past. Important shipments of rough building-stone were made from J. O. Gauthier's quarry, but the tonnage of stone dressed at St. Marc was not considerable. Shipments from Joliette, Hull, St. François de Sales, and other producing localities were small.

INDUSTRIAL LIMESTONE:

The demand for high-calcium limestone for use in various chemical industries was much improved, especially in the last three quarters of the year. As a result, the amount of limestone and marble used

QUANTITY AND VALUE OF LIMESTONE PRODUCTS SOLD IN 1932 AND 1933

CLASSIFICATION	1933		1932	
	QUANTITY (Tons)	VALUE	QUANTITY (Tons)	VALUE
Building stone, rough	14,468	$ 30,159	11,071	$ 18,099
Building stone, dressed	4,270	68,737	6,063	120,147
Monument stone, rough	.....	.....	9	106
Monument stone, dressed	118	2,867	211	2,531
Flagstone	24	62	32	32
Curbstone	5	25	.....	.....
Flux	887	1,180	1,513	2,123
Pulp and paper mills	53,462	44,188	36,128	32,304
Other chemical uses	25	162	69	373
Asphalt filler	24,540	70,497	14,481	41,691
Agricultural limestone	24,019	33,625	26,281	39,143
Rubble and rip-rap	26,134	13,082	101,860	49,285
Crushed stone	957,421	665,885	1,399,574	1,021,650
Total	1,105,373	$930,469	1,597,292	$1,327,484

for chemical purposes increased from 65,704 tons in 1932 to 81,761 tons last year. This is attributable mainly to greater activity in pulp and paper mills and in the carbide manufacturing industry.

MARBLE

Sales of marble by Quebec producers in 1933 totalled $42,283, compared with the record production of 1930, valued at $717,362. The decrease is striking, but it is wholly attributable to the lack of demand for building and ornamental marble.

Marble, in common with limestone, is used for a variety of chemical purposes; and the increased activity in our pulp and paper mills has created a larger demand for these products. As shown in the accompanying table, the amount of marble used in pulp and paper mills last year was almost twice as much as in 1932.

Trial shipments of dolomitic marble were made at the end of the year to glass manufacturers by the *Canada Marble & Lime Company*. The purpose of these shipments was to determine whether the stone could replace dolomitic lime in the manufacture of glass. We are informed that several larger shipments have since been made. The Canada Marble & Lime Company owns and operates a Grenville marble quarry at L'Annonciation, in Labelle county. This quarry was formerly operated by Ovide Brassard and by A. Dupré.

MARBLE PRODUCTS SOLD IN 1932 AND 1933

CLASSIFICATION	1933	1932
Building and ornamental stone, rough	35 tons	.....
Building and ornamental stone, dressed	165 "	1,951 tons
Glass factories	50 "	.....
Pulp and paper mills	3,318 "	1,713 "
Crushed marble	1,266 "	2,288 "
Rubble and rip-rap	3,149 "	3,880 "
Total	7,983 tons	9,832 tons

SAND AND GRAVEL

The compilation of returns received from more than 2,600 sand and gravel pit owners shows a total output of 3,356,232 tons.

Forty-one operators reported sales of sand for building purposes. With the exception of that excavated by railway companies for ballast, the output of the other producers was used almost entirely in construction and maintenance of roads.

It is estimated that 1,897 men were provided with intermittent employment in sand and gravel pits last year.

The quantity of gravel used as ballast in 1933 is quite small in comparison with that of the preceding year. On the other hand, there was an increase of 864,000 tons in the amount of sand and gravel used in road work.

SANDSTONE

The construction of the Beauharnois hydro-electric power plant gave, for a few years, a considerable impetus to the production of sandstone. The crushed stone used in connection with this development was extracted in the excavation of the tail race, which lies in beds of Potsdam sandstone. The first unit of this project is now practically finished and only minor amounts of crushed stone were required last year for its completion.

Excluding the output of the Beauharnois Construction Company, 55,000 tons of crushed sandstone and rubble were produced by operators whose quarries are located in the vicinity of the city of Sherbrooke, at Ste. Foye, and along the south shore of the St. Lawrence below the mouth of the Chaudière river.

QUANTITY AND VALUE OF SANDSTONE SOLD IN 1932 AND 1933

CLASSIFICATION	1933		1932	
	QUANTITY (Tons)	VALUE	QUANTITY (Tons)	VALUE
Building stone, rough	.....	.....	330	$ 660
Rubble and rip-rap	41,212	$ 30,906	9,054	9,885
Crushed stone	31,774	26,497	461,287	264,477
Total	72,986	$ 57,403	470,671	$ 275,022

SLATE AND SHALE

Several shipments of red slate were made last year from Ste. Hénédine, in Dorchester county, and also from Granby, to a pulverizing plant located in Montreal. This product, when finely pulverized, is used as a filler by various industries, such as paint and linoleum manufacturers. Pulverized shale, also, is produced in certain localities and sold for such purposes as surfacing tennis courts, and as an ingredient in artificial stone.

The production of slate and shale sold as such in 1933 amounted to 439 tons, valued at $828.

SAND AND GRAVEL RESOURCES OF THE PROVINCE OF QUEBEC

by Henri Girard, Inspector of Mines

INTRODUCTION

Definition of Sand and Gravel

Sand and gravel are generally thought of as unconsolidated aggregates of siliceous or calcareous grains. For practical purposes, it is customary to make an arbitrary distinction between the two on the basis of grain-size, according to the following definitions:

Sand.—The fine granular material (usually less than one-fourth inch in diameter) resulting from the natural disintegration of rock or from the crushing of friable sandstone rocks ①. When the particles are very fine, the material is known as *silt.*

Gravel.—When the fragments in an unconsolidated deposit are larger than one-quarter of an inch in diameter, the material is called gravel.

A 'sand and gravel deposit' is composed of the natural disintegration products of rock in a loose, unconsolidated state.

Types of Sand and Gravel Deposits

Glacial Deposits:

It is well established that a vast ice-sheet covered the whole of the Province of Quebec during the Pleistocene, or Glacial, period. In its advance, the ice-sheet swept before it, or caught up, all the loose, weathered, rock material in its path, and also scoured and eroded the solid rocks themselves. Eventually, as the ice melted, its load of rock débris was left scattered over the country. For the most part, this material was unsorted and unstratified, a mixture of rock fragments ranging in size from large boulders, many feet in diameter,

① American Society for Testing Materials (serial designation C 58-28, 1928).

down to the finest dust, or 'rock flour' (see Plate II-A). Such deposits are known as *boulder clay, till,* or *ground moraine.* They seldom contain sand or gravel of commercial value.

In places, however, the moraine is in part stratified and may include sand and gravel layers. Such deposits may have formed at the edge of the ice, where the glacier remained nearly stationary in position for a considerable time. They are known as *terminal moraines* or, if at the side of the glacier, *lateral moraines.*

Where rivers have issued from beneath the ice, they have reworked and sorted the morainic material at the edge of the glacier to form irregularly stratified deposits of sand and gravel, known as *kames,* which sometimes have the form of hillocks or short ridges (Plate II-B), or, if the waters escaping from the ice have spread over a flat plain, the deposits are flatter and delta-like.

The sub-glacial streams may, instead, deposit their load of material in their channels beneath the ice, and, after the retreat of the latter, such deposits stand out as ridges resembling kames but usually longer. These are *eskers,* and, like the kames, they are composed of irregularly stratified sand and gravel (Plate III-A). Both esker and kame deposits are important sources of sand and gravel in the Province of Quebec.

A well developed chain of eskers is to be seen along the St. Francis river between Richmond and Sherbrooke, a distance of twenty-five miles, with others extending towards the tributary valleys. There is also a prominent esker at South Durham, in Drummond county. They constitute an almost inexhaustible source of clean sand and gravel for structural uses.

MARINE DEPOSITS:

After the retreat of the ice-sheet, an arm of the sea extended up the St. Lawrence and Ottawa valleys to beyond Ottawa. This ancient sea is known as the *Champlain sea,* and on its floor were deposited well-stratified clay, silt, and sand. The recession of this sea took place in a series of stages, with intervals of rest between each, and as a consequence the deposits that were laid down upon its floor now appear as a succession of terraces at lower and lower levels, with a sloping beach leading from one to the next; but the continuity of the terraces has been modified, especially by rivers which have cut their channels through the Champlain deposits.

The material of these terraces varies in character from very fine sand to coarse sand and gravel. Usually, they consist of sand of very fine grain and uniform texture, in horizontal layers which are generally thin and seldom exceed one foot in thickness. The component grains are mostly rounded, and while they include a variety of minerals, quartz is by far the most abundant. The material of these marine-beach gravel deposits has been derived in large part from disintegration of underlying or neighbouring rocks by weathering and wave action. It often includes a large percentage both of boulders and of silty materials. A well developed terrace may be seen along provincial highway No. 3, running westward from Portneuf to Trois Rivières (see Plate III-B). It stands at an elevation of approximately 75 feet.

STREAM DEPOSITS:

As the Champlain sea receded, rivers entering it from the 'Canadian Shield' region to the north brought with them much sediment which, with the slackening of the current, was deposited in the lower areas of their course or was laid down at the river mouth in the form of a delta. These delta deposits consist of sand and gravel, and some of those on the North shore of the St. Lawrence, at an elevation of 400 to 500 feet, have a thickness varying from 80 to 100 feet. Plate IV-A shows delta deposits at Beauport East, near Montmorency river, in Quebec county.

Both the marine sands and the sands and gravels of the delta deposits are used very extensively for a variety of purposes.

USES OF SAND AND GRAVEL

Sand and gravel suitable for general purposes is widely distributed throughout the Province. Almost every town or village has its local deposit. The production, especially for road construction, is divided among so many widely scattered and intermittent operators that it is beyond the scope of a summary such as this to enumerate them in detail.

The great bulk of the sand and gravel excavated each year is used as concrete aggregate, in ballast for railways, and in road gravelling.

The material used as road-metal has only a nominal value, little more than the cost of digging. For the most part, it is supplied by farmers for local use, and sold on a royalty basis.

The extraction and marketing of 'building sand' for use as concrete aggregate, etc., in the larger cities is a business organized on a stable and permanent basis. Here, capital investment in property, plant, etc., enters into the cost of production and determines the selling price of the material.

Besides the widespread occurrence of sand and gravel suitable for these three main uses, there are in the Province important deposits of special types of industrial sand—as foundry sand, blasting sand, glass sand, and filter sand—but up to the present these have been produced in comparatively small quantities only.

Production Statistics

The following table gives details of production and number of operators in the sand and gravel industry of the Province for the past three years.

The Sand and Gravel Industry, 1931-1934

Classification	1931			1932			1933		
	Quantity (Tons	Value $	Number of Operators	Quantity (Tons	Value $	Number of Operators	Quantity (Tons)	Value $	Number of Operators
Building sands	1,195,618	$ 424,534	52	696,345	$ 227,542	61	1,334,283	$ 430,508	48
Ballast	1,139,844	152,503	3	1,088,090	165,435	2	24,959	4,425	1
Road construction and maintenance	4,912,669	1,221,542	3,517	1,652,148	494,104	1,446	1,996,236	507,173	2,573
Other sands	405,314	134,692	4	5,949	6,223	3	754	323	3
Totals	7,653,445	1,933,271	3,676	3,442,532	$ 892,304	1,512	3,356,232	$ 942,429	2,625

BUILDING SAND

For the purposes of this report, 'building sand' includes all sand and gravel used in making mortar, concrete, and artificial stone for building and engineering works. Generally speaking, material to be used for such purposes is produced in districts contiguous to cities, since these provide the main market. For convenience, therefore, the building-sand industry of the Province may be considered under five main districts, whose centres are, respectively, the cities of Montreal, Quebec, Trois Rivières, Sherbrooke, and Chicoutimi.

Laboratory Tests on Building Sand:

Results of laboratory tests on various Quebec building sands are given in Table I (page 77). These tests include the following:

The *sieve analysis* gives, in percentages, the amount of the sample retained on standard Tyler sieves of, respectively, 4, 8, 14, 28, 48, and 100 mesh.

The *fineness modulus* of sand, or of the fine aggregate (minus-$\frac{1}{4}$-in. material) screened from gravel, is a factor that indicates and represents the fineness of the sand—the larger the percentage of fines in the sand, the lower its modulus. The modulus is obtained by dividing by 100 the sum of the cumulative percentages of material retained on each of the six screens referred to above that are used in making the screen analysis, *e.g.*, if 5.4 per cent is retained on 4-mesh and 9.4 per cent an 8-mesh, the cumulative percentage on 8-mesh is 14.8 ①.

The test for *organic impurities* was made as indicated in the standard method of the American Society for Testing Materials (serial designation C40-27, 1930). The 'organic, parts per million' should not be higher than 250 in terms of tannic acid.

The test for *deleterious substances* is not a standard of the American Society for Testing Materials but is an approximate test for determining the amount of clay and silt in the sand. This quantity, obtained by the sedimentation test, is expressed as a volume percentage of the sample.

① Professor A. Abrams, *Design of Concrete Mixtures*. Published by Structural Materials Research Laboratory, Lewis Institute, Chicago.

The *tensile strength* test, giving the tensile strength developed in a mortar of one part Portland cement to three parts sand (by weight) at the age of 7 and 28 days, was made in the usual manner on briquettes similar to those used in standard cement testing. According to the specification adopted by the American Society for Testing Materials, the tensile strength must be not less than that of a mortar of the same consistency and composition, but containing standard Ottawa (Illinois) sand in place of the sand being tested.

The tests on building sands in the district of Montreal were carried out in the Laboratory for Testing Materials of the City of Montreal. The samples tested were taken during the erection of municipal works in the summer of 1932.

For sands from the other districts, the tests were made in the laboratory of the Roads Department in Quebec city. The samples represent the average run of the bank.

Montreal District

The principal consumption of building sand in the Province is in the Montreal metropolitan district. In addition to two large companies which possess sand-washing and grading equipment, there is a group of small operators who market building sand from privately owned pits and deliver the material by trucks to the city. It is to be noted that sands produced as 'bank run' material are not always suitable as aggregate for concrete work. Specifications on concrete sand for all structures of any importance are very rigid, and call for a clean sand that contains definitely specified proportions of coarse and fine components.

The supply in the district of Montreal is obtained from several sources, of which the more important are: St. Félix de Valois, Lake of Two Mountains, South Durham, Mascouche, Ste. Julienne, Ste. Rose West, and St. Grégoire.

St. Félix de Valois, Joliette County:

Southwest of St. Félix de Valois, there is a very extensive delta deposit which is excavated on a large scale by two operators, the Standard Lime Company, Limited, and Standard Sand and Gravel, Limited. The City of Montreal, also, owns a property nearby.

The Standard Lime Company, Limited.—The property of this Company is on lots 492 to 498, St. Frederic range, municipality of St. Félix de Valois, approximately 6½ miles north of Joliette station on the Canadian Pacific railway. It is served by a spur line, with several branch tracks in the pit. The deposit, composed chiefly of fine to coarse sand and fine gravel, rises to a height of 40 feet above the floor of the excavation, which is more than one mile in length and from 800 to 1,000 feet in width. The sand for the most part is clean and composed largely of rounded grains of quartz, with some feldspar, although thin layers of clay are to be seen in the bank. A modern sand-washing and grading plant has been installed on the property. A sand suction dredge in an artificial lake is used to convey the sand from the face of the pit to the grading plant (see Plate V-A). Sample 8115 is characteristic of the sand ①.

The Standard Sand and Gravel, Limited, on lots 119 to 123, Ste. Marie range, municipality of St. Félix de Valois, has workings in the same delta deposit, which constitutes an excellent and widespread source of sand and gravel. On this property, the sand is excavated by a mechanical shovel working against the face of the bank and the material is screened to the size required before shipment. This pit, also, is served by a spur from the main line of the Canadian Pacific railway. Sample 8701 represents the 'concrete sand' from this property.

The *City of Montreal* owns a property situated not far from that of Standard Sand and Gravel, Limited, on lots 500 to 502, St. Frédéric range, municipality of St. Félix de Valois. The workings are located on a bench cut into the steep north bank of L'Assomption river. The sand is well stratified in layers that range from fine to coarse, but in parts of the deposit it is largely of medium grain, with the coarse material relatively rare, and mostly in the lower part of the bank. Excavating is done with a steam shovel moving on a standard-gauge track linked by a spur to the main line of the Canadian Pacific railway.

① The numbers given here and in the descriptions that follow refer to sample numbers in Table I (page 77), of results of tests on building sand.

POINTE AU CALUMET, TWO MOUNTAINS COUNTY:

Near the north shore of the lake of Two Mountains, off Pointe au Calumet, the *Consolidated Oka Sand and Gravel Company, Limited*, is dredging sand from the lake bottom. The sand is pumped into a dredge, from which it is conveyed to a series of screens for grading. Sample 7370 is representative of the sand.

On Pointe au Calumet, which is in the parish of St. Joseph du Lac, the sand rises from the water's edge to a terrace which represents the level of the lake in some former period. The upper part of this deposit consists of fine sand, in thin, horizontal layers. Below this is clean, coarse to medium sand in layers that dip steeply towards the northeast, probably stratified through streams action. The thickness of the deposit does not seem to be more than twenty feet. Two operators on adjoining properties are at present producing bank-run material from this deposit: the *Point Calumet Sand and Gravel Company, Limited*, on lots 57 and 58 (sample 9039), and the *Two Mountains Sand Company, Limited*, on lots 62 and 68 (sample 8610).

SOUTH DURHAM, DRUMMOND COUNTY:

Some of the best sand produced in the Province is that obtained from the esker deposits of South Durham. They represent glacially accumulated clean sands which have been thoroughly washed and sorted.

The Bonner Sand and Ballast, Limited, on lot 11, concession X, Durham township, is working one of these deposits at a point one mile east of the railway station at South Durham. The excavation, which is 80 to 125 feet in height, extends over 800 feet in length. The material in the western section of the bank-face is mostly gravel, with lenses of coarse sand, whereas that at the eastern end shows large streaks of coarse sand suitable for concrete aggregate without screening. Concrete sand constitutes the main production. The material is excavated with a one and a half yard steam-shovel working in the face of the pit, and is loaded into railway cars. A spur line connects the property with the main line of the Canadian National railway. Sample 9174 represents the concrete sand.

At about one mile to the west, in the same esker deposit, is the property of the *Dominion Sand and Stone Company, Limited,* on lots 14 and 15, concession IX. The bank, which is more than 100 feet in height, is worked in three levels. In the two upper levels, excavating is done by hand and the material loaded directly into railway cars; in the bottom level, a steam shovel is used. The deposit holds a considerable amount of coarse sand, and occasional lenses of gravel, in the upper part. The sand is of excellent quality for concrete work, but production is not large at present. Sample 8818 is representative. Shipments are made over the Canadian National railway, with which the property is connected by a spur line.

ST. HENRI DE MASCOUCHE, L'ASSOMPTION COUNTY:

To the northeast of this village there is a typical beach deposit of very fine sand. The bank rises about thirty feet to a terrace which is conspicuous for many miles along the road leading to L'Epiphanie. Southwest of this ridge, near the Mascouche river, a delta deposit has been formed, probably during the same stage of the Champlain sea. It varies in thickness from ten to fifteen feet. This sand is usually of medium grain, and samples 6606, 8313, 7547, 8512, and 7520 are representative of it. On account of the relative thinness of the deposit, the excavating is usually done by bucket elevator. All the material produced is taken by truck to Montreal, where it is used as mortar and concrete sand. There are a number of adjoining properties, operated as present by:

Lebeau, Louis	St. Pierre range	Lot 319
Thouin, J	Rang Sud du Bas de Mascouche	Lot 134
Therrien, G	" " " "	Lot ?
Lussien, Azarie	" " " "	Lot 135
Beauchamp, L	" " " "	Lot 116
Nantel, Louis	" " " "	Lot 115
St. Eustache Sand and Stone Co	" " " "	Lot 107
Venne, Oscar	Lachenaie parish	Lot 185

St. Grégoire, Iberville County:

At St. Grégoire, on the south side of Mount Johnson, a deposit of sand and gravel is worked by three operators: *Pierre Benjamin, Emile Tétreault,* and *J. A. Benoit.* The working face in the pit of J. A. Benoit, on lot 178, Chartier range, shows three feet of yellow sand at the top, followed by twenty feet of gravel. This deposit was formed during the recession of the Champlain sea, the mountain acting like a high wall, at the base of which the sand and gravel accumulated. The operators are digging the deposit by hand and the output is sold as building sand and road material.

Other Localities:

Some building sand is shipped to the metropolitan district of Montreal from Ste. Julienne, near Rawdon, in Montcalm county. The *Brouillet Sand and Gravel Company, Limited,* is the principal operator. Sample 7304 is representative of the sand of this locality.

There is some production at Ste. Dorothée and at Ste. Rose West, 12 miles northwest of Montreal, from a deposit of stratified sand varying from 10 to 15 feet in thickness. All the production is trucked to Montreal. The operators are *Noel Dutrizac,* on lot 174, parish of Ste. Rose, and *Omer Bigras,* on lots 167 to 172, parish of Ste. Rose. Sample 8458 is representative of the sand.

Other supplies of sand for the Montreal market are obtained from dredging operations in the St. Lawrence river near Sorel, and in the St. Maurice river near Trois Rivières. Sample 6903 is representative of the St. Maurice River sand.

Quebec District

The main sources of supply of building sand in the Quebec district are the deposits of the St. Charles River basin, and those near Montmorency river in the municipality of Beauport.

La Compagnie de Sable, Limitée, is dredging sand from the mouth of the St. Charles river with a floating clam-shell dredge, loading the material into their own bins and one barge. A two-yard bucket is used for the digging and the unloading of the sand. The material is marketed as a natural concrete aggregate without further treatment.

A slack-line cableway has also been in operation across the river since the spring of 1933. This Company is the largest producer in the Quebec district. Sample 1001 is representative of the sand.

Many small sand-pits have been opened along the road to lake Beauport, in the St. Charles River basin. All the material is of glacial origin, derived from granite or gneissic rock. The deposits are in the form of kames and morainic terraces. The operators of pits in this locality are *J. Beaubien, J. B. Bigaouette, V. Giguère,* and *A. Desjardins.* Sample 1002, taken at Beaubien's pit, on lots 70 to 72, range IV, parish of St. Dunstan, is typical of the coarse sand in these deposits.

In the municipality of Beauport is a series of delta deposits, formed by the south-flowing rivers during the period of the Champlain submergence. These deposits constitute one of the most satisfactory sources of sand and gravel, being located conveniently for transportation. Pits are operated here by the *City of Quebec, A. Lagacé,* and *G. Robert.* The concrete sand from the pit operated by the City of Quebec, on lots 328 to 342, is represented by sample 1000.

At present, none of the sand and gravel produced in the Quebec district goes through a washing and grading treatment.

Trois Rivières District

North of the city of Trois Rivières, a sand beach terrace, at an elevation of about 75 feet, is well developed. Several small pits have been opened here along the LeJeune road. The thickness of the sand seems to be about 25 feet, but for the most part the material is too fine in texture to be used for concrete work. The *Three Rivers Sand Company* is the principal operator in the locality.

At Mont Carmel, in Champlain county, fifteen miles north of Trois Rivières, a glacial moraine deposit, in the form of a large knoll more than 150 feet in height, has been opened by *Euclide Marchand* on lot 472, St. Louis range, parish of Notre Dame du Carmel. The side-hill excavation exposes clean sand and gravel, uniformly graded and free from friable particles. The product is sold as road gravel, concrete aggregate, and filtering material.

Sherbrooke District

Several pits have been opened in esker deposits in the neighbourhood of Sherbrooke. All the sand and gravel produced is excavated by hand and used locally. The principal operators are: *The City of Sherbrooke, W. Brault, N. Poliquin, N. Price, T. Chauret, C. Bennett,* and *N. Théroux.*

TABLE I.—TESTS ON BUILDING SANDS

Sample No.	Locality	Sieve Analysis (Per cent retained on sieves)						Fineness Modulus	Organic (Parts per million)	Deleterious Substances %	Tensile Strength (Per cent of Standard)	
		4	8	14	28	48	100				7-day	28-day
8115	St. Félix de Valois: The Standard Lime Company, Ltd.	2.0	10.9	16.9	30.0	25.9	11.3	2.9	25	0.2	114	100
8701	St. Félix de Valois: Standard Sand & Gravel, Limited	7.0	8.2	15.3	34.0	24.4	10.2	3.1	25	0.1	104	91
7370	Oka: Consolidated Oka Sand & Gravel Company, Limited	....	....	7.7	48.1	30.2	11.9	2.5	25	0.5	104	100
8610	Oka: Two Mountains Sand Company, Limited	....	....	0.9	61.7	31.4	4.9	2.6	none	0.3	101	100
9039	Oka: Point Calumet Sand and Gravel Company, Limited	....	....	2.7	64.3	25.3	6.5	2.6	25	0.4	111	110
9174	South Durham: Bonner Sand & Ballast, Ltd	6.5	8.0	9.9	19.8	23.8	19.1	2.4	none	1.5	134	145
8818	South Durham: Dominion Sand & Stone Company, Limited	6.7	8.6	10.8	20.6	24.4	19.5	2.6	25	1.3	122	122
6606	Mascouche: Nantel, Louis	....	1.6	15.4	42.9	35.2	4.0	2.7	100	0.4	111	84
8313	Mascouche: St. Eustache Sand & Stone Company	....	0.5	6.6	48.6	39.1	3.6	2.6	100	1.0	77	85
7547	Mascouche: Therrien, G	0.9	3.8	18.3	46.8	27.8	1.7	2.9	50	0.4	90	87
8512	Mascouche: Thouin, J	0.1	1.5	16.1	46.1	27.7	6.9	2.7	75	0.5	90	85
7520	Mascouche: Beauchamp, L	....	2.3	14.3	42.1	31.9	8.4	2.7	100	0.4	97	82
8458	Ste. Rose West: Bigras, Omer	....	0.8	13.3	28.0	33.7	22.6	2.3	none	0.1	100	106
7304	Ste. Julienne: Brouillet Sand & Gravel Company, Ltd	1.8	12.6	20.6	28.3	20.8	12.0	2.9	25	0.7	130	123
6903	St. Maurice River: Consolidated Oka Sand & Gravel Co., Ltd.	....	0.3	4.8	52.3	32.7	8.0	2.5	60	0.8	80	81
1000	Municipality of Beauport: City of Quebec	1.8	1.3	2.8	11.7	32.7	41.7	1.7	25	0.6	95	87
1001	Quebec: La Compagnie de Sable, Limitée	....	2.9	7.6	23.8	40.9	20.7	2.2	25	1.5	101	99
1002	Lac Beauport: Beaubien, J	4.8	6.7	15.3	24.6	30.6	15.7	2.7	75	0.2	99	180
1003	Sherbrooke: City of Sherbrooke	....	1.0	1.5	16.5	50.5	22.5	1.9	25	1.8	130	142

Ten to fifteen samples of each sand have been taken and tested and the most usual result has been given in this table.

Chicoutimi District

In the lowland region of Lake St. John are numerous glacial moraines and kames, as well as shore-line deposits formed during the period of submergence.

For building purposes, the supply is obtained chiefly from deposits that are within easy transportation distance of the main centres of consumption, which are the towns of Chicoutimi, Jonquière and Kenogami.

One of the largest deposits in the locality is on lot 19A of the town of Chicoutimi. Two large pits have been opened here in the slope of a knoll a short distance from the south bank of the Saguenay river. At the west end of the deposit, the material consists of gravel, containing a large percentage of boulders, whereas, towards the Du-Moulin river, thick layers of sand are interbedded with the gravel. The operators are *Gauthier and Tremblay* and *Euclide Perron.*

On lot 1042, of the town of Chicoutimi, another important deposit is operated by *Gosselin and Gosselin.* The 80-foot bank of the pit shows, at the top, a medium to coarse gravel. Below this is coarse sand with layers of fine gravel.

GRAVEL FOR BALLAST

Any true gravel is suitable for ballast, provided the aggregate is sound. The grading, however, has to be considered, since it directly controls the stability of the roadbed.

In 1932, 1,088,090 tons of gravel ballast were produced by the railway companies for their own use. In 1933 these operations were greatly reduced. The more important of the deposits are the following:

Canadian National Railway Pits

Notre Dame des Anges Pit, on Lot 7, Range N.E., Chavigny Township, Portneuf County.—This pit has been opened in a high bank on the south side of the main line of the railway. It has a total length of about 2,000 feet, with a face up to 150 feet in height. The gravel at the working face appears clean and of medium coarseness, but with some 'pebbles' up to one foot in diameter. A steam shovel is used for excavation and loads the material into cars on a siding.

St. Andrews Pit, on Lot 48A, Parish of St. Andrews, Argenteuil County.

St. Régis Pit, two miles southeast of Ste. Philomène, Chateauguay County.—The deposit here is a stratified marine terrace, with layers dipping towards the north. On the whole, the deposit is not uniform, alternations from coarse gravel to sand occurring in some parts of the pit. The material is hard, but contains a certain amount of clay. A steam shovel is used for excavation and dumps the material into cars on a spur line of the railway. Plate IV-B illustrates the method of excavation as well as the character of the deposit.

Coaticook Pit, on Lot 226, Village of Coaticook, Stanstead County.—A large esker deposit has been excavated to a depth of eighty feet. The pit extends for about one mile and has a width of nearly 700 feet. The bank shows gravel throughout, the aggregate varying from coarse sand to 5-inch gravel, with very few boulders. The gravel is in places strongly cemented together, which is due to a certain percentage of limestone pebbles. A considerable quantity of high-grade sand and gravel is still available here. The material is loaded by steam-shovel directly into cars and transported over a spur to the main line of the railway.

Canadian Pacific Railway Pits

Pont Rouge Pit, on Lots 291 to 297, Parish of Cap Santé, Portneuf County.—This pit adjoins the main line of the railway about one mile northwest of the station at Pont Rouge. A low ridge of sand and gravel has been excavated for gravel ballast. The material seems to be mostly fine, but clean, yellow sand, with some gravel layers, which are fairly free from large boulders. It is not very well exposed in the excavation, however, due to loose wash sand which has fallen down the face.

Ste. Marguerite Pit, on Lots 16 and 17, Augmentation des Milles Iles Township, Terrebonne County.—This pit was worked extensively several years ago. The present working face is 6 feet to 10 feet high. The material is not uniform, there being alternate layers of sand and gravel.

Some material has been excavated also on lots 3 and 4, range VI, Wexford township, of Terrebonne county.

Pit on Lot 51, Aylwin Township, Hull County.—This deposit was evidently worked for some considerable time, as the amount of material removed has been quite large. The present working face is an average of about one hundred and twenty-five feet back from the main line. The material is chiefly sand of various grades, with a few gravel and sandy-clay layers.

Pit on Lot 50, Range II, Denholm Township, Hull County.—A very large gravel pit has been in operation here, in a steep north-south ridge which parallels the river. The gravel varies from fine sand to boulders a foot or more in diameter. The pebbles are largely composed of limestone and granite.

Bolton Centre Pit, on Lot 16, Range VII, Bolton Township, Brome County.—This pit is in a large esker deposit. The bank is 80 feet high. The material is non-uniform, with layers composed of fine sand and coarse gravel alternating with layers of fine gravel.

MATERIAL FOR ROAD CONSTRUCTION

In the Province of Quebec, a very important use of sand and gravel is in surfacing roads. More than 85 per cent of our surfaced roads are so constructed. Road gravel should be well graded, fine, and hard. It should be largely composed of pebbles of sufficient durability to resist traffic wear, but with enough friable matter present to provide bonding material. If shale is present in large amount, the gravel has poor wearing qualities.

The Department of Roads' specifications call for a gravel, to be spread in one or two layers, composed of stones of a maximum size of three inches (3″) in the lower part, two inches (2″) in the middle, and one inch (1″) at the surface. It is also stipulated in the regulations that gravel shall be screened if required, before bringing it on the road. The size of the mesh of the screen may vary from one and one-quarter inch (1 1-4″) to one and three-quarter inch (1 3-4″).

In the case of oversize gravel, it was formerly the practice to screen the material, using only the fines on the road and rejecting the coarse as waste. Now it is customary to run such oversize gravel through a

crusher, by which means a better graded gravel is obtained and there is no waste. On the main trunk gravel roads of the Province, this method has been in use for some time.

During the years 1929 to 1931, R. H. Picher, of the Mines Branch, Department of Mines, Ottawa, investigated the principal deposits of gravel in the Province which have been worked from time to time for road construction, as well as many sand and gravel deposits that have been exploited mainly for the production of cement mortar and concrete aggregate. His survey covered deposits in all parts of the Province with the exception of the Abitibi and Lake St. John regions. Mr. Picher's reports appear in Mines Branch publications Nos. 722 and 726, *Investigations in Ceramics and Road Materials*, for the years 1928-29 and 1930-31, respectively. In these reports, descriptions of the deposits examined are followed by tables giving, for representative samples from each deposit examined, the results of screen analyses, and, for the more important deposits, the results of 'mortar tests' on the minus-$\frac{1}{4}$-inch (sand or fine-aggregate) material screened from the gravel.

INDUSTRIAL SANDS

Moulding Sand

The moulding sands of the Province are found principally along the banks of rivers. They represent material that has been re-worked during recent flood periods. The sand is fine in texture and consists of quartz particles, bonded usually by plastic clay. The deposits seldom exceed one foot in thickness, but some are known with a depth of three to five feet, and it is possible that these could be developed commercially. The small quantity of moulding sand produced at the present time is consumed, as a rule, in the locality where produced, by a nearby foundry. The operators are not experienced in the sorting of grades for particular classes of foundry work. This grading is important, since the requirements in moulding sand vary according to the purpose for which the material is required. For instance, the finer sands are used in malleable and grey-iron foundries and for casting brass, copper, and aluminium; whereas a coarse, highly refractory, open sand is demanded by the steel industry.

Approximately 5,000 tons of moulding sand were imported into the Province in each of the years 1932 and 1933. Of the total, 3,000 tons was fine grained material, mainly 'Albany moulding sand' from the Hudson valley, State of New York; the balance was a coarse-grained silica type from Ottawa, in the State of Illinois.

The price of these sands laid down in the cities of Montreal, Trois Rivières, Quebec, and Sherbrooke ranges from $5 to $8 per net ton. The requirements of the foundries are supplied mainly through the *Canadian Foundry Supplies & Equipment Company, Limited*, of Montreal.

FINE-GRAINED MOULDING SAND:

St. Hyacinthe County.—Just north of Notre Dame cemetery in the city of St. Hyacinthe, on lot 59, Notre Dame de la Rivière Yamaska range, a deposit of moulding sand extends as a narrow strip along the bank of Yamaska river. This sand, which is a recent flood deposit, is of very fine texture and strongly bonded with clayey matter, which makes up about one-fourth of the entire mass. A vertical section shows a thickness of three to four feet of moulding sand grading downwards into silt and clay. Some of this sand has been shipped to foundries in Montreal, but most of the production is used in local moulding works. The results of laboratory tests ① on this and other moulding sands are given in Table II (p. 84). Sample 1 in that table is representative of the sand from the city of St. Hyacinthe.

Bagot County.—For more than twenty-five years, there has been some production of moulding sand from a deposit on the Lapointe farm, in Bagot county, about five miles south of St. Hyacinthe, on lots 226 and 227, St. Dominique N.E. range. The deposit is from two to four feet thick, but rapid changes in texture and the presence of lenses of sharp sand make it necessary to select the places for the required qualities of run-of-bank. The moulding sand lies directly beneath the soil and is succeeded in depth by loose, open sand. This moulding sand has been used in local foundries at St. Hyacinthe, and castings of twelve feet in diameter have been made with it. Sample 2 (Table II) is representative of the sand.

① Laboratory tests to determine the grading of grain size, the grain fineness number, the clay content, and the grade number, have been made according to the standard and tentatively-adopted methods of testing and grading foundry sands, American Foundrymen's Association, 1928. The Tyler standard series was adopted for the screen analysis.

There are encouraging indications that careful prospecting in St. Hyacinthe and Bagot counties would reveal deposits of good moulding sand, of sufficient thickness to be of commercial value.

Argenteuil County.—One mile east of Brownsburg, on lot 6, range 8, of Chatham township, a deposit of yellow-buff moulding sand outcrops along the side of a creek. It is a typical weathered type of moulding sand, six inches to one foot in thickness. Some of this sand has been used in a small foundry at Brownsburg. It is suitable for the general run of small castings. Sample 3 is representative.

Portneuf County.—At Pont Rouge, moulding sand is excavated by the *Supreme Foundry Company*, from a deposit along the side of Jacques Cartier river, only a few feet from their foundry shop. The sand layer is about 18 inches in thickness, and is yellow-brown to reddish-brown in colour. This sand is quite fine in texture, strongly bonded, and is suitable for small iron castings. Sample 4 indicates the analysis of this sand.

L'Assomption County.—On the *J. Landry* farm, on lot 463, Côte Nord du Bas de l'Assomption range, a deposit of moulding sand about one foot thick occurs on the flat border of L'Assomption river. This weathered type of moulding sand has been excavated for local use for some twenty years. A stove foundry also obtains moulding sand from a deposit on lot 173 in the municipality of St. Sulpice, where *Z. Rivest* excavates the sand by hand-digging. The deposit is about one foot thick, of brown coloured sand with some interbedded clay seams. It extends on to the adjacent farm owned by *W. Robitaille*, who excavates the material by hand. Sample 5 represents the sand on the J. Landry farm, and sample 6 that excavated by Z. Rivest.

Missisquoi County.—Approximately five miles southeast of Farnham, on lot 30, range 3, of Farnham West township, moulding sand suitable for small castings occurs along the north side of Yamaska river. Sample 7 is representative of the material. The thickness is about two feet and the area covered is probably of small extent.

Other Occurrences.—Deposits of moulding sand are known to occur also near Actonvale, Bagot county, and in the county of St. Maurice near Trois Rivières.

TABLE II.—RESULTS OF TESTS ON FINE-GRAINED MOULDING SAND

	Sample No.						
	1	2	3	4	5	6	7
On 6-mesh	0.0	0.0	0.0	0.0	0.0	0.0	0.0
" 12 "	0.0	0.0	0.0	0.0	0.0	0.0	0.0
" 20 "	0.1	0.2	0.2	0.8	0.1	0.0	0.0
" 35 "	0.6	4.4	0.2	6.0	0.4	0.2	0.2
" 65 "	4.4	35.2	0.4	10.6	2.6	0.6	4.1
" 100 "	5.8	49.2	1.4	12.2	18.9	1.0	11.8
" 150 "	8.8	6.8	4.0	16.2	23.0	4.6	18.3
" 200 "	18.0	1.6	24.0	22.0	22.2	23.0	24.0
" 270 "	6.8	0.2	10.6	5.4	7.4	10.6	4.0
Pan	45.2	0.8	49.5	21.6	19.6	54.2	29.4
Clay	10.0	1.6	9.6	4.8	5.4	5.8	7.6
TOTAL	99.7	100.0	99.9	99.6	99.8	100.0	99.4
Grain fineness	210	62	227	143	151	235	171
Grade No	1E	5B	1D	2C	2D	1D	2D

Sample No. 1.—St. Hyacinthe.
" No. 2.—St. Dominique, Bagot county.
" No. 3.—Brownsburg, Chatham township.
" No. 4.—Pont Rouge, Portneuf county.
" No. 5.—L'Assomption.
" No. 6.—L'Assomption.
" No. 7.—Farnham West township.

COARSE-GRAINED SILICA-SAND FOR STEEL CASTINGS:

Small quantities of crushed quartzite and sandstone are used in the Province of Quebec for making moulds for steel castings.

At East Templeton, Papineau county, the *Ottawa Silica and Sand Stone, Limited*, is producing sand of several grades from Potsdam sandstone.

During the year 1932, *Canadian Kaolin Silica Products, Limited*, whose property is at St. Rémi, in Amherst township, Argenteuil county, commenced the production of silica-sand, obtained from a white quartzite carrying kaolin.

At Guigues, in Témiscamingue county, twelve miles north of Ville Marie, a deposit of sandstone for use as silica-sand has been opened-up recently, the output going to steel foundries in Montreal. The *Jas. H. Mason Engineering Corporation* is the operator.

A large deposit of white vein-quartz in Dequen township, Lake St. John county, was examined during the 1933 field-season by B. T. Denis, geologist of the Bureau of Mines. His report on the occurrence appears in Part *D* of this year's Annual Report, and it is also referred to in the section on Non-Metallics (*Quartz and Industrial Sand*) in the present volume. Analyses of the quartz from various parts of the deposit indicate that it is sufficiently low in iron and other impurities for use in the manufacture of certain grades of glass. *Silica Products of Canada, Limited,* are mining this quartz on their property on lots 2 and 3, range III, and early in 1934 they started work on the erection of a mill for grading the crushed product.

Sand for Sand-Blasting

The silica-sands mentioned above are also used for sand-blasting and for the manufacture of glass and carborundum. For sand-blasting purposes, these domestic sands are in many cases superior to those now imported from other countries. This is indicated by the results of tests made in the laboratory of the Federal Mines Branch, at Ottawa, in co-operation with the Department of Development of the Canadian Pacific Railway Company.

Core Sand

In making moulds for the interior spaces in castings, a sharp, pure sand, to which a binder is added, is used. In Quebec, the foundries usually obtain their supply of such sand from a local deposit. The grain may be extremely fine, medium, or coarse, depending on the size of the core and the surface-finish desired.

Sand-Lime Brick

Production of sand for the manufacture of silica brick amounted to 3,711 tons in 1933. The *Canadian Carborundum Company* is manufacturing sand-lime brick with sand obtained by crushing Potsdam sandstone from a deposit at St. Canut. The *Standard Lime Company, Limited,* is using sand from the deposit at St. Félix de Valois for the same purpose.

Filter Sand

The employment of sand and gravel in filtration plants for water purification provides another appreciable market for these materials. For this use, there are certain recognized standard specifications in regard to grain diameter, porosity, and composition. The more important requisites are that the sand be clean, free of clay and lime, and possess a degree of porosity that will permit the passage of water readily but retain all solids. There is some difference of opinion as to the most effective size and gradation of the filter sand. At the City of Montreal filter plant, the requirements are as follows for the gravel and sand sizes and depths of layers:

"No. 1 gravel shall be the bottom layer and shall be six inches in total depth. It shall be composed of pebbles passing a screen having $1\frac{1}{4}$-inch circular holes and retained on a screen having $\frac{3}{4}$-inch circular holes, and be uniformly graded between these sizes.

"No. 2 gravel shall be the second layer and shall be four inches in total depth. It shall be composed of pebbles passing a screen having $\frac{3}{4}$-inch circular holes and retained on a screen having $\frac{3}{8}$-inch circular holes, and be uniformly graded between these sizes.

"No. 3 gravel shall be the third layer and shall be three inches in total depth. It shall be composed of pebbles passing a screen having $\frac{3}{8}$-inch circular holes and retained on a screen having $\frac{3}{16}$-inch circular holes, and be uniformly graded between these sizes.

"No. 4 gravel shall be the top layer and shall be two inches in total depth. It shall be composed of pebbles passing a screen having $\frac{3}{16}$-inch circular holes and be retained on a screen having 10 meshes per lineal inch of No. 20 wire.

"The sand shall have an effective size of not less than 0.40 nor more than 0.50 of a millimeter and a uniformity coefficient of not more than 1.75. Not more than one per cent shall be finer than 0.29 of a millimeter. The diameters of sand grains shall be computed as the diameters of spheres of equal volume and all percentages shall be calculated by weight".

Minor Uses of Sand

In addition to the major uses of sand and gravel, discussed in the foregoing pages, sand is also employed for a variety of minor purposes. A fine sand is required for sheet asphalt pavements and fillers; a certain amount is used in stone-dressing plants, in sawing and rubbing marble and other stone; and small quantities are used as engine sand, fire sand, and in making sandpaper.

MINING OPERATIONS AND DEVELOPMENT IN WESTERN QUEBEC IN 1933

by R. H. Taschereau, Inspector of Mines

INTRODUCTION

The mining industry in western Quebec enjoyed a very prosperous year in 1933. Copper was in greater demand in the world's markets, resulting in a substantial rise in price above the previous year's lows; but the price still remained too low to arouse very much interest in exploration for deposits of the metal. Of outstanding importance to the industry, however, has been the phenomenal rise in the price of gold. Many small or low-grade gold veins, formerly not of commercial value, can now be successfully mined, and it is safe to predict that, if present conditions continue, many new and profitable mines will develop throughout the district.

Noranda Mines, Limited, was in a position to take advantage of the enhanced prices for both copper and gold, and the year 1934 will see a still further increase in production by this Company as a result of plant enlargement.

Siscoe Gold Mines, Limited, stepped-up production to over 300 tons per day, and, with the higher price for gold, this resulted in a very substantial gain in profits for this Company.

The 800-ton concentrator of the Beattie Gold Mines, Limited, was completed in May, and production was commenced immediately.

Granada Gold Mines, Limited, continued to treat 100 tons of ore per day, resulting in a production during the year of over 7,500 ounces in gold.

The Bussières mine was in operation throughout the year, and produced upwards of 115 tons of ore per day. In the fall, the control of the Company was taken over by the Quebec Gold Mining Corporation from its previous holders, the Treadwell-Yukon Company.

The Cadillac-O'Brien mine was in continuous operation, and the mill treated about sixty tons of ore per day.

The Greene-Stabell mine was equipped with a 100-ton mill, and the first gold brick was poured towards the end of the year.

Small test-mills were erected at the Minrand and Northern Quebec Prospectors properties, but no production was recorded. The test-mill at the Mathews mine recovered over 80 ounces in gold.

New mills are promised for the McWatters, Sullivan Consolidated, Thompson-Cadillac, and Mathews properties, and it is planned to have these mines in production in 1934. Many other promising prospects will undoubtedly be brought into profitable operation within the next few years.

The interest in base-metals is reviving. Aldermac Mines, Limited, is planning to operate its mine and mill in 1934, and Normetal Mining Corporation is performing underground exploration work in anticipation of an advance in copper and zinc prices.

TRANSPORTATION

A number of motor roads were built during 1933, or were under construction at the end of the year. Other roads were improved for motor traffic.

For the transportation of concentrates, rails were laid from the Beattie mine to Davangus, on the Canadian National Railways' Taschereau-Noranda branch. A light tramway line was also constructed from the Greene-Stabell mine to lake de Montigny.

The 'bus service was maintained twice daily from spring to fall between the towns of Rouyn, Senneterre, and La Reine.

Steamboat services were in operation from Amos to the Dubuisson, Bourlamaque, and Pascalis areas.

Airplane transportation was provided by several organizations with bases at Rouyn, Noranda, Amos, and Senneterre. Winter landing-fields were prepared at the Cadillac-O'Brien and Lamaque mines.

HYDRO-ELECTRIC POWER

Early in 1933, the construction of a power line from Noranda to the Beattie mine was commenced, and this was completed in April. During the summer, a transmission line was erected to the Arntfield mine.

In the fall, plans were made to supply hydro-electric power to the mines in the Harricanaw district. This power line will serve the Bousquet, Cadillac, Malartic, Dubuisson, and Bourlamaque fields. A sub-station is to be constructed at Blouin lake. In April, 1934, this line was completed as far as the Cadillac-O'Brien mine.

GEOLOGICAL FIELD WORK

The Geological Survey of Canada had three field parties working in Western Quebec during the summer, and the Bureau of Mines, four parties. These were as follows:

GEOLOGICAL SURVEY OF CANADA:

M. E. Wilson continued detailed mapping of the Noranda-Waite area.

A. H. Lang revised a part of the Kinojevis map-sheet.

L. J. Weeks commenced geological mapping of the Amos quadrangle.

QUEBEC BUREAU OF MINES:

J. J. O'Neill made a detailed study of an area east of the Beattie mine.

L. V. Bell, of the Division of Geology of the Bureau of Mines, in co-operation with A. M. Bell, mapped the geology of Courville, Senneterre, Montgay, and Carpentier townships, and completed the examination of the northern parts of Pascalis and Tiblemont townships.

J. E. Hawley made a detailed study of the McWatters gold belt, Rouyn and Joannes townships.

J. A. Retty made an exploration trip up the Gatineau river to the Transcontinental (Canadian National) railway.

DESCRIPTION OF PROPERTIES

Dasserat Township

Balzimer-Mitto Group.—This group of claims is situated to the north of lake Labyrinthe, and includes the following: T-2103 to T-2117, inclusive. A description of the geology, and of previous work on the claims, will be found in Memoir 166 of the Geological Survey of Canada, *Geology and Ore Deposits of Rouyn-Harricanaw Region, Quebec* (Cooke, James and Mawdsley), under the title *Russian Kid Claims* (p. 234).

In the fall of 1933, some diamond drilling was carried out on this group, five holes totalling 1,244 feet being drilled. It is reported that this drilling proved the vein for a length of 300 feet, and that it averaged about seven feet in width. One hole encountered encouraging gold values.

Beauchastel Township

Aldermac Mines, Limited.—In the early months of 1932, the 500-ton concentrator was in intermittent operation, and a few carloads of pyritic concentrates were shipped. Mining operations were suspended at that time, and were not resumed until August, 1933, when dewatering of the underground workings was commenced. Lateral work was resumed on the 375- and 500-foot levels at this time, and ore broken in this work was sent to the concentrator. The concentrator was operated in this way for about one month; it was then shut down. In November, enlargement of the shaft from two to three compartments was commenced, and this work was in progress at the end of the year.

In addition to the lateral work performed on the 500-foot level, the No. 4 ore-body was partially developed for sub-level mining practice. A raise was driven on the north side of the main drift to a height of 65 feet, and two sub-levels were started from this raise. The sub-levels are driven at 21-foot vertical intervals, leaving a 14-foot pillar to be extracted in the actual stoping operation. Some box-holes were also started from the level cross-cuts.

Arntfield Gold Mines, Limited.—Underground operations were continued at this property throughout 1933. The inclined raise which was driven to surface from the 230-foot level in the previous year was equipped for use as the main hoisting shaft. A headframe and a combined hoist-house and boiler-house were constructed, and the equipment installed included a 500 cu. ft. compressor driven by a 100 h.p. Diesel engine, a 10 in. by 12 in. steam hoist, and a 125 h.p. *H.R.T.* boiler. In September, 1933, an electric power line was connected with the Northern Quebec Power Company's sub-station, and another 500 cu. ft. compressor was installed. New construction during the year also included a bunkhouse, a sub-station, and a headframe and hoist-house for a new shaft.

Underground work during the first part of the year was confined to the No. 2 shaft workings. A drift was driven on a vein at the 60-foot level for a length of about 150 feet, and several short cross-cuts were driven from the drift. Some encouraging gold values were encountered in this zone, but the east face of the drift struck some seams containing surface clays, and it was deemed advisable to discontinue work at this horizon: the face has been dammed-off with a concrete bulkhead.

The second level was developed on an inclined depth of 160 feet, and approximately 750 feet of east and west drifting was completed, together with a number of north and south cross-cuts. This drift follows a well-defined hanging-wall, and it is reported that encouraging gold values have been obtained across 25-foot widths. Some diamond drilling was carried out from this level early in the year.

Sinking of the No. 2 shaft was resumed in the summer months, and this was completed to the 500-foot level at the end of the year.

Several years ago, during the course of surface work and diamond drilling, encouraging gold values were found in a sheared mineralized zone at a point about 2,000 feet east of the present No. 2 shaft. In the summer of 1933, it was decided to sink a small inclined shaft on this deposit. This shaft measures 6 ft. by 8 ft., and is inclined to the north at 45 degrees. In the upper part of the shaft, numerous quartz stringers are exposed, and some very spectacular free gold was found in this material. The shaft was continued to a depth of 250 feet. At a depth of 60 feet, a cross-cut was driven to north and south for a distance of 70 feet. Quartz stringers occur scattered throughout the length of the cross-cut.

Buffam Claims.—During the early months of 1933, exploration work was continued on this group, and a diamond drilling programme totalling 800 feet was completed. The results of this drilling were indefinite, and operations were suspended.

Francœur Gold Mines, Limited.—Diamond drilling was resumed on this property in the spring of 1933. Two deep holes were put down to depths of 416 and 652 feet. The results have not been published, and no further work was performed during the year. The Company plans to carry out a programme of underground exploration work in 1934.

Halliwell Gold Mines, Limited.—During the summer of 1933, four diamond-drill holes were put down on this property to a total depth of 1,000 feet. It is reported that this work was performed by the Quebec Gold Mining Corporation under an option agreement.

Normont Gold Mines, Limited.—The following claims, situated astride the Rouyn-Beauchastel boundary, are registered in the name of this Company: T-411*a* to T-415, T-2098 to T-2102. The camps are situated on the east part of T-2098.

During the fall and winter months of 1924 and 1925, the Huronian Belt Company explored this group. Trenching, test-pitting, and diamond drilling were carried out at this time. The work was concentrated on a gold-bearing vein on claim T-412. This vein, known as No. 12, is composed of white quartz with inclusions of chloritized schist and tourmaline, and is mineralized with pyrite and minor amounts of chalcopyrite and galena. According to reliable information, it was traced on surface for a length of 350 feet, and it showed a maximum width of eight feet. It strikes N.70°W. and dips 50°N. A second vein, known as No. 11, lies to the west of No. 12; it strikes nearly due north and consists of several short lenticular masses of quartz.

In the early work, 2,000 feet of diamond drilling was completed in six holes, five of which were drilled in the No. 12 vein area, and one on T-414. A prospect shaft was also put down on the No. 12 vein to a depth of 44 feet. It is reported that the walls of the shaft assayed 0.64 ounces per ton in gold over a width of 4.8 feet and to a depth of 38 feet.

During the summer months of 1933, further trenching was carried out, and a 2,000-foot diamond-drilling programme was completed in eight holes. In December, the sinking of an inclined shaft was commenced near the western outcrop of No. 12 vein. A hoist-house and headframe were constructed, and equipment was installed; this included a 6 in. by 8 in. steam hoist, a 25 h.p. boiler, and a 370 cu. ft. gasoline-driven compressor. The shaft measures 7 ft. by 10 ft. and is inclined at 61.5 degrees to the north.

In January, 1934, the shaft was completed to an inclined depth of 100 feet, at which horizon a cross-cut was driven to the north for a length of 70 feet. A quartz vein was intersected at 30 feet from the shaft, and this vein was followed to the northwest for a distance of over 100 feet: the vein apparently averages about four feet in width for this distance. The southeast drift followed a well-defined fracture, but at the end of January, 1934, no definite vein matter had been encountered.

The hoist-house was burned to the ground in February, 1934, and operations were temporarily suspended.

Rouyn Township

Adanac Gold Mines, Limited.—This Company continued surface work, and carried out a programme of diamond drilling in which 19 holes, totalling 3,757 feet, were put down. Towards the end of the year, plans were completed for the sinking of a three-compartment shaft, and this work was commenced with hand steel pending the installation of suitable machinery.

Arno Mines, Limited.—This Company holds the mining rights to two groups of claims in the township of Rouyn. One group is situated on the Kinojevis river to the north of Routhier lake, and consists of claims R-13147 to R-13151. The second group lies to the west of the McWatters mine, and consists of claims R-11609, R-11489, and R-11477 to R-11483.

During the summer of 1933, a large amount of stripping and trenching was completed in the deep overburden on the second group, and a pit was sunk to a depth of 25 feet on claim R-11481: two short

cross-cuts, totalling 27 feet, were driven from the bottom of this pit. Some narrow quartz veins were intersected, but no discoveries of importance were reported.

Astoria Rouyn Mines, Limited.—During the early part of 1933, several diamond-drill holes were put down on this property to a total depth of 900 feet. No further work of importance was recorded during the year.

Bagamac Rouyn Mines, Limited.—In the spring of 1933, the sinking of a 7 ft. by 9 ft. vertical shaft was commenced on Block 41. This shaft is located on the south slope of 'Bagamac' hill. Light mining equipment was installed, and this included a 310 cu. ft. gasoline compressor and a 6 in. by 8 in. hoist. The shaft was completed to a depth of 210 feet, and about 110 feet of lateral work was carried out at the 200-foot level. This work was performed to explore a sheared zone reported to contain gold values.

Brownlee Mines, Limited.—This Company is a reorganization of Brownlee Gold Mines, Limited. Some trenching was carried out during the summer months, and in the fall an extensive diamond-drilling programme was completed to a total depth of 6,444 feet. The Company reports that very encouraging gold values were found in a mineralized silicified rhyolite.

Clericy Consolidated Mines, Limited.—In 1933, this Company performed surface work on the 'Christie' claims at Rouyn lake. These claims are numbered T-4741 to T-4744. Six diamond-drill holes, totalling 674 feet, were also put down. It is reported that the drilling encountered encouraging gold values in a mineralized rhyolite over a length of 250 feet. It is planned to carry out further work on this group in 1934.

East Rouyn Gold Mines, Limited.—In 1933, this Company explored a group of claims situated adjacent to the east boundary of Rouyn township and comprising R-10829 to R-10833 and R-10941 to R-10955.

The claims are, for the most part, covered by heavy overburden, necessitating a large amount of very deep stripping to reach bedrock. Several fractured zones were encountered, and in one place there is a

width of 20 feet composed largely of quartz and containing low gold values. Diamond drilling was commenced in the fall of the year, and this totalled 4,081 feet.

Erie Canadian Mines, Limited.—In 1933, this Company held an option on a group of claims situated in the southeast quarter of Rouyn township. The group includes the following: R-10878, R-10879, R-11056 to R-11060, R-11151 to R-11155, R-11281 to R-11285, and R-12684 to R-12686.

A considerable amount of stripping and trenching was performed. This work explored several quartz veins. A diamond drilling programme followed, and on the completion of 1,500 feet of drilling operations were suspended.

Granada Gold Mines, Limited.—Operations were continued throughout the year under review. In May, the new inclined shaft was made continuous from the surface to the 9th level. This level is at an inclined depth of 1,400 feet below the collar. Deepening of this shaft was also completed to the 13th level, a depth on the incline of 2,100 feet. It is inclined at 48 degrees as far as the 9th level, and from this horizon it steepens to 50 degrees.

The double-drum electric hoist was removed from underground, and was installed in the new hoist-house on the surface. A substantial headframe was also constructed. The ore is dumped from the skips into bins above the 5th level and is trammed to the No. 1 shaft. Waste is hoisted to bins in the new headframe.

Stoping was continued at many points on nearly all levels. On the first level, a short stope was started on No. 2 vein, and some drifting and diamond drilling was carried out. On the 3rd level, some stopes were started, and drifting to the east had been resumed at the end of the year. A new stope was also started above the 4th level. On the 5th level, drifting was continued to the east to a distance of about half a mile from the No. 1 shaft. As the stopes in the west end of the workings became depleted, new stopes were started east of the main fault. A considerable amount of mill-ore was drawn from *K* and *L* stopes; these are 1,500 feet from the shaft. Stoping and development work were continued on the 6th, 7th, and 8th levels. On the 9th level, exploratory drifting was carried out on the No. 2

and No. 3 veins. Exploratory work was also started on the 10th, 11th, 12th, and 13th levels, and loading pockets were completed at these horizons.

The mill continued to treat upwards of 100 tons of ore per day, and over 7,500 ounces of gold was produced. The Hadsel mill, installed in the previous year, was in operation for a short while, but it was apparently unsuccessful on this type of ore, and it was shut down.

Kinojevis Mining Company, Limited.—During 1933, this property was under option to the Consolidated Mining and Smelting Company of Canada. A large amount of deep stripping and trenching was carried out at this time, and this was followed by a programme of diamond drilling: the drilling totalled 4,141 feet. The option was relinquished early in 1934.

McWatters Gold Mines, Limited.—A diamond drilling programme, commenced in 1932, was completed in February, 1933. In this programme, 19 holes, totalling 5,000 feet, were put down. This work confirmed the presence of gold-bearing quartz lenses, and a three-compartment vertical shaft was sunk in the foot-wall of the ore-zone.

Light mining equipment was installed, but this was soon replaced by more substantial machinery. This includes a 1,200 cu. ft. steam-driven compressor, two 120 h.p. boilers, and a 10 in. by 12 in. double-drum steam hoist.

The shaft was completed to a depth of 418 feet, and levels were established at the 150-, 275-, and 400-foot horizons.

The underground work has proved the presence of a number of small ore-lenses. In a report to the Company made in March, 1934, Dr. W. F. James has estimated that a tonnage of 23,700 tons of ore averaging 0.55 ounces per ton in gold has been developed from the surface to a short distance below the 150-foot level.

On the first (150-foot) level, a cross-cut was driven to the north-west, and drifting was carried to east and west on two mineralized zones. The ore lenses occur at intervals along these zones. They

are up to 80 feet in length, and average from five to ten feet in width. A test sample of 400 pounds sent to the Mines Branch at Ottawa averaged 4.1 ounces in gold.

On the second (275-foot) level, a cross-cut has been driven to the northwest, and drifting was carried out to a total length of about 500 feet.

On the third (400-foot) level, a cross-cut was driven to the northwest for a distance of over 300 feet. At the end of the year, no well-defined ore zone had been located at this horizon.

The diamond drilling and underground work carried out to date has been of an exploratory nature, but there has been enough ore developed to warrant the erection of a 50-ton mill. It is planned to have this mine in production in the summer of 1934.

Noranda Mines, Limited.—The General Manager's report on the Company's operations for the year 1933 presents the following information relating to the Horne property:

"MINE:

"No. 4 shaft was deepened from 2,560 feet to 3,048 feet, and stations were cut on the 2,600-foot, 2,725-foot, 2,850-foot, and 2,975-foot levels.

"14,262 feet of drifting, 1,914 feet of raising in rock, and 52,639 feet of diamond drilling was done, and 239,641 cu. feet of rock was excavated in station-cutting and drift-widening.

"During the early part of the year under review, ten vertical, and two inclined, diamond-drill holes were put down in the 'lower *H*' ore-body from the 2475-foot level, the deepest level on which any lateral work has been done in ore. This was done to obtain a general idea of the shape and probable extent of the ore-body below that level, so that a shaft-sinking, development, and ore extraction programme for the mining of this ore-body could be drawn up.

"Five of these holes were drilled 100 feet apart along a north-south cross-cut through the ore-body, which is approximately 550 feet wide at this point; the other five holes were drilled 100 feet apart from an east-west drift located about midway between the north and south walls of the ore-body which, on this level, is approximately 600 feet long.

"Considerably more development work will have to be done before a proper estimate of ore tonnage and grade in 'lower *H*' orebody below the 2475-foot level can be made, but the information obtained from this drilling indicated that the massive sulphide ore in this lens terminates at an average of about 200 feet below the level; that the ore along the south side of this body is good-grade copper ore; and that the grade of this direct-smelting copper ore and the concentrating ore which makes up the rest of the sulphide body, below the 2475-foot level, appears to be somewhat higher than the average of the same class of ore in the present reserves.

"Although the massive sulphide ore in this lens apparently ended about 200 feet below the 2475-foot level, good fluxing ore was found in the underlying rhyolite in five adjoining vertical holes. This extended from the bottom of the massive sulphide ore to an average depth of 500 feet below the 2475-foot level.

"In the last two preceding annual reports, reference was made to exploration done on the Chadbourne property, which comprises a group of claims covering about 1,000 acres adjoining the Horne property on the west. Some years ago, surface exploration had outlined a surface outcrop of rhyolite-breccia about 130 feet wide and 250 feet long, averaging about $3.00 gold per ton. This was found by subsequent diamond drilling to extend almost vertically downward to a depth of at least 750 feet, but the average assay indicated by the deeper drilling was considerably lower than the surface average. At the beginning of 1933, one of the general exploration drifts on the 975-foot level of the Horne mine was being driven over to explore this area. This long drift was advanced 2,288 feet during the past year, and, in November, 120 feet of well mineralized breccia was intersected at a point almost directly under the old prospect shaft on the Chadbourne, which is approximately 6,150 feet from No. 4 shaft of the Horne mine. The average gold content over the 120 feet was 0.105 oz., and the impression obtained from the limited amount of horizontal diamond drilling done was that, although the body of breccia was quite extensive, the better mineralized portion of it at this horizon was considerably smaller, and about 0.05 oz. per ton lower in grade, than the surface outcrop. The body is being further explored by horizontal and inclined holes drilled from the 975-foot level.

"ORE RESERVES:

"From the information obtained in drifting, diamond drilling, inclined raising, and other openings in the various ore-bodies, there is now indicated above the 2475-foot level the following tonnage of the three classes of ore treated:

Class of Ore	Tons	COPPER (per cent)	GOLD (per ton)
Direct-smelting ore	5,875,000	7.34	0.144 oz.
Concentrating ore	16,580,000	1.12	0.197 oz.
Siliceous fluxing ore	890,000	0.15	0.130 oz.

"The above estimate covers the same ore-bodies, and is taken to the same depth, as the year before, and shows an increase of 125,000 tons of direct-smelting ore, an increase of 780,000 tons of concentrating ore, and a decrease of 10,000 tons of siliceous fluxing ore. The increase in tonnage, notwithstanding the removal during the year of over one and one-half million tons of ore, was due largely to the fact that a more detailed study of the ore-bodies during mining operations made possible the extending of ore boundaries beyond the limits previously used. The higher price of gold and decreased operating costs were also contributing factors, as they permitted the inclusion in the ore reserves of material that was formerly too low grade.

"ORE SHIPMENTS:

"The tonnages and average grade of ore shipped from the Horne mine to the smelter and concentrator in 1933 were as follows:

Class of Ore	Tons	COPPER (per cent)	GOLD (per ton)	SILVER (per ton)
Direct-smelting sulphide ore	497,807	3.48	0.325 oz.	0.52 oz.
Siliceous fluxing ore	365,399	0.64	0.166 oz.	0.15 oz.
Concentrating sulphide ore	678,318	2.36	0.152 oz.	0.35 oz.
Total	1,541,524			

"The above total represents an increase of 26.5 per cent over that for the previous year.

"SMELTER:

"During 1933, the smelter treated 1,010,629 tons of ore, concentrate, and refinery slag, and produced 65,337,559 pounds of anodes, the average analysis of which was 99.36 per cent copper, 8.70 oz. gold per ton, and 15.61 oz. silver per ton.

"The following table shows the amount of material treated in the smelter, and the production, each year since commencement of operations:

Year	Ore, concentrate, and refinery slag smelted (tons)	Fine copper produced (pounds)	Gold produced (ounces)	Silver produced (ounces)
1927.....	10,740	552,345	767	2,644
1928.....	271,926	33,065,261	52,949	186,277
1929.....	428,221	51,223,115	68,732	334,279
1930.....	734,072	75,509,373	117,393	691,920
1931.....	765,544	62,859,355	253,363	558,801
1932.....	918,567	63,013,485	341,350	619,597
1933.....	1,010,629	65,008,731	284,675	510,739

"CONCENTRATOR:

"During 1933, the concentrator treated 676,168 tons of ore from the Horne mine, the average assay of which was 2.36 per cent copper, 0.152 oz. gold per ton, and 0.35 oz. silver per ton, from which 145,582 tons of concentrate were produced and sent to the smelter.

"The following table shows the amount of ore treated by the concentrator since it was placed in operation:

1928.....	4,468	tons
1929.....	51,689	"
1930.....	191,856	"
1931.....	317,792	"
1932.....	379,637	"
1933.....	676,168	"

"In March, 1933, the average tonnage treated daily by the concentrator was increased from 1,500 to 2,000 tons, and in October a further extension of the concentrator, designed to bring the total capacity up to 3,000 tons per day, was authorized and is now under construction.

"NEW CONSTRUCTION:

"At the mine, the double ore-pass system—which provides for the transfer of two classes of ore from most of the levels above the 1,225-foot, to a crusher on the 1,350-foot level and thence to a skip loading pocket on the 1475-foot level of No. 4 shaft—was completed and placed in operation in March.

"The construction of an addition to the concentrator, designed to provide additional capacity of 1,000 tons per day and also to regrind and retreat the entire mill tailing, was started early in October, and it is expected that these new units will go into operation in April, 1934.

"In the smelter, the remodelling of the flue system for the two reverberatory furnaces, started in 1932, was completed; a new dryer was installed in coal plant; and a large centrifugal blower, designed to supply 35,000 cu. feet of free air per minute at 15 pounds pressure to the converters, was installed in the power-house.

"In addition to the major items mentioned above, a number of alterations and improvements were made in every department".

It will be observed from the above report that the Company continued its policy of mining ores of a high-gold, low-copper content. A substantial profit was made, and two dividends totalling $1.50 per share were paid during the year. This brings the total disbursement to shareholders in the six years since production commenced to over 13 million dollars.

In the past few years, the annual reports of the Bureau of Mines have drawn attention to the extraordinary flexibility of the Noranda operation in the relative variation of its gold and copper production. The following table may be of interest:

Year	Value of gold in each ton of copper produced
1928	$66.20
1929	55.50
1930	64.30
1931	166.40
1932	224.00
1933	248.30 *

* Gold at $28.40 per ounce.

Noranda Mines, Limited, also explored several optioned groups of claims during the year. The Thompson-Duval group, in Joannes township, and the Vallée claims, in Barraute township, are referred to on later pages, under the owners' names. The Company also acquired an option on the Coffin-Gilligan group at Bourdeau lake, in the Chibougamau region.

Northern Quebec Gold Mines, Limited.—Operations were resumed on this property in 1933. Substantial camps were erected on claim R-9831, and a road was built from the Granada mine to the camps, a distance of about one and a half miles.

A large amount of stripping and trenching has been performed on the group. A number of fractured zones, in which quartz occurs in the form of kidney-shaped lenses and stringers, have been traced for considerable distances. These zones have a general strike of about N.72°W., and they dip to the north. Sulphide mineralization is not pronounced, but fine free gold has been found at several points.

An adit has been driven into the hillside on claim R-6583 with the object of cross-cutting some of the vein fractures. By the end of the year, a total of about 180 feet of cross-cutting had been completed, and encouraging results were reported. The sinking of a small inclined shaft was commenced towards the end of the year.

Pontiac Rouyn Mines, Limited.—Exploration work was resumed on this property in 1933. The sampling of several mineralized zones is reported to have returned encouraging gold values. A diamond drilling programme was commenced in November. At the end of March, 1934, 29 holes had been put down, totalling 6,263 feet. It is reported that this drilling was confined to five promising zones, and that gold values of interest were encountered.

Seguin Rouyn Gold Mines, Limited.—This Company was incorporated in 1933 with a capitalization of 2,500,000 shares of no-par-value stock. Operations were confined to the 'Dallaire' group of claims, where a promising gold discovery had been made in the previous year. The group now held by the Company includes the following: R-13152 to R-13156, R-14023, R-14024, R-14481 to R-14485.

During the summer of 1933, camps were erected, and some surface stripping and trenching was carried out. In the fall, 5,425 feet of diamond drilling was completed in fifteen holes. It is reported that this work met with favourable results, and that the original discovery zone was proved for a length of 400 feet.

The surface work uncovered several other mineralized zones, but no further exploration work was done on them.

Stadacona Rouyn Mines, Limited.—Operations were resumed on this property in 1933. A motor road was constructed from the Granada road to the mine. A deep diamond-drilling programme was carried out during the summer months, and four holes with a total of 3,000 feet were put down. It is reported that this drilling met with favourable results, and underground work was resumed to further explore the intersections where gold values were obtained. Lateral work was resumed on the 300-foot level in November. A drift was started toward the west from the south cross-cut, and in January, 1934, it had reached a length of 212 feet.

Wiltsey-Coghlan Mines, Limited.—Operations were resumed on this property in the spring of 1933. The work was confined to diamond drilling, and at the end of January, 1934, seven holes totalling 5,400 feet had been put down. One deep hole was nearly 2,000 feet in length. It is reported that no commercial ore was encountered, but that the results indicated favourable geological structure.

Joannes Township

Thompson-Duval Group.—A group of claims, Nos. R-10996 to R-11005, R-13096 to R-13100, and R-13043 are situated astride the Rouyn-Joannes boundary. Noranda Mines, Limited, acquired an option on the group, and performed a considerable amount of exploratory work.

An interesting discovery was made on claim R-11005, of a quartz vein carrying visible gold. It was traced for a length of over 40 feet, and is up to three feet in width. Following an extensive programme of surface stripping and trenching, a diamond drill was brought in, and ten holes were put down to a total length of 3,195 feet. The option to this group has been relinquished.

Polson Group.—A group of claims situated astride the Joannes-Bousquet boundary is registered in the names of Polson and associates. This group includes A-39711, R-12082 to R-12085, R-11779, R-11782, R-11794, and R-11795.

During the summer of 1933, a large amount of surface work was carried out on the group, mainly on claims R-12082 and A-39711. A portable gasoline-driven compressor was used in rock trenching.

The discovery consists of a silicified mineralized zone in the Témiscamian greywackes. It is apparently from three to six feet in width, and is exposed for a length of over 300 feet. It contains stringers of dark quartz, and is mineralized with pyrite, arsenopyrite, chalcopyrite, and specks of galena. No free gold is visible, but some high gold values have been found, apparently in association with the chalcopyrite.

Duprat-Dufresnoy Townships

Waite-Amulet Mines, Limited.—The annual report of this Company, for the year 1933, contains the following information:

"During the year, your Company changed its name from Waite-Ackerman-Montgomery Mines, Limited, to Waite Amulet Mines, Limited; increased its authorized capital from 2,000,000 shares to 3,000,000 shares no-par-value; and purchased the properties of Amulet Mines, Limited, for 1,000,000 shares.

"Your Company did not possess a mill and therefore shipped its ore to the Noranda concentrator for treatment. The Amulet Company had erected a mill, and now that the properties are united, ore from both the Waite mine and the former Amulet mine will be treated in the same mill at such time as production is resumed, which, it is expected, will permit more economical operation.

"No mining operations were carried on during the year. Considerable ore has been proven on your properties, and it is the intention of your Directors to resume production as soon as copper and zinc prices rise to a point making possible profitable operation, provided such prices show a reasonable expectation of being maintained".

Duparquet Township

Beattie Gold Mines, Limited.—During the early part of 1933, this property was being rapidly developed. The sinking of a main hoisting shaft was completed in March, and the 800-ton flotation concentrator was completed in April. Rails were laid from the C. N. R. Taschereau-Noranda branch to the mine, and the power-line was erected from Noranda.

The mill flow-sheet is as follows: The ore is hoisted in skips to a 400-ton bin. Primary crushing is accomplished in a 30 in. by 42 in. jaw crusher. The ore then passes to two double-deck Niagara screens. The oversize is rescreened on a 1-in. mesh Niagara screen, the coarse material going to a 4-ft. standard Symons cone crusher, and the fine material to a 4-ft. shorthead Symons crusher. The cone crusher discharges are returned to the first screens.

The undersize from the first screens is transported by belt conveyor to two 750-ton mill-bins. This ore is fed to two Hardinge ball-mills in closed-circuit with Dorr classifiers. Later in the year, another ball-mill and classifier were installed.

The classifier overflow enters the second cell of a 20-cell Denver Sub-A flotation machine. Four cells are operated as primaries. The froth is cleaned, and the tailings from the cleaner cell are returned to cell 2. The remaining 15 cells are utilized as roughers, and the spigot product goes to tailings. The froth from the roughers is thickened in a Genter thickener, and is re-ground in a tube-mill in closed-circuit with a Dorr bowl classifier. The classifier overflow is cleaned in a 4-cell Denver machine making, with the concentrates from the cleaner cell, a finished product. The concentrates are thickened to 50 per cent solids, filtered in a Dorrco filter, dried in a Ruggles-Coles drier, and then stored in a 300-ton bin. Trucks with flanged wheels transport the concentrates over the light railway to the Taschereau-Noranda branch of the Canadian National railways for shipment to a customs smelter at Tacoma, Washington.

Later in the year, two 6-cell primary and one 6-cell cleaner flotation units were added to the mill.

The mine is opened-up by three levels at 200, 350, and 500 feet. The ore is mined by a system of spiral stoping, and open-pit operations were carried on during the summer and fall months. Produc-

tion was gradually increased from 500 to over 800 tons per day. The annual report of Ventures, Limited, for the year 1933 contains the following information about the Beattie mine:

"Beattie Gold Mines, Limited:

"This property went into production late in May. Since then 145,011 tons of ore have been milled, averaging 0.22022 oz. of gold per ton, from which a recovery of 0.1668 oz. per ton was obtained. In spite of the necessary adjustments and difficulties naturally arising in the early stages of this operation, preliminary figures indicate an operating profit of $154,584.90. Owing to the limited tonnage treated, all of the profit will necessarily be absorbed by the annual charges for depreciation and deferred development.

"The mill is now treating about 25,000 tons per month, but, before increasing this rate materially, a local plant for the treatment of the concentrates should first be established. Active investigations are being carried on to determine the best method for treating these concentrates, but as yet no final solution has been found. It must be recognized that the material is refractory, and so far, it appears unlikely that a low concentrate treatment cost can be obtained.

"Exploration by diamond drilling will be carried on here during 1934 for the purpose of finding new ore-zones and proving the extensions of known ore-bodies".

Galatea Gold Mines, Limited.—Diamond drilling was commenced on this property in January, 1933, under an option agreement with Ventures, Limited. The drilling totalled 2,357 feet. It is reported that the results did not conform to previous surface sampling, and the option was relinquished.

Destor Township

Engineers Exploration Group.—A group of nineteen claims, situated east of the Perrault highway, is registered in the name of W. C. Martin and associates. A discovery was made in the fall of 1933. Re-sampling of some old trenches on claims R-12822 and 12823 indicated the presence of encouraging gold values, and further trenching was carried out. This work has indicated that there is a zone of finely disseminated pyrite, from 10 to 30 feet in width, and carrying over 0.15 ounces of gold per ton for a length of 500 feet.

Desmeloizes Township

Normetal Mining Corporation.—This Company resumed work in August, 1933. Sinking of the main shaft, suspended in 1930, was resumed. It has been completed to a depth of 827 feet, and stations have been cut at depths of 675 and 800 feet. It is planned to carry out underground exploration work at these horizons in preparation for the return of higher base-metal prices.

Bousquet Township

McLachlan Group.—In 1933, this group of thirteen claims, numbered A-39932 to A-39940 and A-38985 to A-38988, was under option to E. J. Thompson. It is situated at the east end of Bousquet lake. In the spring, a large amount of deep stripping was completed, and some rock trenching was also carried out. Several fractured zones were traced for lengths of over five hundred feet, and these contain lenses and stringers of bluish quartz. The most important zone is about two feet in width. It is reported that fine free gold has been found in the quartz.

Norgold Mines, Limited.—This Company now holds the mining rights to the Clement claim, A-36373. During 1933, further surface work was carried out.

Northwestern Quebec Prospectors, Limited.—The mining rights of this Company have been transferred to Golden Quebec Mines, Limited. The property was formerly known as the 'Cavanagh' group. During 1933, further surface work was carried out, and an adit was started at the base of the hill below the promising vein systems, with the intention of cross-cutting these systems. A small test-mill, known as a Nutt mill, was erected on the shore of the lake, but no production is recorded from this plant.

Cadillac Township

Cadillac-O'Brien Mine.—This mine was in continuous production throughout 1933, and an average of 60 tons of ore per day was milled. Early in the year, a second 240 h.p. steam engine was installed to drive the electric generator.

The ore for the mill was obtained from several stopes and from development work. Towards the end of the year, the shaft was continued to the 500-foot horizon, and new levels were established at 400 and 500 feet. During the period of shaft-sinking, ore for the mill was drawn from the surface dump.

The road from the town of Amos to the property was open to motor traffic in the summer months. In the fall, a winter landing-field for airplanes was cleared close to the camps.

Canadian Gold Operators, Limited.—Underground work was continued on the 125-foot level of this property until April, 1933, when all operations were suspended. The work did not indicate the presence of sufficient ore-bodies.

Pandora, Limited.—During 1933, further lateral work was carried out on the 125- and 250-foot levels of this property. On the upper level, several sections of ore were developed in the No. 1, No. 5, and the *Bell* veins. It was reported that the Bell vein carried good gold values across a width of three feet for a length of 200 feet.

Diamond drilling was commenced in the spring, and three holes were drilled, totalling 1,495 feet in length. This drilling was carried out from 250-foot level, to cut the veins at the 500-foot horizon, preparatory to sinking to this depth. It is reported that encouraging gold values over a length of 300 feet were indicated.

Sinking of the shaft was resumed, and at the end of the year it had been completed to the 500-foot level.

Thompson-Cadillac Mines, Limited.—This Company resumed operations in the fall of 1933. The mine was de-watered, and a re-examination was made. It is reported that, at ruling gold prices, the ore is of high enough grade to warrant the erection of a mill, and it is planned to bring the mine into production in 1934.

A small amount of underground work was carried out, and 877 feet of diamond drilling was completed before the end of the year.

Tonawanda Mines, Limited.—This Company performed work on a group of claims lying to the east of the Pandora group. Two diamond-drill holes were put down, their combined length being 960 feet. It is reported that this drilling met with favourable results.

Malartic Township

Malrobic Mines, Limited.—This Company resumed work on its claims in the fall of 1933, when 1,500 feet of diamond drilling was completed. It is planned to resume underground work on this property in 1934.

Stark Claims.—Early in 1933, optioners did some diamond drilling on former claim A-36677. This claim was the south half of lot 9, range VI. The drilling was completed in two holes with a combined length of 997 feet.

Fournière Township

Canadian Malartic Gold Mines, Limited.—This Company was incorporated in 1933, with a capitalization of 4,000,000 shares of no-par-value stock, to resume the further exploration of the Malartic mine.

The mine was de-watered, and underground work was commenced in the summer months. Drifting and cross-cutting on the 125-, 250-, and 375-foot levels was attended with very encouraging results. One new ore-body, known as the footwall section of No. 1 zone, has been developed, and it is indicated that it is over twenty feet in width and 150 feet in length. Some further work was also completed on the hanging-wall, or north, zone.

The first annual report of the Company, for the period ending December 31st, 1933, contains a report by the Manager detailing results up to February 1st, 1934. The following paragraphs are reproduced from this report:

"Development Progress, Foot- and Hanging-wall Sections of No. 1

	Footwall Section	Hanging-wall Section
Surface.....	Exposed by trenches	Outcrop not definitely connected
125 level.....	About one-third developed	Only indicated by drill holes
250 level.....	About 70 per cent developed	Exposed in places
375 level.....	Just reached	Fully developed
Depth.....	Not previously explored	Indicated by drilling to depth of 125 feet below bottom level

"It is difficult to estimate ore tonnage in the irregular replacement type of ore-body under development, but in view of the advanced stage of development on all levels in one of them, known as No. 1, I am prepared to submit an estimate of the part of this ore-body which I consider reasonably assured... In all instances, where gold values are used, the price at which the metal is calculated is $20.67 per ounce.

"It is estimated that 150,000 tons of gold ore, averaging $6.50 per ton, exist in the footwall section of the No. 1 ore-body, giving a reasonable allowance for extensions horizontally and vertically where this is evident. In the hanging-wall section, I estimate that there are 75,000 tons averaging $7.40 per ton, with a reasonable allowance for extension vertically above and below the 375 level. In addition, I estimate that 350,000 tons of ore averaging $3.75 per ton exist in the margins of the ore-bodies and elsewhere, which have not been included in the higher-grade estimate".

Launay Township

Wendt-Wriedt Consolidated Mines, Limited.—A group of claims including the north half of lots 21 to 28, range I, and the south half of lots 25 to 28, range II, is held in the name of this Company.

During the past summer and fall, some trenching and stripping was carried out, and several test-pits were sunk to shallow depths. The work was confined to a sheared zone in highly metamorphosed volcanic rocks. Some quartz and calcite are present in this zone, in the form of irregular lenses and stringers. Free gold has been observed in the quartz.

Landrienne Township

Randall Mines Corporation, Limited.—This Company optioned several groups of adjoining claims in Landrienne and Barraute townships, but operations were confined largely to the Mines Development Corporation group. This group embraces the south half of lots 53 and 54, and lots 55 to 57, range IV, and the south half of lots 53 and 54, range V, Landrienne township.

In 1932, an encouraging gold discovery was made on the group. The new Company installed light mining equipment, and commenced the sinking of a vertical shaft in January, 1933. The shaft was completed to 215 feet, and stations were cut at the 100- and 200-foot levels. During this period, 2,024 feet of diamond drilling was completed in eight holes.

Underground work was confined to the 200-foot level. A crosscut to the northeast encountered a five-foot-wide schisted zone at a distance of 57 feet from the shaft. This zone contains stringers and lenses of quartz. It was followed to the northwest and southeast for a total distance of about 600 feet. The results did not indicate a commercial ore-zone. Further diamond drilling was carried out in July to a depth of 427 feet. Early in August, the hoist-house was destroyed by fire, and operations were suspended.

Barraute Township

Randall Mines Corporation, Limited.—This Company explored the 'Fisher-Quebec' group, in Barraute township. On lot 9, range III, some stripping and trenching was completed on a mineralized zone about four feet in width containing quartz stringers. Visible gold was observed in the quartz. During the year, 424 feet of diamond drilling was completed.

Vallée Claims.—This group of claims includes the north half of lots 42 to 49, the south half of lots 46 to 49, and lots 50 and 51, in range II. During the summer months, Damara Mines, Limited, did some surface work on a quartz vein on lots 47 and 48.

The discovery consists of a fractured zone in a porphyritic granodiorite. The zone is partially filled with quartz. It has been traced for a length of about 1,200 feet, and averages about three feet in width. Over a length of about 65 feet, it is fairly well mineralized with pyrite, and, in places, encouraging gold values were obtained.

The property was optioned to Noranda Mines, Limited, in December, 1933, and in the following month 628 feet of diamond drilling was completed in seven holes.

DUBUISSON TOWNSHIP

Greene-Stabell Mines, Limited.—In the spring of 1933, preparations were made to place this mine on a producing basis. Excavations and foundations for a 100-ton mill were completed, and the mill was erected in the summer months. Electric power is generated by a 550 h.p. Diesel-driven generator, purchased from the Normetal mine. A steel headframe was erected over the shaft. To transport the heavy equipment from lake de Montigny to the mine, a tramway line was constructed.

Milling was commenced in November, 1933. The mill flowsheet is as follows:

Ore from the mine is hoisted in cars and trammed to an 8-ft. grizzly over an 80-ton coarse-ore bin. This bin discharges to a picking belt, where waste is removed. The ore then enters a 10-in. by 20-in. jaw-crusher, where it is reduced to about 2-in. mesh, and is then conveyed to the 120-ton mill bin. It is then fed to two 15-ft. by 7-ft. ball-mills, in series, both of which are in closed-circuit with an Akins classifier. The discharge is approximately 87 per cent −200-mesh. It is conditioned, and then enters an 8-cell Sub-A flotation battery. The flotation concentrate, carrying most of the copper and a large part of the gold, together with the other sulphides in the ore, is filtered on a disc filter. The concentrate is stored for shipment to a customs smelter. The spigot product from flotation goes to cyanidation. It is thickened, and then enters the first of four Pachuca tanks operated in series. After agitation, the pulp enters another thickener, and the overflow from this is sent to the precipitating presses. The pulp is filtered and goes to tailings disposal. It is reported that approximately 30 per cent of the gold in the ore is recovered in the cyanide plant.

Some underground work was completed during the year. Stopes were started on the 150-, 300-, and 450-foot levels. On the 300-foot level, a length of over 350 feet was developed for stoping. A raise was driven from the upper level to tap the surface ore-dump. Crosscutting was in progress on the 600-foot level at the end of the year. Diamond drilling totalling 916 feet was carried out during the year.

In late December, the first gold brick was poured, and the mill was treating about sixty tons of ore per day. The Company plans to purchase hydro-electric power from the Northern Quebec Power Company, and, when this is available, production will probably be increased.

Minrand Gold, Limited.—This Company holds the mining rights to a property formerly known as the Union, or Unison, mine. The surface geology is described in Memoir 166 of the Geological Survey of Canada, and in *Gold Deposits of Lake de Montigny*, by Adhémar Mailhot, published by the Quebec Bureau of Mines in 1922.

A small test-mill was constructed during the year, the equipment including a jaw-crusher, a Huntingdon mill, a stamp-mill, four amalgam plates, and a Frue vanner.

Four short raises were driven from the 100-foot level, and a winze was sunk to a depth of 30 feet below the level. This work was carried out to explore a quartz vein exposed in previous underground work. The operations were not continuous, and the property was idle at the end of the year.

In the spring of 1934, a diamond drilling programme was commenced on the property.

Siscoe Gold Mines, Limited.—The annual report of the Company for 1933 gives the following information:

"PRODUCTION:

"96,348 tons of ore were milled, yielding a total of $1,132,928.73. To this must be added a total premium received of $483,558.35, making a grand total of $1,616,487.08. The total operating expense was $515,085.57, or an average cost of $5.346 per ton milled. The following table shows comparative results since 1930:

Year	Production (Value)	Ore Milled (tons)	Heads $/ ton *	Tailings $/ ton *	Extraction (per cent)
1930.....	$ 367,266.20	33,744	$11.11	$ 0.230	97.70
1931.....	742,811.76	55,675	13.63	0.285	97.91
1932.....	1,006,297.49	63,998	15.94	0.219	98.63
1933.....	1,132,928.73	96,348	12.10	0.345	97.14

* Gold at $20.67 per ounce.

"MINING:

"For most efficient operation, stoping was conducted quite uniformly, distributed over the first five levels, that is, down to and including the 725:

Place	Tons
First level	17,342
Second level	19,165
Third level	17,699
Fourth level	15,353
Fifth level	20,349
Sixth level	3,324
Seventh level	3,116
Total	96,348

"BROKEN ORE RESERVES:

"For careful regulation of grade and uniform flow of tonnage, it is necessary to carry a reasonable reserve of broken ore. At the beginning of the year, the broken-ore reserve was 31,310 tons. This was increased by 7,313 tons, bringing the reserve of broken ore at the end of the year to 38,623 tons. For the size of our operations, this tonnage seems ample. To increase it would mean tying-up considerable sums of money, on which there would be no return. Our investment at the present time in broken-ore reserves is $64,084.60, which is a cost of $1.659 per ton. This is the average of mining costs over the period of time since broken-ore reserves have been accumulating.

"DEVELOPMENT:

"3,274.5 feet of cross-cuts, 6,969.0 feet of drifts, and 3,051.5 feet of raises, a total of 13,295.0 lineal feet, were driven during the year in the search for, and development of, new ore. 5,357 lineal feet of work was in vein material of profitable grade.

"10,964.0 feet of diamond drilling was also done; all of this underground. During much of the time, two machines were in operation.

"As a result of the development work done during the past year, 121,947 tons of profitable ore were put in sight. This is 25,599 tons over and above the 96,348 tons milled.

"Programme of Development and Exploration:

"Exploration for the coming year will be an extension of the programme already initiated. It will consist of routine and detailed exploration in the vicinity of ore occurrences already developed and a search for other ore in areas at a distance from these.

"In the first category comes the deepening of the main shaft to the 1,350 horizon to open-up the main veins below present levels. Preliminary diamond-drilling has already indicated that values occur there. Shaft and stations should be completed by about May 15th.

"In the same category comes the development of the *K* vein zone near the granodiorite contact. Present workings in this zone will be extended westward to and beyond the *D* shaft workings and, as well, to the east. Present indications are that the *K* zone will be of considerable length and, although ore grade is relatively low, mining in the zone will be profitable at the present price of gold.

"Routine exploration will consist of diamond drilling, raising, etc., close to already known ore-bodies, to determine ore boundaries at present surmised.

"The more extended type of exploration should include the sinking of the shaft on the mainland and exploration of the *A* vein zone and of the favourable zone within the granodiorite a few hundred feet north of the contact.

"Work on the mainland presents interesting possibilities. A shaft and lateral work there will explore a known body of sulphide-quartz material. It will also determine whether or not the north contact of the granodiorite beneath the lake carries vein extensions corresponding to those already mined toward the south contact.

"*A* vein zone lies in the greenstone south of the granodiorite contact. One vein is already indicated in a zone which is exposed on surface. This vein may be only one of an extensive system. The zone will initially be explored by shallow surface drilling and, if warranted, by underground workings connected with the main shaft.

"Within the granodiorite, the favourable zone now extends several hundred feet north of the south contact. There is no reason to believe that this zone should stop laterally close to the present workings, and a series of cross-cuts and drill holes will be extended northwest and southeast within this zone to the property boundaries.

"MILLING OPERATIONS:

"Alterations and additions to milling equipment were completed in the month of April, which permitted increasing the average tons per day milled from 174.86 to 300. The average for the year was 263.9 tons per day. We have since improved the amalgamating part of our flow-sheet by the installation of additional blanket tables and the use of hydraulic concentrating cones in place of the old-type hydraulic concentrating boxes. Mill costs have been considerably reduced, and the high recoveries formerly made continue to be obtained.

"NEW CONSTRUCTION:

"The installation of the 675 h.p. Crossley Premier Diesel engine, direct-connected to a 480 k.w. generator, was completed in the early part of the year at a total cost of $48,040.45. This addition to our power plant has given us ample power-generating capacity for the present scale of our operations. All machines in the power-house are in excellent working condition.

"Another big item of capital expenditure was in connection with additions and alterations in the mill which has resulted in the increasing of our milling capacity 72 per cent, to the present high tonnage in excess of 300 tons per day.

"Located as we are on an island entirely owned by the Company, away from any village or centre of population, it is necessary to provide housing facilities for all employees. Four new residences, a new staff-house, and a three-story bunk-house, were constructed during the year, thus supplying ample accomodation for our present needs. Additions were made to the warehouse and office, and a new post-office was also built".

During the year, the Company paid dividends amounting to fourteen cents a share.

Sullivan Consolidated Mines, Limited.—Lateral exploration and development work continued throughout most of 1933, and a raise was completed from the 250- to the 150-foot level.

In the spring, the shaft was continued to a depth of 370 feet, and a station was cut at the 350-foot level. At this horizon, a cross-cut was driven to the east, and the No. 1 vein was intersected at 250 feet from the shaft. Drifting on this vein for a length of over 500

feet indicated that it is narrower here than on the upper levels. The cross-cut was then extended a further 320 feet to intersect another narrow vein, where some drifting was carried out.

Lateral work was also carried out on the 150- and 250-foot levels, and a diamond-drilling programme totalling 16,500 feet was completed in the early months of the year.

New equipment installed during the year included an electric pump of 240 gallons per minute capacity, and a 50 k.v.a. 550-volt generator to supply additional power in case of emergency, by connecting it to the Diesel-driven compressor.

Operations were suspended in September, but were resumed a few months later. Plans were made to bring the mine into production, and the erection of a mill of from 50 to 100 tons capacity was commenced. It is planned to utilize Diesel engines for generating the necessary electric power.

Varsan Township

Dorval-Siscoe Gold Mines, Limited.—This Company was incorporated in 1933, and holds the mining rights to the following claims: A-32210, A-33388 to A-33390, A-38656 to A-38659, A-39273 to A-39280, A-43276 to A-43279. The group is situated in the south part of Varsan township.

During the past year, 6,479 feet of diamond drilling was completed on this group.

Stanley Siscoe Extension Gold Mines, Limited.—In the fall of 1933, this Company commenced the sinking of a vertical, three-compartment shaft. It was completed to a depth of 377 feet in January, 1934. Cross-cutting was started to the south at the 350-foot level to explore some veins previously indicated by diamond drilling. The shaft measures 15 ft. 10 in. by 6 ft. 4 in., and is located on lot 43, range I.

.Several buildings, including a cook-house, bunk-house, and office, were erected. The power-house houses an 8 in. by 10 in. reversible steam hoist, a 700 cu. ft. Diesel-driven compressor, a 75 h.p. steam boiler, and a 4 k.w. lighting plant. There are four oil-storage tanks of 38,000-gallon capacity.

Operations were suspended early in the year.

BOURLAMAQUE TOWNSHIP

Herbin Lake Gold Syndicate.—This Company held several groups of claims in Bourlamaque township, and performed work on two of these groups.

On Block 1, which includes claims A-10472 to A-10474 and A-35960 to A-35964, located at Herbin lake, over four thousand feet of diamond drilling was completed at the end of the year.

On Block 2, situated east of the Lamaque Gold Mines property, and including claims A-44490 to A-44493, A-40551 to A-40553, A-34425 to A-34427, and A-47610, 7,688 feet of diamond drilling was completed in nine holes. Early in 1934, this group was transferred in part to Lamaque Contact Gold Mines, Limited, and East Lamaque Gold Mines, Limited.

Lamaque Gold Mines, Limited.—The Read-Authier property, optioned to Teck-Hughes Gold Mines, Limited, in 1932, was transferred to this Company in January, 1933.

Towards the close of 1932, the parent Company diamond-drilled five holes, with a total footage of 1,705 feet. In 1933, 83 additional drill holes, totalling 28,049 feet, were put down by the subsidiary company, Lamaque Gold Mines, Limited.

The sinking of two vertical shafts was commenced early in the year. No. 3, the main, shaft is located near the old *F* shaft. It measures 15 ft. by 6 ft., and is divided into three compartments. The hoist and power-house contains two 120 h.p. *H.R.T.* boilers, two 750 cu. ft. steam-driven compressors, an 11 in. by 9 in. double-drum steam hoist, and a 5 k.w. lighting set.

No. 4 shaft is located 600 feet east of shaft No. 3. It is a two-compartment shaft. The mechanical equipment includes a 50 h.p. boiler and a 7 in. by 10 in. reversible steam hoist.

Towards the end of the year, the sinking of another vertical shaft, known as No. 5, was commenced. This is located 1,300 feet south of shaft No. 3, and is of the same size. The equipment includes an 11 in. by 9 in. double-drum hoist, two boilers rated at 50 to 80 h.p.,

respectively, and a 50 h.p. a.c. generator and steam engine. The latter was installed for lighting purposes, and to provide power for the camp water-supply.

No. 3 shaft was sunk to a depth of 470 feet, and stations were cut at the 100-, 150-, 200-, 250-, 300-, and 400-foot horizons. No. 4 shaft was sunk to a depth of 318 feet, and levels were established at the 100-, 200-, and 300-foot horizons. At the 200-foot level, there is a connection with the No. 3 shaft workings.

Several vein systems were explored in the underground work, and by diamond drilling. The veins consist of quartz and tourmaline. They are fairly well mineralized with coarse pyrite, and in places carry spectacular free gold.

No. 3 vein, also known as the Float vein, was encountered on the 100-foot level. It strikes east-west, and dips to the south at forty degrees. It was drifted-on for a length of over 500 feet, and it is indicated that it is of commercial grade over drift width for a great part of this distance. On the 200-foot level, it was explored for a length of over 1,000 feet, most of which is apparently of commercial grade. Only a small amount of drifting was completed on this vein at the 300-foot level.

No. 1 vein was outlined by diamond drilling for a length of 2,000 feet, and to a depth on the vein of 400 feet. The vein strikes southwest, and dips at about 40 degrees to the southeast. It is reported that some very encouraging gold values were obtained in the drilling, and the results would indicate an ore-body 1,500 feet in length and five feet in width. The underground exploration of this vein will be completed from No. 5 shaft.

No. 2 vein was encountered on the 100-foot level of No. 4 shaft. It is very irregular in strike and dip, and consists of a series of disconnected stringers and lenses of quartz and tourmaline. It was followed for a length of 250 feet, sixty feet of which is of ore grade, with scattered values throughout the remainder of the length. On the 200-foot level, this vein was followed for a length of 400 feet, more than 200 feet of which is of ore grade.

No. 4 vein enters the No. 3 shaft at a depth of 417 feet. It was explored on the 400-foot level. Some very spectacular free gold was found in it, but further work is necessary to prove that there is continuity to the deposit.

During the year, the Company erected two two-story bunkhouses and three residences, in addition to the mine buildings. A townsite has been incorporated, and this will be known as the town of Bourlamaque. It is probable that this property will be in production in the near future.

Read-Authier Mine, Limited.—This Company, in addition to owning a substantial interest in Lamaque Gold Mines, Limited, acquired an option in 1933 on a group of 36 claims lying to the north of the Lamaque mine. In 1929, some trenching was carried out on a tourmaline-quartz vein on the north line of claim M.L.2404: this work was performed by La Reine Mines, Limited.

In the fall of 1933, camps were erected, and a diamond drilling programme commenced. While the drill was set up on the first hole, to explore the vein referred to above, an important gold discovery was made on the south part of the group. This discovery consists of quartz and tourmaline, in the form of a network of stringers. In places, the quartz is massive. The zone is up to thirty or forty feet in width, and has been traced on the high ground for a distance of 400 feet. Sampling indicated encouraging gold values. The diamond drill was immediately moved to this discovery. At the end of January, 1934, over 3,300 feet of drilling had been completed in ten holes. This drilling confirmed the surface work, and proved the ore-zone for a length of over 700 feet, and a depth of between 100 and 200 feet. Other sections of ore were also obtained in the drilling. Since this date, Dome Mines, Limited, has acquired an option on twenty-one of these claims, and an underground exploration programme has been commenced.

Pascalis Township

Mathews Gold Mines, Limited.—Operations were continued on this property throughout 1933. A vertical shaft was sunk on claim A-34888 to a depth of 200 feet, and lateral work was carried out on the 175-foot level. In the early spring, some ore was extracted from the surface outcrop of the Mathews vein and this was milled in the small test plant, resulting in a recovery of about 85 ounces in gold.

The underground work was attended with encouraging results. Cross-cuts were driven to the north and south, at the 175-foot level, for distances of 410 and 170 feet, respectively. From the south

cross-cut, a drift was driven to the east for a distance of 380 feet, and at 220 feet a cross-cut was driven to the south for 105 feet. This cross-cut encountered a well-mineralized quartz vein, striking northwest and dipping at about 25 degrees to the southwest. This vein has a true width of about one and a half feet. It was followed in a drift for 100 feet, and was also explored by short raises.

Early in 1933, lateral work was suspended and shaft-sinking was resumed. It is planned to explore at deeper levels, and to erect a 50-ton mill.

Louvicourt Township

Bussières Mining Company, Limited.—This mine was brought into production in the fall of 1932, and continuous operation was maintained throughout 1933. During the year under review, more than 40,000 tons of ore were hoisted and milled, resulting in a recovery of over 7,500 ounces in gold.

Underground work was continued on the four levels of the mine. In addition to the lateral work, a number of stopes were developed above the levels. This work was necessarily of an exploratory character, and it has indicated that the ore-bodies generally occur in the form of tabular lenses of irregular width and varying grade. The mode of occurrence of the deposits does not permit the estimation of ore reserves.

On the 200-foot level, more than twelve stopes were developed on flat-lying deposits. Scrapers were frequently used in this work. Some lateral work was also carried out, and a raise was started to the surface in the west end of the level.

On the 350- and 500-foot levels, some raising and lateral work was completed, and a few small stopes were developed. Several large stopes were also developed above the 650-foot level.

During the year, a total of over 13,000 feet of diamond drilling was completed from the underground workings.

In the fall, the control of this Company passed from the Treadwell-Yukon Company into the hands of the Qubeec Gold Mining Corporation, Limited.

Dunlop Consolidated Gold Mines, Limited.—This Company holds the mining rights to a group of fifteen claims, as follows: A-37253 to A-37266, and A-40734. The group is situated on the north side of the east-west centre line of Louvicourt township.

Surface stripping and trenching was in progress during the summer months. This work exposed a strongly sheared zone in the granodiorite. A diamond drill was brought in, and 1,058 feet of drilling was completed in five holes. It is reported that this drilling indicated encouraging geological structure.

Vicour Gold Mines, Limited.—This Company continued to explore its optioned group in Louvicourt township. Surface work and diamond drilling was, for the most part, confined to a wide mineralized zone in which encouraging gold values were found. The zone strikes east and west. It was apparently traced by trenching for a length of 600 feet, and is from twenty to fifty feet in width. Quartz occurs throughout the zone in the form of stringers, and the sulphide mineralization consists of pyrite, together with small amounts of chalcopyrite. It is reported that free gold has been found in association with the pyrite.

In addition to a large amount of deep stripping and trenching, 4,545 feet of diamond drilling was completed on the group. It is reported that this work did not result in the development of a commercial ore zone.

Tiblemont Township

Hollinger Consolidated Gold Mines, Limited.—In January, 1933, this Company commenced a diamond drilling programme on the Woods group of claims, but after putting down a number of holes totalling 7,100 feet, the Company relinquished its option. A new Company, Mecca Gold Mines, Limited, was formed early in 1934 to develop the property.

South Tiblemont Mines, Limited.—This organization holds the mining rights to a group of 39 claims situated at the south end of Fish lake. Camps were erected on the lake shore, and a large amount of stripping and rock trenching was performed during the summer months. The group includes the following claims: A-43388 to A-43407, A-46094 to A-46112.

The work was largely confined to claim A-43399. On this claim there is a ridge of granodiorite with greenstone inclusions. The intrusive rock is fractured, and many of the small fractures are filled with quartz. Two quartz veins, six inches in width, have been exposed for a length of about 200 feet. Free gold was found in a number of places in these veins.

It is reported that underground work is planned for this property.

Tiblemont Island Mining Company, Limited.—This Company was incorporated in 1933 with a capitalization of 3,000,000 shares of no-par-value stock. It holds the mining rights to a group of claims covering Tiblemont island, as follows: A-37588 to A-37601, A-37803, A-46843, and A-48444.

During the summer months, camps were erected on claim A-37599, and some stripping and shallow rock-trenching were performed. This work was, for the most part, confined to an area about 700 feet long and 400 feet wide. It exposes a zone of well-fractured granodiorite containing a network of quartz stringers and veinlets, which are irregular in size, strike, and dip. In places, the quartz occurs in inclusions of basic flow-rocks. The general strike of the quartz-filled fractures is approximately due west. Free gold, usually in a fine form, is plentifully distributed throughout the zone.

In the fall of the year, the driving of an adit was commenced from the southeast shore of the island, in order to cross-cut the zone. The adit intersected several scattered fracture-zones, in which free gold was observed. This underground work was accomplished with the aid of a 320 cu. ft. portable gasoline compressor.

Early in 1934, a diamond drilling programme was commenced.

EMPLOYMENT, WAGES AND ACCIDENTS IN MINES AND QUARRIES DURING THE YEAR 1933 *

EMPLOYMENT AND WAGES

Reports covering the calendar year 1933 received by the Bureau of Mines from operators of mines and quarries show that a total of 10,737 men were employed in the mining industry of the Province during the year. Returns were received from 133 mines and 289 quarries, and also from numerous claim holders who completed the required amount of assessment work. Details of employment in the several branches of the industry are given in the main table of mineral production on page 7 and in Table II below.

These 10,737 men worked a total of 2,229,217 days, which gives an average of 207.6 working days for each employee. Calculated on the basis of the 300-day year adopted by the Bureau for statistical purposes, the number of men employed totalled 7,431.

TABLE I

WORKMEN EMPLOYED IN MINES AND QUARRIES IN THE PROVINCE OF QUEBEC, 1930 TO 1933

	1933	1932	1931	1930
Number of men employed.....	10,737	9,821	13,185	13,754
Number of men on a 300-day basis.....	7,431	6,855	9,116	10,549

The increase in total number of employees, amounting to 9.3 per cent as compared with the previous year, is very gratifying. It marks a halt in the successive decreases that have been recorded since 1928. The increase, however, is due to greater employment in the mines group only, the number of men working in quarries having been slightly less than in 1932.

* Compilation from reports of Inspectors of Mines, by Henri Girard.

TABLE II

DISTRIBUTION OF WORKMEN IN THE VARIOUS MINES AND QUARRIES

	Number of men employed	Number of men calculated on 300-day basis	
	1933	1933	1932
MINES:			
Asbestos	1,589	1,423	1,158
Copper and pyrite	1,568	1,596	1,629
Chrome, titaniferous iron ore, zinc, and lead	14	4	6
Feldspar and kaolin	55	20	8
Gold, silver	1,202	1,146	700
Magnesite and dolomite	108	86	43
Marl	21	1	.....
Mica, phosphate	55	23	23
Mineral paints, ochre	23	16	20
Mineral water	4	1	1
Molybdenite	6	1	.....
Natural gas	16	10	13
Peat	1	1	3
Quartz, silica rock, garnet	95	46	38
Talc, soapstone	41	32	26
Assessment work on claims	1,033	814	616
Sub-totals	5,831	5,220	4,284
QUARRIES:			
Brick, pottery	482	161	296
Cement	338	291	419
Granite	723	324	385
Lime	214	174	164
Limestone	1,114	511	584
Marble, slate, sandstone	138	45	201
Sand and gravel	1,897	705	522
Sub-totals	4,906	2,211	2,571
TOTALS	10,737	7,431	6,855

Following the peak of 1929, employment in mines proper reached its lowest mark in 1931. There was a slight improvement in 1932, with a total of 4,861, and last year the swing was definitely upward, with a total of 5,831 men employed, or a gain of 20 per cent. Gold mining led, with the remarkable increase of 68 per cent, and the number of men engaged in assessment work on claims rose from 761 to

1,033. Western Quebec chiefly benefits from these activities, which have helped greatly in reducing unemployment in the whole district. Some improvement is shown in the asbestos industry and also in most of the other non-metallic mining operations, due to better market conditions for the several products. The revival of activity in phosphate mining in the Buckingham district, referred to in last year's report, has, however, died down for the present.

In the quarry group, there was a falling-off in employment in all items except lime, and sand and gravel. Twice as many men as in 1932 were engaged by the Provincial Roads Department for the operation of gravel pits. The increased activity in the lime industry was due to greater demand for lime for industrial uses. Owing to the exceedingly dull conditions which continued to prevail in building construction, there was little or no work for many of those who are normally employed in stone quarries.

Due to the coming into production of several gold mines, the number of employees in producing mines was very much higher in 1933 than in 1932, the figures for the two years being, respectively, 4,284 and 2,784. This is the more notable as being the first increase recorded since 1930.

Wages paid to miners and quarrymen amounted to $7,401,045, as compared with $6,996,341 in the previous year. Details of the wages in the several branches of the industry are given in the table of mineral production on page 7. Of the total, workmen in mines received $5,837,921 and those in quarries $1,563,124, which figures compare, respectively, with $4,827,489 and $2,168,852 in 1932. Including both mines and quarries, the average wage earned by a 300-day workman was $996; in 1932 it was $1,021.

Wage conditions were very poor in quarries, especially as regards men employed by small operators. A continuous decline is registered for the last three years, from an average of $3.37 per day in 1931 to $2.35 per day in 1933. In mines, wages were substantially the same as in previous years.

TABLE III

WORKMEN EMPLOYED IN PRODUCING AND NON-PRODUCING MINES IN 1933

	Number of workmen	Wages	Number of days' work	Number of 300-day workers
Producing mines	4,283	$ 4,589,787	1,208,606	4,029
Non-producing mines	515	443,751	113,135	377
Assessment work on claims	1,033	804,383	244,291	814
Total	5,831	$ 5,837,921	1,566,032	5,220

ACCIDENTS

The total number of accidents in mines, quarries, and annexed plants, as reported by operators, was 357, of which 8 were fatal. The rate per thousand workers, on the 300-day basis, was 48, which is lower than for the past three years.

As regards fatal accidents, the rate for the year was 1.08 per thousand full-year workers. This is a better record than for any other year for which statistics are available, except 1911 and 1917, when the rates were a little lower.

TABLE IV

SUMMARY OF ACCIDENTS IN MINES, QUARRIES, AND ANNEXED PLANTS IN 1933

	Number 300-day workers	Accidents		Total	Per 1,000 300-day workers
		Fatal	Non-fatal		
Mines	5,220	8	314	322	61.7
Quarries	2,211	0	35	35	15.8
Total	7,431	8	349	357	48.0

The total number of non-fatal accidents, also, was less than in 1932. The distribution of accidents, fatal and non-fatal, in mines, quarries, and annexed plants, is shown in Table V, compiled from information furnished by operating companies.

TABLE V

ACCIDENTS IN MINES, QUARRIES, AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC DURING 1933

	Fatal		Non-fatal		Totals	
	No.	%	No.	%	No.	%
MINES:						
Underground	6	1.7	169	47.3	175	49.0
Open pits	0	0.0	22	6.2	22	6.2
Surface	2	0.6	44	12.3	46	12.9
	8	23	235	65.8	243	68.1
QUARRIES:						
In pits	0	....	28	7.8	28	7.8
Surface	0	....	1	0.3	1	0.3
	0	....	29	8.1	29	8.1
ANNEXED PLANTS:						
Concentrators	0	0	35	9.8	35	9.8
Smelters	0	0	17	4.8	17	4.8
Shops	....	....	19	5.3	19	5.3
Warehouses	....	....	5	1.4	5	1.4
Power plants	....	....	9	2.5	9	2.5
	0	0	85	23.8	85	23.8
TOTALS	8	2.3	349	97.7	357	100.0

It is to be noted that accidents in open-pits in mines are gradually on the decline. In 1927, such accidents accounted for 51.7 per cent of the total, whereas the corresponding figure for 1933 was only 6.2 per cent. These accidents have occurred for the most part in connection with box loading and hoisting operations in open-pit asbestos mining, but today most of the asbestos output is won by underground mining methods.

FATAL ACCIDENTS:

The eight fatal accidents all occurred in mines, six of them underground and two on surface. There were no fatalities recorded in quarries.

Two of the fatal accidents were caused by rock rolling down inclines where men working in inclined raises or stopes were struck by a rolling rock dislodged from the slope above them. Two other fatalities resulted from explosives—one underground and one on surface.

TABLE VI

ANALYSIS OF FATAL ACCIDENTS IN MINES, QUARRIES, AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC DURING 1933

Cause of Accident	Under-ground	Open pits	Surface	Totals	
				No.	%
MINES:					
Rock rolling down incline...	2	....	....	2	25.0
Explosives.....	1	0	1	2	25.0
Hoisting and shaft.....	1	0	0	1	12.5
Fall of person.....	1	0	0	1	12.5
Fall of rock.....	1	0	0	1	12.5
Haulage.....	....	....	1	1	12.5
Totals.....	6	0	2	8	100.0

NON-FATAL ACCIDENTS:

Table VII gives an analysis of the non-fatal accidents. As will be noted, the great majority of these accidents fall, as usual, in a comparatively small number of groups when classed according to cause.

Mines.—'Fall of person' was the cause of 35 accidents in mines, or about 15 per cent of the total; under this heading are included accidents due to men falling down chutes, raises, and slopes when working underground, or to slipping and tripping on surface. 'Handling rocks or objects' accounted for 30 accidents, or nearly 13 per cent; seven of these occurred while men were handling drills underground. 'Loading cars and boxes' was responsible for 23 accidents, or about 10 per cent; as already stated, this was for many years the main cause of accidents in Quebec mines, during the period the asbestos mines were all operated as open pits. With regard to 'machinery and tools', with a total of 22 accidents, or rather more than 9 per cent, it should be remarked that proper guarding of machinery would have prevented many injuries from this cause.

Quarries.—The most frequent causes of accidents in quarries were 'loading boxes', which accounted for 34.5 per cent of the total, and 'handling stone or objects', responsible for nearly 21 per cent.

Annexed Plants.—The largest number of accidents in annexed plants was caused by 'machinery and tools', about 32 per cent of the injuries being due to this cause. 'Handling objects and stone' and 'fall of objects or rocks' were also frequent causes of accident.

TABLE VII

ANALYSIS OF NON-FATAL ACCIDENTS IN MINES, QUARRIES, AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC DURING 1933

Cause of Accident	Underground	Open pits	Surface	Total	
				No.	%
MINES:					
Fall of person	21	1	13	35	14.9
Handling rocks or objects	23	2	5	30	12.8
Loading cars and boxes	15	8	....	23	9.8
Machinery and tools	12	1	9	22	9.4
Fall of rock	18	....	....	18	7.6
Haulage	9	....	7	16	6.8
Drilling	13	1	....	14	6.0
Rock rolling down incline	12	....	....	12	5.1
Slides of rock and ground	6	3	2	11	4.7
Explosives	6	1	1	8	3.4
Lifting heavy object	6	....	2	8	3.4
Fall of objects	4	....	3	7	3.0
Hammering stone and cobbing	4	1	1	6	2.5
Cable-derrick	....	4	....	4	1.7
Sealing	4	....	....	4	1.7
Burns	3	....	1	4	1.7
Hoisting and shaft	3	....	....	3	1.3
Nails	3	....	....	3	1.3
Shovelling	3	....	....	3	1.3
Scaffolding and ladder	2	....	....	2	0.8
Miscellaneous	1	....	....	1	0.4
Dust	1	....	....	1	0.4
Totals	169	22	44	235	100.0
QUARRIES:					
Loading boxes	....	10	....	10	34.5
Handling stone or objects	....	6	....	6	20.7
Machinery and tools	....	3	1	4	14.0
Fall of person	....	3	....	3	10.3
Slides of rocks and ground	....	3	....	3	10.3
Hammering stones	....	1	....	1	3.4
Fall of rocks	....	1	....	1	3.4
Derrick	....	1	....	1	3.4
Totals	....	28	1	29	100.0

TABLE VII—(*Continued*)

Cause of Accident	Concentrators	Smelters	Repair shops	Warehouses	Power plants	Total	
						No.	%
ANNEXED PLANTS:							
Machinery and tools	7	4	11	..	5	27	31.7
Handling objects and stone	8	2	6	2	3	21	24.7
Falls of objects or rocks	4	2	2	2	..	10	11.8
Burns	..	7	..	..	1	8	9.4
Fall of person	4	1	..	..	..	5	6.0
Bagging and handling bags	3	..	..	1	..	4	4.7
Haulage	1	1	..	..	..	2	2.3
Hammering stone and cobbing	2	..	..	..	..	2	2.3
Gearing, shafting, belt'g	2	..	..	..	..	2	2.3
Lifting heavy objects	1	..	..	..	..	1	1.2
Electricity	1	..	..	..	..	1	1.2
Scaffolding and ladder	1	..	..	..	..	1	1.2
Nails	1	..	..	..	..	1	1.2
Totals	35	17	19	5	9	85	100.0

PREVENTION OF ACCIDENTS

The accident rate—as regards both fatal and non-fatal accidents—of the mining industry of the Province compares very favourably with that of any other Province in the Dominion, or with that of any other country. The record is greatly to the credit of all operators in the Province. The larger mining companies, in particular, are sparing no effort to reduce as far as possible the causes of accidents on their properties, and to eliminate all 'preventable' accidents by inculcating in their employees a proper regard for 'safety-first' measures.

In the Annual Report for 1932, we included an account of the work which the Joint Safety Association of the Quebec Asbestos Producers, then recently organized, was undertaking, and of the success which had already attended its efforts in the prevention of accidents. This year, at our request, Mr. P. W. Meahan, Safety Engineer for Noranda Mines, Limited, has furnished us with the account that follows of the methods adopted, and of the results obtained to date, in the accident prevention campaign of that Company. It is followed by a short account of the results obtained by the Asbestos Association.

Safety Work at Noranda Mines, Limited

The Safety Department of Noranda Mines, Limited, was established in January, 1930. Operations had been greatly enlarged during 1928 and 1929 and, due to the scarcity of experienced labour obtainable at the time, a large number of the new employees were inexperienced. This was probably the main reason for the relatively large number of accidents at the property during those years.

Each department of Noranda Mines has its safety committee, the safety inspector devoting most of his time to the underground branch of the work. Meetings are held once a month by the smelter, concentrator, and mechanical-electrical departments, and every week by the underground department. All foremen are required to attend these meetings. Here, accidents and their causes, also dangerous practices and unsafe working conditions, are brought before the meeting, and suggestions as to overcoming these conditions are discussed. The underground department also arranges that each foreman shall hold a meeting with his shift from time to time, at which he reads over and explains the safety regulations and mining laws to them.

Each foreman is responsible for safety conditions on his own beat. He must report all accidents. These are tabulated, and monthly reports are forwarded to the General Manager, Assistant General Manager, and the several department heads, stating the nature of the accidents, time lost, and the foreman under whom the accident occurred.

A number of employees in all departments have received first-aid training. Two fully-equipped first-aid rooms are maintained, one at the mine and another at the smelter. At the mine, a first-aid attendant is always on shift.

All underground employees are required to wear safety hats. Leather gloves are made compulsory on certain jobs, and safety boots are now being introduced. Safety goggles are also furnished all underground employees.

In May, 1929, a course in mine rescue and first-aid work was instituted, and to date a total of 49 men have been trained in the use of oxygen-breathing helmets, in case it should ever become necessary to fight mine-fires or to rescue men who may have been cut off from the exits by gases generated by mine-fires or other causes. The Company has furnished equipment for use in connection with this work.

The accompanying tables show the results obtained since the safety campaign was inaugurated. An accident is classed as a 'lost-time' accident when the injured man loses one day or more; a 'compensatable' accident is one through which more than seven days are lost.

ACCIDENTS ON SURFACE, NORANDA, 1932 AND 1933

DEPARTMENT	LOST-TIME ACCIDENTS		COMPENSATABLE ACCIDENTS
	1932	1933	1933
Mine surface	21	11	2
Smelter	39	22	9
Coal plant	1	2	2
Shops	8	5	5
Crushers	6	2	0
Sample mill	4	1	1
Concentrator	2	5	0
Construction	29	23	11
General	0	0	0
Totals	110	71	30

UNDERGROUND ACCIDENTS, NORANDA, 1930 TO 1933

Year	Lost-time accidents	Compensatable accidents	Ratio of lost-time accidents to number of shifts worked	Increase or decrease in lost-time accidents over previous year, proportionate to shifts worked
1930	502	.....	1 in 474	
1931	276	150	1 in 724	34.0 per cent decrease
1932	232	123	2 in 1,054	31.2 " " "
1933	171	76	1 in 1,341	21.0 " " "

RATE AND FREQUENCY OF UNDERGROUND ACCIDENTS, NORANDA, 1931-1933

	1931	1932	1933
Rate per 1,000 300-day workers	414	284	224
Frequency per 1,000 hours exposure	0.17	0.12	0.09

CLASSIFICATION OF LOST-TIME ACCIDENTS, NORANDA, 1932 AND 1933

CAUSE OF ACCIDENT	1933		1932	
	Non-Fatal	Fatal	Non-Fatal	Fatal
Loose back at face	6	....	5	....
Loose back	9	1	12	1
Rolling rock	35	....	23	....
Rush of ore or rock	6	1	3	....
Mucking	14	....	7	....
Motor haulage	7	....	11	....
Tramming	1	....	5	1
Fall of persons	40	....	43	....
Falling of objects	23	....	27	....
Blasting	2	....	4	....
Hoists, derricks, etc	3	....	1	....
Rock or dust in eye	11	....	18	....
Gas	5	....	9	....
Crushed between objects	38	....	29	....
Hand tools	10	....	10	....
Machinery	4	....	9	....
Nails or splinters	8	....	9	....
Strain while lifting	3	....	7	....
Cage, skip, or bucket	2	....	6	....
Burns	2	....	2	1
Slag or matte burns	10	....	11	....
Electricity	1	....	2	....
Cranes, ladles, hooks	0	....	0	....
Air lines	1	....	0	....
Timbering	(a)	....	2	....
Chutes	(a)	....	31	....
Drills	(a)	....	33	....
Sampling	(a)	....	1	....
Scaling	(a)	....	8	....
Unclassified	1	....	14	....
Totals	242	2	342	3

(a) This classification not used during the year 1933.

JOINT SAFETY ASSOCIATION OF THE QUEBEC ASBESTOS PRODUCERS

With the inception of the present Quebec Workmen's Compensation Act, the Quebec Asbestos Producers formed a joint Safety Association, of which Kenneth B. S. Robertson of Montreal is the head and Walter E. Montgomery is the Safety Engineer. The object of this association is to be a clearing house for Safety information and to co-ordinate the efforts of the member companies, in the further reduction of their accident experience.

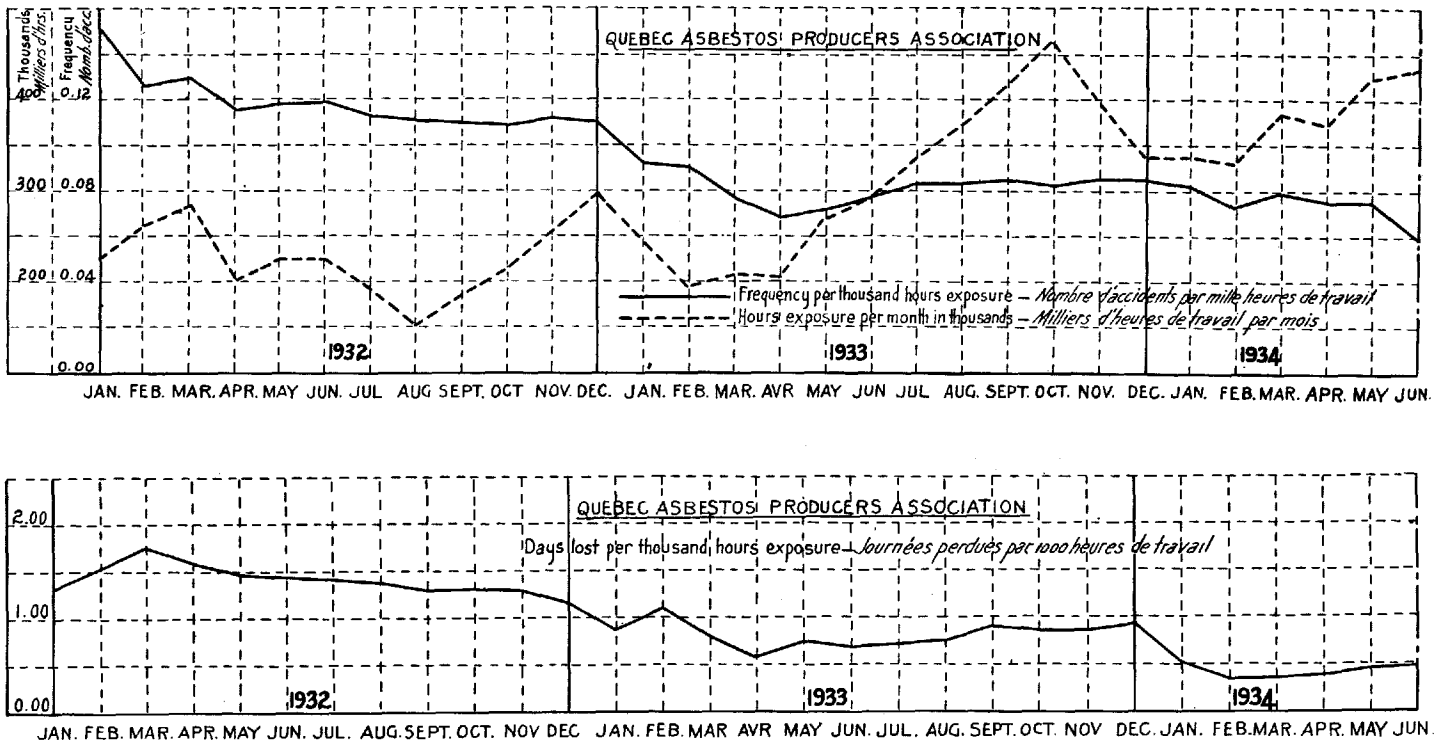


FIGURE 2.—Accident frequency and days lost through accidents in asbestos mining and milling.

The Safety Engineer makes a monthly tour of inspection of all properties. His findings and recommendations are included in a separate report to each company and are subsequently referred to every month until their completion.

In 1932, when the Safety Association was formed, the accident frequency and severity showed a consistent reduction throughout the entire year. With working hours averaging 222,000 per month, the "frequency" dropped from 0.15 to 0.11 and the "days lost" from a 1.75 peak to 1.19 per thousand hours worked.

Consistent with concerted effort, the downward trend in the accident experience continued throughout 1933. The frequency was further reduced from 0.11 to 0.085, while the days lost fell from 1.19 to 0.92.

It should be noted that the reduction in frequency and severity in 1933 is made further impressive when it is realized that the hours worked increased from a monthly average of 222,000 hours in 1932 to 309,000 hours in 1933.

Notwithstanding the further increase in "hours worked" in the first six months in 1934, to a 380,000 hours' average, the frequency rate again dropped from 0.085 to 0.06, while the severity changed from 0.92 to 0.50.

It is seen by the upper chart of Figure 2 that the accident frequency, over a period of two and a half years, has been reduced by 60%, whereas the average thousand hours work per month has increased 70% in the same period.

All company officials and foremen are given due credit for this work, which indicates that accidents can be prevented and suffering eliminated to a great extent.

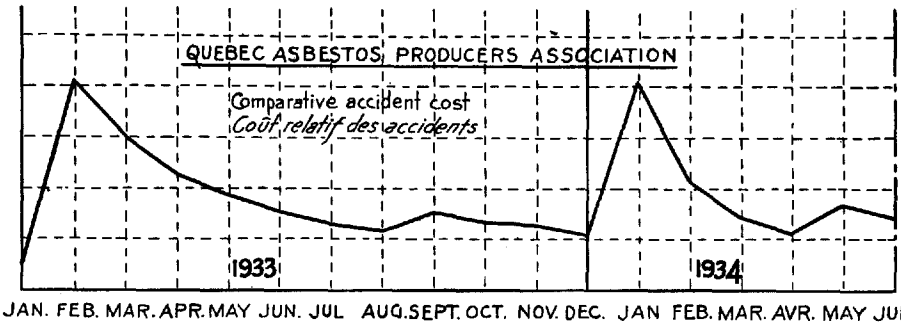


FIGURE 3.—Comparative accident cost in asbestos mining and milling.

DESCRIPTION OF FATAL ACCIDENTS

February 3rd.—Mike Yurinich, Jugo-Slav, 32 years of age, was instantly killed in a slide of broken ore at the Noranda mine.

The accident happened in the blasting chamber of 338 raise, about 20 feet above the 1318 drift on the 300-foot level. Yurinich was employed as grizzly-tender. It was his duty to keep the ore flowing from the stope ('G' ore-body) through the grizzlies.

Yurinich went on shift at 7 a.m. on February 3rd. He notified the switchman on the level that he was going to blast the broken ore which was hanging up in the raise above. A companion who was working in the adjoining blasting chamber heard the ore run in 338 chamber and he shouted to Yurinich to find out if he was all right. Hearing no answer, he went over to investigate. When he did not see Yurinich, he went to the level for assistance. The body of Yurinich was found on the slope above the grizzly, lying on the back with the head towards the grizzly and the feet up the slope. A small amount of stemming clay was found on the deceased's chest, indicating that, at the moment of the accident, he was probably engaged in placing the dynamite and cap. It was proved, however, that no explosion had taken place, as the sound was not heard by men in the near vicinity and there were no fumes in the place immediately after the accident. It is probable that, when the broken ore started to run, the deceased was struck on the forehead by falling pieces, causing numerous puncture wounds. He was thrown backwards and fell on a sharp piece of rock that caused a wound in the back and the rupture of the spinal column.

The victim's work was necessarily of a somewhat hazardous nature. It is frequently necessary to crawl into places where broken ore is hanging up, in order to observe the conditions and to take the proper means to bring it down. It may be mentioned that the men doing such work are provided with long wooden poles with which to place the dynamite in hazardous locations. The use of blasting chambers of this sort eliminates chute-blasting and is a safety measure. An accident of this character should not happen, if the men take all precautions.

Verdict: Accidental death.

February 10th.—Jack Gorman, aged 44 years, employed at the Noranda mine, died from injuries received in falling more than 200 feet.

Scaling of the station at the 19th level of No. 4 shaft was in progress on the morning of February 10th. The rock is a blocky 'older diabase', and, in these lower levels of the shaft, it has been a continuous hazard. The man had covered the bucket compartment with planks, in order to prevent any of the loose rock from falling down the shaft. Some rock had been scaled down close to the west side of the shaft, and one piece had broken one of the planks covering the compartment. The scalers called to Jack Gorman, who was on the floor of the level, to remove the broken plank and replace it with a new one. It was believed that the back was sound enough to permit this operation, without danger. Gorman stood on a wall-plate and, while replacing the broken plank, a piece of loose rock fell from the station roof. It struck him in the back and forced him forward through the broken plank, into the shaft. He fell a distance of about 290 feet to the sump below. Death was instantaneous.

The operation that Gorman was about to perform involved a great measure of risk. However, it was undoubtedly necessary to replace the broken plank before further scaling was attempted, as men were working on the 20th and 21st levels and falling rocks in the shaft might ricochet into these levels.

Verdict: Accidental death.

February 21st.—William J. Millenbach, 32 years of age, employed as a cage-tender in the No. 2 shaft at the Beattie mine, was instantly killed in falling a distance of about three hundred feet to the bottom of the shaft.

Shortly before 9 a.m. on February 21st, Jay Tuttle, mine superintendent, descended the No. 2 shaft from the surface to the 200-foot level, on the cage, in company with the cage-tender, William J. Millenbach. On reaching the level, Tuttle went into the drift to direct some work there, leaving Millenbach at the station. Two cars of ore were in the station at the time. Tuttle returned several minutes later, to take the cage to the next level. He saw no sign of Millenbach and the cage was hanging in the shaft a few feet above the level, with an empty car on it. The guard-rail of the shaft was not in place. Tuttle rang the cage down to the chairs, removed the empty car, and ascended to surface. A search there failed to locate Millenbach, so Tuttle returned to the 200-foot level, and then descended the ladderway compartment. At the 350-foot level, he found Millenbach's hat, and a short distance above the 500-foot level he saw portions of human remains on the shaft timbers. The body was found on the bulkhead at the 500-foot level station. Tuttle then entered the drift on the 500-foot level, where two miners were drilling, and obtained their assistance to bring the body to surface.

It is indicated that Millenbach loaded a car of ore on the cage, and sent it to the surface. The empty car was returned, and, when the hoistman noticed that the cage did not engage the chairs, he hoisted it a few feet above the station floor. All evidence points to the belief that Millenbach fell down the shaft a few minutes after the mine superintendent had left him. The fact that the guard-rail was up would indicate that Millenbach must have raised it before the return of the cage, or perhaps had never lowered it after loading the car of ore on the cage. The possibilities are that he may have lost his balance while standing near the open shaft, or he may have looked over into the shaft, and the down-coming cage may have struck him on the head.

Verdict: Accidental death.

February 24th.—Ludger Loignon, locomotive engineer, aged 37 years, was instantly killed in the yard at the King mine, operated by the Asbestos Corporation, Ltd.

According to the brakesman, Emile Doyon, the accident occurred in the following way: Loignon's train, consisting of four empty cars and a locomotive, was to be shunted from one track to another. Doyon recommended the victim to drive slowly at the switch, as the cars might jump the track. After he had opened the switch, he signalled him to pull away. As the train was passing near, he noticed that the victim was standing on the window-frame of the locomotive with one leg over, while with the other he was driving the controller of the locomotive. His head and body leaned out of the window, his head being about nine inches above the roof. Loignon was looking backward to see that the cars were shunted correctly. The track on which the train was moving runs under a storage-bin, into which the cable-derrick boxes are emptied. It would appear that, in trying to look backward in this way, Loignon struck his head against the steel sluice-gate of the storage-bin, and fell between the locomotive and the next car. His body was drawn a distance of ninety feet before the locomotive stopped. He was found, terribly crushed, at the rear end of the locomotive, but none of the wheels had passed over his body.

Since this accident, the operators have been notified to see that men who are driving a locomotive stay under the locomotive shelter when their train is in movement.

Verdict: Accidental death.

July 3rd.—Thomas Edstrom, aged 23 years, was the victim of a fatal accident in the shaft of Bagamac Rouyn Mines, Limited.

From an examination of the witnesses at the scene of the accident, and from evidence produced at the inquest, it is apparent that the accident happened in the following manner: The shaft at the Bagamac Rouyn property is a small prospect opening, measuring seven feet by nine feet in the clear, and the depth is about 72 feet. There is an open ladder-way on one side. There are three platforms in the ladder-way, the lowest of which is at a depth of about 50 feet below the collar. From the latter point, a removeable ladder is used to reach the bottom.

On June 30th, a round was blasted in the bottom of the shaft. The men did not return to work until the morning of July 3rd. They arrived at the shaft at 6.30 a.m., and commenced to de-water it.

There was about 9 feet of water in the bottom at the time. Edstrom was stationed on the third lowest platform, to steady the bucket after it was filled with water. Henry Larsen, a companion, was on deck.

At about 7.45 a.m., some thirty buckets of water had been removed. The bucket was then lowered and filled again with water. When filled, Edstrom shouted to Larsen to hoist, and the bucket was hoisted about twenty feet above the bottom and was held there to permit Edstrom to steady it. Larsen states that at this moment he heard a splash, and believed that the victim had thrown a piece of rock from the platform or wall. The bucket was still swinging, and Larsen called to him to steady it. Receiving no reply, he descended the ladder. Finding no trace of Edstrom, he returned to surface and called for aid. A man was lowered into the water and succeeded, with the aid of a pick, in recovering Edstrom's body. Artificial respiration was attempted, but to no effect.

Verdict: Accidental death.

September 7th.—Eusèbe Leroux, 28 years of age, employed as a grizzly man at the King mine of the Asbestos Corporation, Limited, died from a broken larynx.

At the time of the accident, the deceased was working alone in one of the grizzly chambers that have been installed in the new 'block-caving' system of working. It is probable that, while barring a big rock of 700 to 800 pounds, it came down suddenly, striking his bar before he could pull it out of the way. The bar struck him on the throat, breaking the larynx. The only person near him at the time did not see the accident but rushed to his assistance when he saw him falling. He died a few minutes later.

Verdict: Accidental death.

October 21st.—John Sten, aged 31 years, was instantly killed by an explosion of dynamite at the property of Northern Quebec Gold Mines, Limited.

On the morning of October 21st, Sten and his helper, Dalton Beach, went to work in an adit. It was about 60 feet from the mouth of the adit to the face. They set up their machine and drilled

off a round of about fourteen holes. The machine was then removed, and the holes were loaded with explosive. Each hole was about five feet in depth and was charged with four sticks of Forcite. The primer in each case was the second stick from the bottom. The holes were filled with clay stemming. The fuses were cut to about five feet in length.

Sten split the fuse ends. He then commenced to light the round, starting with the cut holes. There was water dripping on the fuses and he had difficulty in lighting them. In some instances, he re-cut the ends. He was using his lamp for lighting the fuses, and it went out. He had difficulty in re-lighting it. There was no other lamp conveniently close. Beach was becoming nervous and suggested to Sten that they had better be getting out of the way. At the same time, Sten was trying to light the fuse of one of the lifters (bottom holes). When the first shot went off, Beach was thrown down, but he managed to get to his feet and ran for the entrance. He was out of the adit before the second shot went off. Sten, on the other hand, was caught with the full force of the blast, and was instantly killed. Examination revealed a fracture of the skull, a fracture of the left leg, and hemorrhage.

Verdict: Accidental death.

December 1st.—Roch Nadon, age 21 years, was killed by a blasting accident that occurred on the property of the International Mining Corporation at Bourbeau lake, Chibougamau district.

On the morning of December 1st, a gang of men was engaged in surface work on the claims of the International Mining Corporation. Towards noon, Roch Nadon and a helper had completed the drilling of two holes in a shallow pit, and had loaded each of these holes with three cartridges of 40 per cent Forcite and one primer cartridge of 50 per cent Forcite. The caps were No. 8 strength, and the fuses were from 2½ to 3 feet in length.

Gerard Nadon was working in a trench about 100 feet away from his brother, and he had charged one hole there. When it was time to fire he called to Roch Nadon, and they commenced to light their fuses. When his own fuse was alight, he noticed that Roch had lit one of his fuses but that the other fuse had not been ignited. He

told him to cut off an inch or so and to re-light it. Roch lit a match, but it was extinguished by the wind, and as the other fuses had been burning for a few minutes, the brothers departed to the blacksmith shop about 600 feet away, where they were protected from flying débris. The other workmen had arrived there previously. Two shots were then heard, and Roch returned to light the third fuse. A few minutes later, his companions heard a third shot go off, and as Roch had not returned to the shop, they went to look for him. He was found in the pit, in a pool of blood, and it was evident that the blast had gone off under him.

The injured man suffered injuries to his eyes, and one forearm was almost severed. He died on December 14th, from gangrene poisoning.

Verdict: Accidental death.

LIST OF THE PRINCIPAL OPERATORS AND OWNERS OF MINES AND QUARRIES IN THE PROVINCE OF QUEBEC

I.—METALLIC ORES AND MINERAL PRODUCTS

ASBESTOS

Name of Operator	Address	Location of Mine (Township)
Asbestos Corporation, Limited	Canada Cement Building, Montreal	Thetford, Coleraine and Broughton
Canadian Johns-Manville Co., Ltd	Asbestos	Shipton
Compagnie d'Amiante de Thetford, Ltée, (La)	Thetford Mines	
Compagnie de la Mine d'Amiante Boisvert, Ltée, (La)	St. Calixte de Kilkenny	Kilkenny
Croteau, Louis	Belmina, Wolfe Co	Wolfeston
Johnson's Company	Thetford Mines	Coleraine and Thetford
Keasbey & Mattison Company	Bell Asbestos Mines Dept., Thetford Mines	Thetford
Nicolet Asbestos Mines, Limited	c-o Greenshields & Greenshields, 820 Transportation Building, Montreal	Tingwick
Northern Asbestos Co., Ltd	Black Lake	Thetford
Pelletier, l'Hon. L. P. (Succession)	c-o Chs. J. Baillargeon, 71 St. Peter St., Quebec	Thetford and Coleraine
Pharaoh Asbestos Limited	c-o J. B. Payne, Granby	Potton
Quebec Asbestos Corporation	East Broughton	Broughton
Queen Asbestos, Limited	c-o A. Manseau, Vice-Pres., Drummondville	Cleveland
Roberge, L. I	Coleraine	Garthby

CHROME

Name of Operator	Address	Location of Mine (Township)
Asbestos Corporation, Limited	Canada Cement Co. Bldg., Montreal	Coleraine
Brousseau, Nap	Courcelles, Que	Garthby
Colonial Chrome Co., Ltd	120 Broadway, New York, N.Y., U.S.A.	Coleraine
The Dominion Mines & Quarries, Ltd	Canada Life Building, 40 University Avenue, Toronto, Ont	Coleraine
Gosselin, Nap	D'Israéli	Garthby
Gray, Ernest	Thetford Mines	Coleraine
Larochelle, J. A	Black Lake	Coleraine
Reed Realties, Limited	c-o H. A. Peverley, 1536 St. Mark St., Montreal	Coleraine
Ross, Frank W	67 St. Peter St., Quebec	Coleraine
Victory Chrome Mines, Limited	c-o General Trust of Canada, 112 St. James Street, Montreal	Garthby
Wilson, David	191 Victoria Street, Sherbrooke	Coleraine

COPPER

Name of Operator	Address	Location of Mine (Township)
Abacourt Mining Corporation, Ltd.	c-o Ernest Dussault, 660 St. Catherine St. West, Montreal	Destor
Abbey Mines, Limited	915 Transportation Building, Montreal	Desmeloizes and Dufresnoy
Abitibi Copper Mining Syndicate, Ltd.	Villemontel	Trécesson
The Adsit Mining Corporation	c-o The Noranda Mines, Ltd., 802 Royal Bank Building, 2-8 King St. East, Toronto 2, Ont	Rouyn
Aldermac Mines, Limited	500 Dominion Square Bldg., Montreal	Beauchastel
Alamac Mines, Limited	1811 Royal Bank Building, Montreal	Desmeloizes
Alderson & MacKay Inc.	Room 500, Dominion Square Bldg., 1010 St. Catherine St. West, Montreal	Beauchastel
Alliance Mining and Securities, Ltd.	c-o L. A. McKinley, Secretary, Room 111, Blackburn Building, Ottawa, Ont	
Area Mines, Limited	c-o Chauvin, Walker, Stuart & E. Martineau, 414 St. James St. West, Montreal	Duprat, Dufresnoy & Rouyn
Astoria Rouyn Mines, Limited	70 St. Paul St., Quebec	Rouyn, Beauchastel and Joannes
Aura Mines, Limited	Lorrainville	Laverlochère
Bagamac Rouyn Mines, Limited	Bank of Nova Scotia Building, Haileybury, Ont	Rouyn
Beaver Mountain Copper Mines, Ltd.	c-o W. C. Offer, Box 722, Orillia, Ont.	Dufresnoy
Big Bend Mining Corporation, Ltd.	c-o Donat O. Ducharme, Rouyn	
Blake-Chibougamau Mining Corporation	c-o Messrs. Bernard Devlin, André Taschereau & Louis-Philippe Pigeon, 65 St. Anne St., Quebec	Chibougamau Region
Calbec Copper Nickel Syndicate, Ltd.	26-7 Fraser Building, Ottawa, Ont.	Calumet Island
Canada Quebec Mining Corporation, Ltd.	Room 915, Transportation Building, Montreal	Desmeloizes
Carlson Copper Syndicate	New Liskeard, Ont	Dufay
Centre Boischatel Copper Co., Ltd.	c-o E. D. Ranck, The Coleman Lamp & Stove, Queen St. East & Davies Ave., Toronto, Ont	Beauchastel
The Chance Syndicate	Room 26, 88 King St. East, Toronto 2, Ont	Beauchastel
Chibougamau McKenzie Mines, Limited	Room 336, Board of Trade Building, Montreal	Roy, McKenzie
Chibougamau Prospectors, Limited	276 St. James St. W., Montreal	Chibougamau and Louvicourt
La Cie Minière Ville-Marie-Rouyn	Ville-Marie	Rouyn
Clériçy Consolidated Mines, Ltd.	11-12 Carleton Chambers, 74 Sparks St., Ottawa, Ont	Clériçy
Coniagas Mines, Limited	1514 Canada Permanent Building, Toronto, Ont	Beauchastel, Montbray and Duprat
Consolidated Copper & Sulphur Co.	Eustis,	Ascot
Consolidated Mining & Smelting Co. of Canada Limited	840 Dominion Square Building, Montreal	Duparquet
Cosmos Copper Mining Corp'n, Ltd.	c-o Alex. Livventaal De Livi, Sienna	Weir, Gaspé and Bonaventure
Dufault Lake Mines, Ltd. (Les Mines Lac Dufault, Ltée)	755 Marie Anne St. East, Montreal	Dufresnoy
Dugoss Mines, Limited	168 Pitt Street, Cornwall, Ont	Duparquet
East Bay Copper Company, Ltd.	Rouyn	Dufresnoy
Frontenac Copper Mines, Limited	c-o J. J. Harold, 204 Notre-Dame St. West, Montreal	Clériçy and Dufresnoy
Gilbec Mines, Limited	200 Bay Street, Toronto 2, Ont.	Dufresnoy
Glenwood Mining Co., Limited	c-o Albert MacDonald, Manager, Rouyn	Rouyn
Joannes Mine Corporation, Limited	Room 410, 276 St. James St., Montreal	Joannes
Lakeside Mines, Limited	1610 Concourse Building, 100 Adelaide St. West, Toronto, Ont	Rouyn
Memphremagog Mining Company	c-o Geo. E. Smith, Manager, R.M.D. No. 2, Mansonville	Potton
Montbray Rouyn Mines, Limited	1307 Concourse Building, Toronto 2, Ont	Montbray
Newbec Mines, Limited	c-o Holden & Murdoch, Suite 603, 4 Royal Bank Building, 2-8 King Street East, Toronto, Ont	Dufresnoy and Rouyn

COPPER—Continued

Name of Operator	Address	Location of Mine (Township)
Noranda Mines, Limited	804 Royal Bank Building, 2-8 King St. East, Toronto 2, Ont.	Rouyn
Normac Mining Syndicate	411-3 Pigott Building, Hamilton, Ont.	Beauchastel
Normetal Mining Corporation, Limited	350 Bay Street, Toronto, Ont.	Desmeloizes
Northern Investment and Mining Co.	c-o J. F. Grenon, C.E., Chicoutimi.	Obalski
Northwaite Mining Company, Limited	372 Bay Street, Toronto, Ont.	Duprat and Dufresnoy
Opemiska Copper Mines, Limited	100 Adelaide Street West Toronto, Ont.	Opemiska
Pontiac Rouyn Mines, Limited	c-o Millar & Hunter, 59 Yonge St., Toronto 2, Ont.	Rouyn
Prospectors Airways Co., Ltd.	c-o C. F. Tuer, Haileybury, Ont.	
Quebec Copper Corporation	c-o E. D. Ranck, The Coleman Lamp & Stove Co., Ltd., Queen St. East & Davies Avenue, Toronto, Ont.	Duprat
Quebec Copper Gold Mines, Limited	c-o J. L. McDougall, Sec'y, 75 Sparks St., Ottawa, Ont.	Beauchastel
Quemont Mining Corporation, Limited	350 Bay Street, Toronto, Ont.	Rouyn
Renown Mining Company, Limited	c-o Thos. G. Stratton, Sec'y, 212 Jackson Building, Ottawa, Ont.	Beauchastel
Rhyolite Rouyn Mines, Limited	1004 Bank of Hamilton Building, Toronto 2, Ont.	Duprat
Robb-Montbray Mines, Limited	Room 1001, 85 Richmond St. West, Toronto, Ont.	Montbray
Ribago Copper Corporation, Limited	c-o W. A. Gordon, K.C., Haileybury, Ont.	Beauchastel
Suzor Mining Syndicate	Box 99, Noranda, Que.	Suzor
Syndicat d'Explorations Minières de la Rivière Mistassini Enrg.	c-o Pierre Doucet, Girardville.	
Syndicat Minier de Gaboury	Guigues	Gaboury
Le Syndicat Minier de Senneterre, Limitée	Senneterre	
Succession Pierre Tétreault	70 Holyrood Avenue, Outremont	Brome
Thompson Joannes Syndicate	Noranda	Rouyn
Turtle Lake Mining Company	c-o J. A. Parent, 193 Main Street, Hull	Dufay
United Copper Syndicate, Limited	130 Coristine Building, Montreal	Rouyn
Ventures, Limited	Canadian Bank of Commerce Building, 25 King Street West, Toronto, Ont.	Duprat
Ventures Claims, Limited	Canadian Bank of Commerce Building, 25 King Street West, Toronto, Ont.	Duprat
Waite-Amulet Mines, Limited	804 Royal Bank Building, 2-8 King Street East, Toronto, Ont.	Dufresnoy
Wasamac Mines, Limited	755 Marie-Anne St. East, Montreal	Dufresnoy and Dasserat
Windsor Mines, Limited	c-o J. L. Alain, Sec'y, 170 Blvd Langelier, Quebec	La Sarre

FELDSPAR

Name of Operator	Address	Location of Mine (Township)
Gordon Bigelow	Glen Almond	Portland East
Bon Ami, Limited	Box 166, Hochelaga, Montreal	Aylwin
Maurice A. Brazeau	Buckingham	Portland West
The Buckingham Feldspar Company	c-o E. S. Higginson, P. O. Box 54, Buckingham	
Buckingham Mining Co., Ltd.	1400 Dorchester St. West, Montreal	Buckingham
Wm. & J. J. Cameron	Buckingham	Derry
Canadian Amber Mica Co.	P. O. Box 246, Station B, Montreal	Portland West
Canadian Flint and Spar Co., Ltd.	900 Victoria Building, Ottawa	Derry
Joe Cooligan	Buckingham	
Estate P. M. Côté	197 Wilbrod Street, Ottawa, Ont.	Templeton
Louis Couture	Glen Almond	Buckingham
Derry Mining Company	Buckingham	Derry
Robert J. Donaldson	Glen Almond	Buckingham
W. E. Evans	Buckingham	

FELDSPAR—Continued

Name of Operator	Address	Location of Mine (Township)
Feldspar Quarries, Limited	Room 1300, 507 Place d'Armes, Montreal	Buckingham
The Gatineau Spar Milling Co., Ltd	197 Wilbrod St., Ottawa, Ont	Hull
J. B. Gauthier	Buckingham	Buckingham
John Laneville	Buckingham	Buckingham
Antoine Larose	Weir	Arundel
Laurel Mining Co., Limited	4 Des Forges St., Trois Rivières	Wentworth
A. J. McMillan	Box 84, Buckingham	Buckingham
Saul C. E. Melkman & Frances Marie Neubauer	5165 Côte St. Antoine, Montreal	Thelmina, Thelma Bay (Saguenay Co.)
Henri Mercier & John Lauzon	Shapley Creek, Hull Co	Derry
New York Feldspar Corporation	Lewiston, Panna, U.S.A	Buckingham
O'Brien & Fowler, Limited	Ottawa Electric Building, 56 Sparks St., Ottawa, Ont	
Ottawa Valley Mines, Limited	New Birks Building, Montreal	Buckingham
Alfred Parcher	Glen Almond	Derry
Gonzague Pedneaud	Buckingham	Buckingham
St. Lawrence Feldspar Company, Ltd	c-o S. E. Melkman, 765 Côte St. Antoine, Montreal	Thelmina, Quetachoom, Manicouagan Bay (Saguenay Co.)
T. Whitfield	Buckingham	Buckingham
Mrs. A. R. Whittemore	475 Kent St., Ottawa, Ont	Derry
Winning & Downing	Notre-Dame de la Salette	Buckingham

GARNET

Name of Operator	Address	Location of Mine (Township)
Langlade Garnet, Limited	80 St. Peter St., Quebec	Beaudin and Trévet

GAS AND OIL

Name of Operator	Address	Location of Holdings
Alberta Gas and Fuel Co., Ltd	c-o Henry L. Doherty & Co., 60 Wall Street, New York, N.Y., U.S.A	St. Pie de Guir
Bordeaux Coal & Oil Co., Ltd	c-o Dr. Arthur Beauchamp, Pres., 2101 Boulevard Gouin West, Montreal	
Louis Brochu	Banque Canadienne Nationale Bld'g., 112 St. James St., Montreal	
Canadian Seaboard Oil and Gas, Ltd	c-o Wm. Fraser Macklaier, 507 Place d'Armes, Montreal	
Côté Gas and Oil, Limited	c-o J. W. St. Onge, Pres., Drummondville	Aston
De Sales Oil Syndicate	755 Marie Anne St. East, Montreal	
The Gaspesian Oil Company, Limited	c-o Joseph Têtu, Rivière du Loup	Gaspé South
Lanoraie Oil and Gas Syndicate, Ltd	715 Blackburn Building, Ottawa, Ont	St. Joseph de Lanoraie
Provincial Gas & Oil Co., Limited	c-o Hope Scott, Seifert Building, Quebec	
St. Paul Oil and Gas Corporation, Ltd	105 University Tower, 660 St. Catherine St. West, Montreal	St. Henri de Mascouche
Hope Scott	14 de la Fabrique St., Quebec	
Trinidad Mines, Gas & Oil, Limited	116 Côte de la Montagne, Quebec	
Twin Cities Gas and Oil Co., Limited	Room 614, 276 St. James St., Montreal	St. Grégoire, Lanoraie and Deschambault

GOLD

Name of Operator	Address	Location of Mine (Township)
Adanac Gold Syndicate	c-o Wm. E. Smith, 601 Northern Ontario Bld'g., Toronto 2, Ont.	Rouyn
Aldermac Mines, Limited	500 Dominion Square Building, Montreal	Beauchastel
American Venture Corporation	Room 3404, 255 Broadway, New York, N.Y., U.S.A.	Louvicourt and Bourlamaque
Anglo-Huronian Limited	Suite 1206, Star Building, 80 King St. West, Toronto 2, Ont.	Beauchastel
Arcadian Rouyn Gold Mines Syndicate, Ltd.	105 Côte de la Montagne, Quebec	Rouyn
Arno Mines, Limited	63 Sparks Street, Ottawa	Rouyn
Arntfield Gold Mines, Limited	c-o R. V. Arntfield, Sec'y-Treas., 159 Bay Street, Toronto, Ont.	Beauchastel
Arntfield Mining Syndicate, Ltd	c-o R. V. Arntfield, 159 Bay Street, Toronto, Ont.	Beauchastel
Basin Gold Mines, Limited	Room 200, 31 St. James St. West, Montreal	Dubuisson
Beattie Gold Mines, Limited	Canadian Bank of Commerce Bld'g., 25 King Street West, Toronto, Ont.	Duparquet
Beaufor Gold Mines, Limited	905 Dominion Square Building, Montreal	Pascalis
Bidlamaque Gold Mines, Limited	713 Canada Permanent Building, 320 Bay Street, Toronto, Ont.	Bourlamaque
Blairmont Mining Company, Limited	c-o J. C. Carroll, Pres., Senneterre	Tiblemont
Boischatel-Quebec Mines, Limited	2000 McGill College Avenue, Montreal.	Beauchastel
Brown Bousquet Mines, Limited	212 Keefer Building, 1440 St. Catherine St. West, Montreal	Bousquet
Brownlee Mines, Limited	Noranda	Rouyn
Buffalo Canadian Gold Mines, Limited	c-o Holden, Murdoch, Walton & Beatty, Suite 603, 4 Royal Bank Building, 2-8 King St. East, Toronto, Ont.	Beauchastel
Bussières Mining Company, Limited	221 Notre-Dame St. West, Montreal	Louvicourt
Cadillac Exploration, Limited	Amos	Cadillac
Canadian Enterprises, Limited	212 Keefer Building, Montreal	Cadillac
Canadian Exploration, Limited	c-o Louis Brochu, Manager, Amos	Desmeloizes
Canadian Gold Operators, Limited	c-o Emilien Gadbois, K.C., 84 Notre-Dame St. West, Montreal	Cadillac
Canadian Gold Placers, Limited	c-o L. Joubert, 34 St. James St. West, Montreal	
Canadian Malartic Gold Mines, Limited	63 Main Street, Hull	Fournière
Canadian Pandora Gold Mines, Limited	P. O. Block, New Liskeard, Ont.	Cadillac
Central Gold Mines, Limited	Picton, Ont.	Dasserat
Churchill Mining & Milling Co., Ltd.	1105 Atlas Building, Toronto, Ont.	Cadillac
Coffin Mining Company, Limited	15 King Street West, Toronto, Ont.	Senneterre
Cook & Lloyd	St. Simon les Mines, Beauce County	
Consolidated Chibougamau Goldfields, Ltd.	Suite 702, Insurance Exchange Bld'g., 276 St. James St., Montreal	Obalski and McKenzie
Contact Gold Mines, Limited	713 Canada Permanent Building, 320 Bay St., Toronto, Ont.	Bourlamaque
Cummings-Trudel Mining & Development Co., Limited	Room 300, Victoria Building, Ottawa, Ont.	Malartic, Desmeloizes, Cadillac and Barraute
John Dalton	Timmins, Ont.	Dubuisson
Dasserat Rouyn Goldfields, Limited	c-o Smellie & Lewis, 47-48 Sparks St., Ottawa, Ont.	Rouyn
Donchester Mines, Limited	c-o Messrs. Meredith & Meredith, 46 Dalhousie St., Quebec	Duparquet
Don Rouyn Gold Mines, Limited	c-o H. S. Harrison, Sec'y, 710 Blackburn Bld'g., Ottawa, Ont.	Rouyn, Dufresnoy and Malartic
Dorval-Siscoe Gold Mines, Limited	Suite 504, General Assurance Bld'g., Cor. Bay & Temperance Sts., Toronto, Ont.	Varsan
Dubec Mining Co., Limited	345 Dominion Square Building, Montreal	Duprat, Dufresnoy
The Dubuisson Gold Mining Co., Limited	Pine St., Timmins, Ont.	Dubuisson
Dubuisson Mines, Limited	Canadian Bank of Commerce Bld'g., 25 King St. West, Toronto, Ont.	Bourlamaque, Bousquet and Tiblemont
Dunlop Consolidated Mines, Limited	Room 406, 19 Melinda St., Toronto, Ont.	Louvicourt and Tiblemont

GOLD—Continued

Name of Operator	Address	Location of Mine (Township)
Duparquet Mining Co., Limited	c-o James McWilliam, Sec'y-Treas., 204 Hospital Street, Montreal	Duparquet
East Rouyn Gold Mines, Limited	c-o Holden, Murdoch, Walton & Beatty, 2-8 King St. East, Toronto 2, Ont.	Rouyn
Eclipse Gold Mining Company, Limited	c-o Kornfeld & Bisgeir, 11 Park Place, New York, N.Y., U.S.A.	Destor
Erie Canadian Mines, Limited	Kirkland Lake, Ont.	Pascalis and Rouyn
L'Etoile d'Or Limitée	96 St. Joseph St., Quebec	Dalquier and Trécesson
Explorer Syndicate	c-o W. M. Goodwin, M.E., Ste-Anne de Bellevue	Rouyn
Farrell Rouyn Mines, Limited	Canadian Bank of Commerce Bld'g., 25 King St. West, Toronto, Ont.	Rouyn
Fiske Gold Mines, Limited	P. O. Box 208, Ottawa, Ont.	Rouyn and Beauchastel
Fleming-Thompson Gold Mines, Limited	Rouyn	Duparquet
Francœur Gold Mines, Limited	500 Dominion Square Building, Montreal	Beauchastel
Galatea Gold Mines, Limited	New Liskeard, Ont.	Destor and Duparquet
Gold Bar Mines, Limited	204 Royal Bank Building, Toronto, Ont.	Rouyn and Beauchastel
Gold River Mining Company, Limited	956 New Birks Building, Montreal	Ditton
Goldstrike Syndicate	206 Reford Building, Bay Street, Toronto, Ont.	Rouyn
Graham-Bousquet Mining Corporation	603-4 Royal Bank Building, Toronto 2, Ont.	Bousquet
Granada Gold Mines, Limited	1108 Federal Building, Toronto, Ont.	Rouyn
Greene Stabell Mines, Limited	1402-6 Concourse Building, Toronto, Ont.	Dubuisson
Halliwell Gold Mines, Limited	132 St. James St. West, Montreal	Beauchastel
The Harricana Amalgamated Gold Mines, Inc.	15 Congress St., Boston, Mass., U.S.A.	Dubuisson
Herbin Lake Gold Syndicate, Limited	Room 504, 357 Bay St., Toronto, Ont.	Bourlamaque
Hollinger Consolidated Gold Mines, Ltd	Timmins, Ont.	Tiblemont
Hosking Mining Company, Limited	15 King St. West, Toronto, Ont.	Louvicourt
Kindale Mines, Limited	400 McGill Building, Montreal	Rouyn
Kinojevis Mining Co., Limited	c-o R. J. Driscoll, Sec'y-Treas., Témiscamingue	Rouyn
Lacoma Gold Mines, Limited	c-o R. L. Lang, Swastika, Ont.	Tavernier
The Lake Fortune Mining Co., Limited	941 Dominion Square Building, Montreal	Beauchastel
Lake Malartic Development Co., Limited	Sterling Tower, Toronto, Ont.	Malartic..
Lake Maron Gold Mines, Limited	1001 Northern Ontario Building, Toronto, Ont.	Dasserat
Lake Shore Prospecting Syndicate	Amos.	Varsan
La Mine du Lac Limitée	Notre-Dame du Lac	Notre-Dame du Lac
Lamaque Contact Gold Mines, Limited	Sterling Tower, 372 Bay Street, Toronto, Ont.	Bourlamaque
Lamaque Gold Mines, Limited	Amos	Bourlamaque
Landrienne Gold Mine, Limited	Landrienne	Landrienne
La Rose-Rouyn Mines, Limited	112 Yonge Street, Toronto 2, Ont.	Rouyn
Lartic Mines, Limited	c-o Holden & Murdoch, Suite 603-4, 2-8 King Street, Toronto 2, Ont.	Malartic and Cadillac
Legault Gold Mines, Limited	c-o Adélard Beauchemin, Amos	Cadillac and Dubuisson
LeRoy Gold Mines, Limited	660 St. Catherine St. West, Montreal	Louvicourt
Locarno Gold Mines, Limited	c-o F. G. Ardouin, Sec'y-Treas., 34 Murray Street, Ottawa, Ont.	Cléricy, Dufresnoy, Cadillac and Bousquet
Louvicourt Mines, Limited	Room 1610, 100 Adelaide St. West, Toronto, Ont.	Louvicourt
Louvre Gold Mines, Limited	407 McGill Street, Montreal	Louvicourt
MacDonald Gold Mines, Limited	Elmiron, Ont.	Duparquet
McDonough Mining Syndicate, Limited	Room 712, 63 Sparks Street, Ottawa, Ont.	Louvicourt
McWatters Gold Mines, Limited	Haileybury, Ont.	Rouyn
Mabell Mines, Limited	c-o Albert Leclaire, Pres., 21 Bowen Street South, Sherbrooke	Cléricy
Magog Gold Mines Corporation	424 Sherbrooke St. West, Montreal	Ascot
Andréa Maheux	St. Martin de Beauce	
Malrobic Mines, Limited	32 Imperial Bank Chambers, 161 Yonge St., Toronto 2, Ont.	Malartic
Marillac Mining Syndicate, Limited	c-o Lloyd A. Bissell, Sec'y, 55 Ossington Avenue, Ottawa, Ont.	Joannes

GOLD—Continued

Name of Operator	Address	Location of Mine (Township)
Maritime Cadillac Syndicate	c-o Jos. Lewis, Amos	Cadillac
Marsouins Mines, Limited	Marsouins, Gaspé County	Christie
Mathews Gold Mines, Limited	Pascalis, Que	Pascalis and Senneville
Mideour Prospectors, Limited	c-o J. J. Gray, 906 Central Building, Toronto 2, Ont	Louvicourt
Midland Mining Corporation, Limited	381 Notre-Dame St. West, Montreal	Desmeloizes
Minerals Syndicate of Canada, Ltd	1434 St. Catherine St. West, Montreal	Hébécourt
Mines Development Corp'n	189 St. John Street, Quebec	Barraute, Landrienne and Dalquier
Les Mines d'Or de Laverlochère, Ltée	c-o Horace Bédard, St. Eugène de Guigues	
Minrand Gold Limited	231 St. James St. West, Montreal	Dubuisson
Mission Gold Mines Syndicate, Ltd	5325 Waverley Street, Montreal	Dubuisson
Moffatt Hall Mines, Limited	Haileybury, Ont	Bourlamaque and Louvicourt
Natagan Gold Mines Syndicate, Ltd	c-o A. P. Robitaille, Sec'y-Treasurer, Charlesbourg	Barraute
Newbec Mines, Limited	603 Royal Bank Building, Toronto 2, Ont	Rouyn and Dufresnoy
NewRoy Gold Mines, Limited	465 Bay Street, Toronto, Ont	Louvicourt
Noranda Mines, Limited	804 Royal Bank Building, Toronto 2, Ont	Rouyn
Norlake Mining Corporation	902 Castle Building, Montreal	Figuery
Normont Gold Mines, Limited	905 Transportation Bld'g., Montreal	Rouyn
Northern Aerial Canada Golds, Ltd	1406 Concourse Building, Toronto, Ont.	Dubuisson
The Northern Quebec Gold Fields & Exploration Company	Trois-Rivières	Bousquet and Joannes
Northern Quebec Gold Mines, Limited	Room 611, Dominion Square Building, Montreal	Rouyn
Northwestern Quebec Prospectors, Ltd	P. O. Box 661, Rouyn	Bousquet
O'Brien & Fowler, Limited	900 Victoria Building, 140 Wellington St., Ottawa, Ont	Cadillac
O'Leary-Malartic Mines, Limited	Rouyn	Duparquet and Malartic
Orebec Gold Exploration Company, Ltd	56 Sparks Street, Ottawa, Ont	Clériey
Osisko Lake Mines, Limited	c-o H. Whittingham, Sec'y, 100 Adelaide St., Toronto, Ont	Rouyn
Osisko Rouyn Exploration Co., Limited, (The)	Room 710, Transportation Building, Montreal	Rouyn
Pascalis Gold Mines, Limited	Canadian Bank of Commerce Building, 25 King Street West, Toronto, Ont	Pascalis and Louvicourt
Perron Gold Mines, Limited	Pascalis	Pascalis
Pontiac & Abitibi Gold Mines, Limited	c-o J. C. Lamothe, K.C., Suite 204, 25 St. James St. East, Montreal	Beauchastel
Powell-Rouyn Gold Mines, Limited	Room 440 Confederation Life Building, Toronto, Ont	Rouyn
Quebec Consolidated Gold Mines, Ltd	Room 100, 45 St. James St. West, Montreal	Malartic and Launay
Pre-Cambrian Holdings, Limited	212 Keefer Building, 1440 St. Catherine St. West, Montreal	Malartic and Cadillac
Quebec Eureka Gold Syndicate	Suite 506, 11 King Street West, Toronto, Ont	Tiblemont and Vauquelin
Quebec Gold Belt Mines, Limited	P. O. Box 190, Fort Erié, Ont	Bourlamaque
Quebec Gold Mining Corporation	221 Notre-Dame St. West, Montreal	Dubuisson, Bourlamaque, etc.
Quebec Gold Mining Syndicate, Limited	c-o Bigué & Bigué, 757 Côte Place d'Armes, Montreal	
Quebec Gold Research Limited	c-o Joseph Brochu, 915 Transportation Building, Montreal	Malartic
Quebec Prospectors, Limited	25 King Street West, Toronto 2, Ont	Bousquet
Randall Mines Corporation	225 Notre-Dame Street West, Montreal	Barraute and Landrienne
Read-Authier Mines, Limited	112 St. James Street West, Montreal	Bourlamaque
Auguste Renault	Ville-Marie, Pontiac	Dasserat
Rouyn Lake Gold Mines, Limited	c-o P. Bédard, Kapuskasing, Ont	Rouyn
Rubec Mines, Limited	130 Coristine Building, Montreal	Cadillac and Bousquet
Seguin Rouyn Gold Mines, Limited	719 Tramways Building, Montreal	Rouyn
Carl Sekyer	2739 Rosemount Boulevard, Montreal	Seigniory of Rigaud-Vaudreuil
Senator Mines, Limited	c-o Redmond Quain, Pres., 187 Main St., Hull	Beauchastel and Rouyn
Shawkey Gold Mines, Limited	c-o Bain, Bicknell et al, Lumsden Building, Toronto 2, Ont	Dubuisson

GOLD—Continued

Name of Operator	Address	Location of Mine (Township)
Siscoe Gold Mines, Limited	Room 905, Dominion Square Building, St. Catherine St. West, Montreal	Varsan and Dubuisson
Sladen Malartic Mines, Limited	Trust Building, Ottawa, Ont	Malartic and Fournière
South Tiblemont Mines, Limited	Suite 202, 53 King Street West, Toronto 2, Ont	Tiblemont
Stadacona Rouyn Mines, Limited	719 Tramways Building, 159 Craig St. West, Montreal	Rouyn
Standard Gold Mines, Limited	c-o Pierre Beauchemin, Amos	Bourlamaque
Stanley-Siscoe Extension Gold Mines, Ltd	710 New Star Building, Montreal	Varsan and Dubuisson
Stonetrue Gold Mine Company, Limited	P. O. Box 80, Amos	Cadillac
Sulcoe Gold Mines, Limited	c-o Millar & Hunter, 59 Yonge St., Toronto 2, Ont	Dubuisson
Sullivan Consolidated Mines, Ltd	1135 Beaver Hall Hill, Montreal	Dubuisson
Thompson Cadillac Mines, Limited	212 Keefer Building, Montreal	Cadillac
Tiblemont Island Mining Company, Ltd	Amos	Tiblemont.
Tonawanda Mines, Limited	c-o J. H. Murray, Sec'y-Treas., P. O. Box 254, Haileybury, Ont	Cadillac
Tonopah Canadian Mines Co	570 Bullitt Building, Philadelphia, Pa., U.S.A	Duprat, Beauchastel and Montbray
Towagmac Exploration Co., Ltd	941 Dominion Square Building, Montreal	Dasserat
Trinidad Mines, Gas & Oil, Limited	116 Côte de la Montagne, Quebec	Dufresnoy
Twin Lakes Mining Corporation	59 St. James St. West, Montreal	Beauchastel
United Gold Exploration, Limited	c-o Messrs. Long & Daly, 25 King St. West, Toronto, Ont	Laverlochère
Valco Mines Company	8 Sault-au-Matelot Street, Quebec	Malartic and Cadillac
Vicour Gold Mines, Limited	Fort Erié, Ont	Louvicourt
Vimy Gold & Metals, Limited	c-o A. H. Tanner, K.C., 201 Notre-Dame St. West, Montreal	Montauban
Waite-Amulet Mines, Limited	804 Royal Bank Building, 2-8 King St. East, Toronto, Ont	Duprat and Dufresnoy
West McWatters Syndicate, Limited	Room 1300 Concourse Building, 100 Adelaide St. West, Toronto, Ont	Rouyn
Wiltsey-Coghlan Mines, Limited	c-o L. Soliague, Sec'y-Treas., 25 King St. West, Toronto 2, Ont	Rouyn
Wood Cadillac Mines, Limited	c-o V. W. Allin, 212 Keefer Building, Montreal	Cadillac.

GRAPHITE

Name of Operator	Address	Location of Mine (Township
E. Bertrand	Gracefield, Wright Co	Northfield
R. J. Cameron	Buckingham	Buckingham
Canadian Graphite Corporation	1193 Phillips Place, Montreal	Boyer
Crucible Graphite Co., Ltd	52 Spadina Avenue, Toronto, Ont	Buckingham
North Quebec Mining Development Co., Ltd.	c-o Geo. Fréchette, St. Jean d'Iberville	Amherst

IRON ORE

Name of Operator	Address	Location of Mine (Township)
Northern Iron & Metal Smelters, Inc	c-o Louis Fitch, K.C., Room 516, 107 Craig Street West, Montreal	
The Ungava Miners & Traders, Limited	Room 713, 132 St. James St., Montreal	Nastapoka, Hudson Bay

KAOLIN

Name of Operator	Address	Location of Mine (Township)
Robert A. Bryce	85 Richmond St. West, Toronto, Ont.	Amherst
Canadian Kaolin Silica Products, Ltd.	1602 University Tower, Montreal	Amherst

MAGNESITE AND DOLOMITE

Name of Operator	Address	Location of Mine (Township)
Canadian Refractories Limited	Canada Cement Building, Montreal	Grenville
International Magnesite Company	Calumet	Harrington
N. S. Parker	P. O. Box 25, Eastman	Bolton East

MARL

Name of Operator	Address	Location of deposit
Chs. B. Arseneault	Thivierge	
Elzéar Arseneault	St. Siméon, Bonaventure Co.	
Philémon Arseneault	Gravel, Bonaventure Co.	
Samuel Arseneault	Rivière Bonaventure	
Thomas L. Arseneault	Petit Bonaventure	
A. Audet	Maria, Bonaventure Co.	
Elzéar Babin	Ste-Hélène de la Croix	
Nap. Babin	New Carlisle	
Louis Berger	Gascons West, Bonaventure Co.	
Edmond Bérubé	Ste. Florence de Beaurivage, Matapedia Co.	
Alfred Boucher	Little Pabos, Gaspé Co.	
Thomas Bourdage	Bonaventure East	
Samuel Bourgeois	Lac au Saumon	
Joseph F. Bujold	St. Siméon, Bonaventure Co.	
Ephraim Casey	Bonaventure East	
Albert Caron	St. Léandre, Matane Co.	
John Castilloux	Hopetown, Bonaventure Co.	
Chs. Castonguay	Causapscal	
Jean F. Cayouette	Thivierge, Bonaventure Co.	
Frank Cormier	New Richmond	
Auguste Côté	Ste. Irène, Matapédia Co.	
Arthur Couturier	Amqui	
Pierre Cyr	Ste. Adelaide, Gaspé Co.	
Louis Dégarie	Maria Capes, Bonaventure Co.	
W. Derops	Lac au Saumon	
M. Desrosiers	St. Léandre, Matane Co.	
Ferdinand Didier	Causapscal	
Mrs. Francis Dion	Maria Capes, Bonaventure Co.	
Mrs. James Dow	Port Daniel West, Bonaventure Co.	
Nap. Drapeau	Sayabec	
Leslie Edwards	Escuminac, Bonaventure Co.	
John Fenderson & Co., Inc.	Sayabec, Matapédia Co.	
Pen Flowers	New Carlisle	
Benoît Gagné	Petit Cascapédia Nord	
Nap. Gagné	Lac au Saumon West, Matapédia, Co.	
J. Léonard Gallagher	Maria East, Bonaventure Co.	
Chrysostome Gauthier	Thivierge, Bonaventure Co.	
J. P. Gauthier	New Richmond	
Isidore Gauvreau	Drapeau, Bonaventure Co.	
Alfred Godet	Lac au Saumon	
Alexis Henry	Bonaventure East	

MARL—Continued

Name of Operator	Address	Location of deposit
Barthélémi Henry	Bonaventure East	
Jos. Huard	Hopetown, Bonaventure East	
Simon Horth	Paspébiac	
Calixte Landry	Drapeau, Bonaventure Co	
David Lapierre	Lac au Saumon	
Ernest Lapierre	Lac au Saumon	
Laurel Chalk Corporation, Limited	Room 901, 1410 Stanley St., Montreal.	
Léonard Lauzier	Val Brillant, Matapédia Co	
Antoine Lavoie	St. Léon le Grand, Matane Co	
Eusèbe Leblanc	Lac au Saumon	
Ferdinand Leblanc	Allard, Bonaventure Co	
Apollinaire Lelièvre	Petite Rivière East, Gaspé Co	
Pierre Levesque	Ste. Irène, Matapédia Co	
Nap. Loiselle	Hopetown, Bonaventure Co	
G. McEnnis	Port Daniel East, Bonaventure Co	
Auguste Malaison	Lac au Saumon	
Zénon Marcoux	Grande Rivière, Gaspé Co	
Albert Michaud	Val Brillant	
Alfred Michel	New Carlisle	
Lazare Ouellet	St. Léon le Grand, Matane Co	
Théo. Ouellet	Amqui	
Damase Philipp	Drapeau, Bonaventure Co	
Elide Poirier	Cullen's Brook	
Georges Poirier	Maria East, Bonaventure Co	
Alphonse Poitras	Ste. Anne des Monts, Gaspé Co	
Aubin Richard	Lac au Saumon	
Isidore St-Onge	St. Alphonse de Caplan	
Isidore Soucy	Allard, Bonaventure Co	
Antoine Tardif	Chandler, Gaspé Co	
R. Turbide	Lac au Saumon	
Jos. Vaillancourt	Lac au Saumon	
Paul Vignet	Gascons West, Bonaventure Co	
Martin Wall	Chandler, Gaspé Co	

MICA

Name of Operator	Address	Location of Mine (Township)
Wm. Ahearn	538 McLaren St., Ottawa, Ont	Hull
Blackburn Bros., Limited	Blackburn Building, Ottawa, Ont	Portland East
Brown Bros	Lucky Reserve, Cantley, Wright Co	Hull
Canadian Amber Mica Co	P. O. Box 246, Station B, Montreal	Portland West
The Capital Mica Co., Ltd	c-o W. Ahearn, 538 McLaren Street, Ottawa, Ont	Wakefield
Osborn Carman	Farm Point	Hull
Z. E. Chenier	148 Laurier Street, Rockland, Ont	Grenville
Isidore Cheslock	Poltimore	Portland West
La Compagnie des Mines de Mica de la Côte Nord, Ltée	351 des Fossés, Québec	Bergeronnes
W. C. Cross	Cascades	Hull
S. H. Cross	90 Fifth Avenue, Ottawa, Ont	Hull
David de Rainville	R. R. No. 1, Wilson's Corners	Wakefield
Estate J. Ellard	Wright	Alleyn
H. T. Flynn	33 Montcalm St., Hull	Hull and Wright
J. B. Gauthier	Box 226, Buckingham	Buckingham
The Gracefield Mica Mining Co	c-o J. A. C. Ethier, 4908 Adam St., Montreal	Northfield
Percy Hamilton	Perkins Mill	Templeton
W. H. Kellar	Cascades	
Kent Brothers	Kingston, Ont	Hull
Kenneth Kilbourn	101 Murray Street, Montreal	Grenville
Silvio Lafortune Mining Company	Pointe Gatineau	Templeton
E. M. Lapointe	Buckingham	Derry
Laurel Mining Co., Limited	4 des Forges Street, Trois Rivières	Wentworth

MICA—Continued

Name of Operator	Address	Location of Mine (Township)
The Laurentide Mica Co., Ltd.	c-o John J. Jackson, Advocate, Gulf Bld'g, Pittsburgh, Penna, U.S.A.	Templeton East
A. G. Martin	236 Besserer St., Ottawa, Ont.	Lytton and Huddersfield
Geo. W. McElroy	Davidson's Corners	Templeton
R. J. McGlashan & Co.	190 Montcalm Street, Hull	Wakefield
T. G. McLaurin	42 Stanley Avenue, Ottawa, Ont.	Portland
C. McManiman	Rawdon	Rawdon
Mineral Products Co., Limited	901 Federal Building, Toronto, Ont.	Wakefield
Richard Moore	Wright	Lytton
Jos. Morris	Wilson's Corners	Wakefield
J. B. Nault	Maniwaki	Cameron
Estate T. F. Nellis	c-o Nellis, Thompson & Ellis, Royal Bank Chambers, Ottawa, Ont.	Hull
Northern Mica Co., Limited	720 St. James Street West, Montreal,	Wentworth
O'Brien & Fowler	Ottawa Electric Building, 56 Sparks St., Ottawa, Ont.	Villeneuve
Pierre Paradis	Laurel, Argenteuil Co.	
Perkins Mining Company	P. O. Box, 63 Pointe Gatineau	Templeton
Ernest Poulin & Thos. Holmes	Cantley	Hull
Louis E. Richard	L'Ange Gardien	Petit Pré, Montmorency Co.
Saguenay Mica Company, Limited	c-o Germain Beaulieu, Advocate, P. O. Box 21, Quebec	
William J. Sparks	Stevenson Place P. O., Ont.	Hincks
Wallingford Bros., Limited	Banque Nationale Building, Ottawa, Ont.	Templeton
Geo. & Chas. Wallingford Co.	495 Clarence Street, Ottawa, Ont.	Templeton
Jos. N. Wallingford	Perkins Mill	Templeton
Estate S. Wilson	Cascades	Thorne
Bush Winning	Notre-Dame de la Salette	Portland

MINERAL WATER

Name of Operator	Address	Location of Spring
Abénakis Mineral Springs Co., Ltd.	c-o J. N. Cantin, P. O. Box 312, Montreal	
Abénakis Springs Co., Limited	Abénakis Springs	St. François du Lac
Eau Minérale Etoile	c-o Jules Massicotte, Ste-Geneviève de Batiscan	Ste. Geneviève de Batiscan
L'Eau Naturelle Purgative de Chambord, Limitée	c-o David Doré, Desbiens, Lac St. Jean Co.	Métabetchouan
Chas. Gurd & Co., Limited	1016 Bleury Street, Montreal	Varennes
Maski Bottling Works	Maskinongé	
Radnor Mineral Water Springs	St. Maurice, Champlain Co.	
Adélard St-Jean	Ste-Hélène de Bagot	
St-Léon Mineral Water Co.	Room 26, King Street, Toronto, Ont.	
Succession S. C. Riou et Mme Caroline Pelletier	c-o Royal Trust Company, 58 St. Paul St., Quebec	

MOLYBDENITE

Name of Operator	Address	Location of Mine (Township)
The Height of Land Co.	c-o Percy Cole, Sec'y, 4327 Old Orchard Avenue, Montreal	Preissac
Indian Lake Molybdenite Co.	c-o John Bain, 56 Sparks St., Ottawa, Ont.	Masham
T. A. Lalonde, Ltée	Amos	Preissac
Metallum, Limited	460 St. John Street, Montreal	
James Riley	Hodgins, Pontiac Co.	Thorne

OCHRE AND IRON OXIDE

Name of Operator	Address	Location of Mine (Township)
Thos. H. Argall	Argall's Siding, Pointe du Lac	Pointe du Lac
Canadian Siennas	c-o Alex. de Livi, Manager, Sienna	Lynch
Montmorency Paint Products Co., Ltd	6684 St. Urbain St., Montreal	Les Forges, Trois-Rivières
Paint Products, Limited	Room 516, St. James St. West, Montreal	
Paint River Oxide Company	P. O. Box 44, Station B, Montreal	Pte. Rivière Romaine
The Sherwin-Williams Co. of Canada, Ltd	Red Mill, Champlain Co	Red Mill

PEAT

Name of Operator	Address	Location of Bog
La Compagnie de Tourbe, Ltée	P. O. Box 2468, Montreal	
The Hydropeat Company, Limited	P. O. Box 46, St.Hyacinthe	St. Hyacinthe

PHOSPHATE

Name of Operator	Address	Location of Mine (Township)
Blackburn Bros	711 Blackburn Building, Ottawa, Ont.	Templeton
Pierre Carissi	Perkins Mills	
J. B. Gauthier	P. O. Box 226, Buckingham	Buckingham
Kent Bros	Mica Dealers, Kingston, Ont	Hull
R. J. McGlashan	190 Montcalm St., Hull	Wakefield
James Miller	105 Arthur Street, Ottawa, Ont	
R. Gordon Richardson	87 Rochester Street, Ottawa, Ont	
A. St. Amour	Notre-Dame de la Salette	Portland East
Wallingford Bros., Limited	Banque Nationale Building, Ottawa, Ont	Templeton
Bush Winning	Notre-Dame de la Salette	Portland

PYRITE

Name of Operator	Address	Location of Mine (Township)
Aldermac Mines, Limited	Room 500, Dominion Square Building, Montreal	Beauchastel
Consolidated Copper & Sulphur Co	Eustis	Ascot

SILICA (Rock and Sand)

Name of Operator	Address	Location of Mine (Township)
B. Bigelow	Buckingham	
Gordon Bigelow	Glen Almond	Portland East
R. Bigelow	Buckingham	Buckingham
John Bonell	Buckingham	
Henri Bouchard	Chicoutimi	St. Louis de Bagot
Buckingham Mining Co., Ltd	1400 Dorchester St. West, Montreal	Buckingham
Wm. & J. J. Cameron	Buckingham	Buckingham
Canadian Carborundum Company	Shawinigan Falls	St. Canut
Canadian Flint and Spar Co., Limited	900 Victoria Building, Ottawa, Ont	Derry
Canadian Kaolin Silica Products, Ltd	1602 University Tower, Montreal	Amherst
Robert J. Donaldson	Glen Almond	Buckingham
Feldspar Quarries, Limited	1403 Trenton Trust Building, Trenton, N.J., U. S. A.	Buckingham
J. B. Gauthier	Buckingham	Buckingham
Albert McClements	Buckingham	

SILICA (Rock and Sand)—Continued

Name of Operator	Address	Location of Mine (Township)
Jas. H. Mason Engineering Corp'n	1451 King Street West, Toronto, Ont.	
Euclide Montpetit	Melocheville	Melocheville
O'Brien & Fowler, Limited	900 Victoria Building, 140 Wellington St., Ottawa, Ont	
Ottawa Silica and Sand Stone, Ltd	East Templeton	Templeton
Ottawa Valley Mines, Limited	New Birks Building, Montreal	Buckingham
Alfred Parcher	Glen Almond	Derry
G. Pelneaud	Buckingham	Buckingham
Wm. Stewart	Box 19, Buckingham	Buckingham
The Silica Products of Canada, Ltd	Chicoutimi	
Wm. Warwick	Buckingham	
Winning & Downing	Notre-Dame de la Salette	Buckingham

SILVER

Name of Operator	Address	Location of Mine (Township)
Aldermac Mines, Limited	1108 Dominion Square Building, Montreal	Beauchastel
Beattie Gold Mines, Limited	Canadian Bank of Commerce, 25 King St. West, Toronto, Ont.	Duparquet
Bussières Mining Company, Limited	221 Notre-Dame St. West, Montreal	Louvicourt
Consolidated Copper & Sulphur Co	Eustis	Ascot
Granada Gold Mines, Limited	1108 Federal Building, Toronto, Ont.	Rouyn
Greene Stabell Mines, Limited	1402-6 Concourse Building, 100 Adelaide Street West, Toronto, Ont.	Dubuisson
Newbec Mines, Limited	603 Royal Bank Bldg., Toronto 2, Ont	Dufresnoy and Rouyn
Noranda Mines, Limited	804 Royal Bank Building, Toronto, Ont.	Rouyn
O'Brien & Fowler	900 Victoria Building, 140 Wellington St., Ottawa, Ont.	Cadillac
Siscoe Gold Mines, Limited	Room 905, Dominion Square Building, St. Catherine St., Montreal	Dubuisson
Waite-Amulet Mines, Limited	804 Royal Bank Building, 2-8 King St. West, Toronto, Ont.	Duprat

TALC

Name of Operator	Address	Location of Mine (Township)
Broughton Soapstone & Quarry Co., Ltd	Broughton Station, Beauce Co.	Broughton
Canadian Talc Rock Products, Limited	c-o E. P. Bélair, Cashier's Office, City Hall, Montreal	
Charles Fortin	Robertsonville	Thetford
Jos. Houle	Pontbriand	Thetford
The Megantic Mining Co	175 Spadina Road, Toronto, Ont.	Ireland
N. S. Parker	Eastman	Bolton
Mrs. George R. Pibus	Knowlton	Bolton West
Reed Realties, Limited	c-o H. A. Peverly, President, 1148 Union Avenue, Montreal	Thetford

TITANIC IRON

Name of Operator	Address	Location of Mine (Township)
Acme Titanic Iron Ore Company	c-o J. O. Paré, Notary, Baie St-Paul, Charlevoix Co.	St. Urbain
American Titanic Iron Co., Ltd	c-o J. H. Boisvert, 115 Claire-Fontaine St., Quebec	St. Urbain
Baie St. Paul Titanic Iron Ore	c-o J. O. Paré, Notary, Baie St-Paul, Charlevoix Co.	St. Urbain
Loughborough Mining Co., Ltd	Sydenham, Ont.	St. Urbain
Titanium (Canada) Limited	384 St. Paul Street West, Montreal	Beresford
Titanium Products Corporation	c-o G. C. Piché, Pres., 43 Chemin Ste. Foy, Quebec	

ZINC AND LEAD

Name of Operator	Address	Location of Mine (Township)
Alpha Mining Company	c-o A. F. Brigham, Timmins, Ont.	Wright
Clermont Mines, Limited	85 St. Peter Street, Quebec	Clermont
Federal Zinc & Lead Co., Ltd.	Room 608, 1117 St. Catherine St. West, Montreal	Lemieux
Gaspé Mines	c-o Hon. John Kelly, New Carlisle	Lemieux
Lyall & Beidelman	Room 608, Drummond Building, 1117 St. Catherine St. West, Montreal	Lemieux
North American Mining Company	New Carlisle	
Shawinigan Mining & Smelting Co., Ltd.	c-o W. T. Henderson, Sec'y, 116 Dalhousie Street, Brantford, Ont.	Montauban and Chavigny
Succession P. Tétreault	70 Holyrood Avenue, Outremont	Montauban
Trinidad Mines, Gas & Oil, Limited	116 Côte de la Montagne, Quebec	Montauban and Chavigny
Waite-Amulet Mines, Limited	804 Royal Bank Building, 208 King St. East, Toronto, Ont.	Duprat and Dufresnoy

II.—STONE QUARRIES, CLAY AND SAND PITS

BRICK

Name of Operator	Address	Location of Plant
Ascot Tile & Brick Co., Ltd.	Ascot Corner	Ascot
La Brique Champlain, Ltée.	56 Laliberté Street, Quebec	Beauport
La Brique de Chicoutimi, Ltée.	c-o Royal Bank, Chicoutimi	Chicoutimi
La Brique de Scott, Ltée.	8 St. Joseph St., Quebec	St. Maxime de Scott
Citadel Brick, Limited	14 St. Joseph St., Quebec	Beauchastel
La Briqueterie Duquette & Lacroix	East Angus	Westbury
La Briqueterie Lotbinière, Ltée.	Deschaillons	Deschaillons
Nap. Brunelle	Victoriaville	Victoriaville
La Cie de Brique Panet, Ltée.	L'Islet	L'Islet
David T. Hodgins	Shawville	Clarendon
L'Industrielle de St. Tite, Ltée.	St. Tite, Champlain Co.	St. Tite
The Laprairie Company, Inc.	Canada Cement Building, Montreal	Laprairie and Delson
Nap. Loiselle, Mrs.	133 Franklin Street, Granby	Granby
Emile Longpré	St. Félix de Valois	St. Félix de Valois
Frank Oliver	Ormstown	Ormstown
Alphonse Potvin	Deschaillons	Deschaillons
St. Lawrence Brick Co., Limited	935 Dominion Square Building, 1010 St. Catherine St. West, Montreal	Laprairie
Stone Bros.	Brome	
E. P. Suddard Brick Works	Gaspé	Douglas West

CEMENT

Name of Operator	Address	Location of Plant
Canada Cement Company	Box 290, Station B, Montreal	Montreal East and Hull
National Cement Company	P. O. Box 170, Hochelaga Station, Montreal	Montreal East

GRANITE

Name of Operator	Address	Location of Quarry
Beebe White Granite Co., Limited	Beebe	Stanstead
Jos. Bergeron	Shawinigan	Almaville
Aug. Bernier	Roberval, Lake St. John	St. Dominique Range
Berry and Redicker Granite Quarry	Beebe	Stanstead
Lucien Bérubé & Fils	Brownsburg	Chatham.
Blackburn & Larouche	81 St. Anne St., Chicoutimi	St. Paul Range
Thomas Blanchette	Chicoutimi West	
Nérée Boily	Roberval	Roberval
J. A. Bourbonnais	Vaudreuil Station, Vaudreuil Co	Rigaud
Brodie's Limited	1070 Bleury Street, Montreal	Graniteville, Guenette, Mount Johnson
A. E. Bronson	Beebe	Stanstead
Joseph Brunet	4411 Côte des Neiges Road, Montreal	Chatham
Amédée Bussières	Ste. Cécile, Compton Co	Whitton
La Ville de Chicoutimi	Chicoutimi	Chicoutimi
Cloutier Bros	Beebe, Stanstead Co	Stanstead
La Compagnie de Granit	88 St. Louis Road, Quebec	Colbert, Rivière-à-Pierre
Delwaide & Goffin	12-16 du Hâvre St., Chicoutimi	St. Thomas Range
Robert Denney & Barrowman	Beebe, Stanstead Co	
Albert Desrosiers	Beebe	Stanstead
Diamond Granite Co	Beebe	
Alphonse Dontigny	112, de la Station St., Shawinigan	Glenada
J. B. Doyer	c-o Mme. J. B. Doyer, Rousseau Mill	Montauban
Arthur Dumas Cie Enrg	Rivière-à-Pierre	Rivière-à-Pierre
Auguste Dumas	Rivière-à-Pierre	Rivière-à-Pierre
William Duncan	R. R. No. 1, Beebe	Stanstead
La Carrière Fournier Enrg	Beebe	Stanstead
Jos. Gagné	Port Alfred	
Gingras & Frères, Ltée	St. Marc des Carrières, Portneuf Co	Stanhope
G. Goheil & J. Perrault	Beebe	Stanstead
Oscar Gosselin	Mégantic	
La Cité de Grand'Mère	City Hall, Grand'Mère	Grand'Mère
Granit Jonquière, Enrg	c-o J. F. Gauthier, Jonquière	Jonquière
Le Granit National, Limitée	P. O. Box 276, Roberval	
Elie Grenier	Glenada	Glenada
Guenette Granite Co., Limited	Guenette, Labelle Co	Campbell
A. C. Hartley	Beebe	Stanstead
Wm. Haselton	Beebe	Stanstead
O. Hébert	Ville-Marie	Ville-Marie and Laverlochère
Alfred Holmberg & R. Smith	Beebe	Stanstead
Earl Kennison	Graniteville	
Lacasse & Boulais	Box 23, Beebe	Stanstead
Lacroix & Bédard	Beebe	Stanstead
A. M. Mackenzie & M. M. Morrison	Scotstown	
Robert McIntosh	R.R. No. 1, Beebe	Stanstead
Montreal Construction Supply & Equipment Limited	1466 Sherbrooke Street West, Montreal	
Polycarpe Moreau	Roberval	Roberval
Carl Nett	Beebe	
Francis Nolet	Rivière-à-Pierre	Rivière-à-Pierre
Arthur Perron	Rivière-à-Pierre	Bois
Stanislas Perron	Rivière-à-Pierre	Bois
Herbert Plunkett & B. Fountain	Beebe	Stanstead
La Ville de Port Alfred	Port Alfred, Chicoutimi Co	
Henri Provencher	Guenette	
M. C. Reynolds	Cedarville	Stanstead
Riverin & Riverin Enrg	39 Montcalm Street, Chicoutimi	Rivière du Moulin
Rivière-à-Pierre Granite, Ltd	Rivière-à-Pierre, Portneuf Co	Bois
W. H. Rollins	Beebe	Stanstead
Saint Bruno Quarry & Paving Co., Ltd	7420 Laroche Street, Montreal	St. Bruno
Scotstown Granite Company, Ltd	Scotstown	Scotstown
The Shawinigan Engineering Co., Limited	c-o H. G. Budden, 107 Craig St. West. Montreal	St. Michel des Saints
Ville de Shawinigan Falls	Shawinigan Falls	Shawinigan Falls
Silver Granite Company	117 Côte d'Abraham, Quebec	St. Samuel
J. H. & R. Smith, A. Clark	Graniteville	Stanstead
The Stanstead Granite Quarries Co., Ltd	Beebe	Stanstead
Thibaudeau & St. Pierre	Rivière-à-Pierre	Bois
Joseph Tremblay	Baie St. Paul	Baie St. Paul
E. R. Truchon	Roberval	
Département de la Voirie	Quebec	
Fortunat Voyer & Frère	Rivière-à-Pierre	Bois
Frank Wilkinson	Beebe	Stanstead

LIME

Name of Operator	Address	Location of Kiln
Arnaud & Beaudry	16 Ste. Angelique Street, Joliette	Joliette
Arthur Boivin	Pont Rouge	Pont Rouge
Praxède Bouchard	Ste. Anne de Chicoutimi	Tremblay
Canada Lime & Stone, Limited	St. Marc des Carrières	St. Marc des Carrières
R. B. Carswell	Bryson, Pontiac Co.	
Gaspard Desfonds	St. Cuthbert, Berthier Co.	
The Dominion Lime Company	East Angus	Dudswell
Yvon Dontigny	Ste. Thècle, Champlain Co.	
Octave Gagné	St. Ulric, Matane Co.	
Pierre Gédéon Giroux	Beauport East	
Joseph Lalumière	St. Dominique de Bagot	St. Dominique de Bagot
Laurentian Stone Co., Ltd	82 Crémazie Street, Hull	Hull
Limoges Fils & Cie	552 Poupart Street, Montreal	Montreal
Paul Maheux	St. Michel de Beauport	
Camille Mercure	9 St. Denis Street, St. Hyacinthe	St. Dominique de Bagot
Montreal Lime Co., Limited	St. Marc des Carrières	
St. Martin Lime Company	Cap St. Martin, Laval Co.	
The National Stone & Lime Co., Reg'd	386 Lemoyne Street, Montreal	
Shawinigan Chemicals, Limited	Room 611, 107 Craig Street West, Montreal	Shawinigan Falls
Standard Lime Co., Limited	Joliette	St. Paul de Joliette and St. Marc des Carrières
Stinson Reeb Builders Supply Co	360 Dorchester St. W., Montreal	Côte St. Michel

LIMESTONE

Name of Operator	Address	Location of Quarry
Joseph Allard	Ville de Léry	
Honoré Z. Arseneault	Drapeau, Bonaventure Co.	
Baillargeon & Faubert	62 Blvd Union, St. Lambert, Chambly Co.	
A. A. Baker	Chateau-Richer	Chateau-Richer
Bathurst Power and Paper Co., Ltd	Bathurst, N.B.	Port Daniel East
Beaudet & Bergeron	St. Antoine de Tilly, Lotbinière Co.	
Jos. Pitre Beaudry	Box 209, Joliette	Joliette
Albert Boily	Baie St. Paul, Charlevoix Co.	
François Bourcier	Ste. Philomène	
Bosca & Buraglia	East Bathurst, N.B.	
O. Brisebois	33 Windsor Street, Ville St. Pierre	
Canada Cement Co., Ltd	Box 290, Station B, Montreal	Hull
Canadian Quarries, Limited	4740 Iberville St., Montreal	
Canadian Rock Products, Limited	2020 Union Avenue, Montreal	
Carrière Marcil, Ltée	St. Michel Station, Napierville Co.	
Carrière Montréal-Est	c-o Cyrille Durocher, 11021 Notre-Dame Street East, Montreal	
Carrière St. Barthélémi	St. Barthélémi	
Carrière St. Louis	St. Louis de France, Champlain Co.	
Carrière St. Maurice, Limitée	307 St. Alexandre St., Trois-Rivières	St. Louis de France, Ste. Marguerite
Robert B. Carswell	Bryson	Bryson
Le Cercle Agricole de St. Godefroi	St. Godefroi, Bonaventure Co.	St. Godefroi
DeLorimier & Rogers Quarries Company	c-o Paul Labrecque, 6618 Chambord St., Montreal	Montreal
Deschambault Quarry Corporation	52 St. Paul Street, Quebec	St. Marc des Carrières
Edgar Désormeaux	Cap St. Martin, Laval Co.	
R. C. Dickson	2501 Monsabré Street, Montreal	Montreal
Dominion Lime Company	East Angus	Lime Ridge
Dufresne Construction Company, Limited	1832 Pie IX Boulevard, Montreal	Rivière des Prairies
Athanase Dugas	Ste. Geneviève, Jacques-Cartier Co.	
Eastern Townships Paving Company	Sherbrooke	
Alphonse Faubert	Bellevue Station, Ville de Léry	Ville de Léry
Donat Faubert	Ville de Léry, Chateauguay Co.	Ville de Léry

LIMESTONE—Continued

Name of Operator	Address	Location of Quarry
Adélard Filion	Lachute	Lachute
J. Filion	Lachine	Pointe Claire
The Foundation Co. of Canada Limited	1538 Sherbrooke Street West, Montreal	
Omer Fontaine	St. Maurice, Champlain Co.	
Fuger & Smith Limited	Pointe Claire	Pointe Claire
Octave Gagné	St. Ulric	
Emile Gagnon	271 St. Dominique St., Jonquière	Métabetchouan
Martin Gagnon	7794 St. André Street, Montreal	Villeray
Gaspesian Fertilizer Co., Reg'd	Port Daniel East	Port Daniel
Olivier Gauthier	St. Marc des Carrières	St. Marc des Carrières
Carrière Giffard, Ltée	Giffard	Giffard
Gingras & Frère Ltée	St. Marc des Carrières	St. Marc des Carrières
F. X. R. Giroux	St. Louis de Courville	St. Louis de Courville
La Carrière Gravel, Ltée	Château-Richer	Château Richer
Guilbault & Frère	Ste. Elizabeth	Ste. Elizabeth
Héon & Héon	St. Louis de Champlain	
Hull Cut Stone Quarry	c-o Andrew Stafford, 60 Papineau St., Hull	
Kennedy Construction Co., Ltd	310 Shaughnessy Building, Montreal	St. François de Sales and Acton Vale
Laberge & Marchand	Chateauguay	
Théodore Lacouline	Château-Richer	Château-Richer
La Carrière Lagacé	St. Martin, Laval Co	St. Martin
Emile Lapointe	St. Dominique de Bagot	St. Dominique de Bagot
Joseph Lapointe	12034 Lachapelle Street, Montreal	Cartierville
Laurentian Stone Co., Ltd	82 Crémazie Street, Hull	Hull
Laval Quarry Co., Limited	c-o J. Alph. Lemay, Sec'y-Treas., 6418 St. Hubert Street, Montreal	Cap St. Martin
Edouard Leclerc	St. Joachim	St. Joachim
Leclerc and Day Lime Stone Co., Ltd	c-o J. J. Leclerc, Rimouski	Nouvelle
Leclerc & Robitaille Enrg	Roberval	Roberval
Alexandre Lecompte	Bellerive	
Victor Lecrenier	8434 De Gaspé Street, Montreal	Cap St. Martin
Armand Levesque	Roberval	Roberval
Henri Loiselle	St. Dominique, Bagot Co	St. Dominique de Bagot
Martineau & Fils, Ltée	517 Marie-Anne St. East, Montreal	St. Marc and Montreal
Matthew Devito Construction Limited	6138 Hamilton Street, Montreal	Pointe Claire
Camille Mercure	9 St. Denis Street, St. Hyacinthe	St. Dominique de Bagot
R. H. Miner Co., Limited	7411 de Lanaudière St., Montreal	Montreal
Montreal Construction Supply & Equipment, Limited	1460 Sherbrooke St. West, Montreal	
Montreal Quarry, Limited	1340 Bellechasse Street, Montreal	Montreal
National Quarries, Limited	Park Avenue & Beaubien St., Montreal	Cote St. Michel
Oscar Naud	Lachevrotière, Portneuf Co	
Oscar Noel & Cie	44 Wright Street, Hull	Wrightville
Northern Quarry, Limited	Room 1401, 660 St. Catherine St. W., Montreal	St. Michel de Laval
Jos. Pagé	Charlesbourg West	Charlesbourg West
Damien Paquette	Village Bélanger, Laval Co	Cap St. Martin
Lévis Paquette & Cie	Cap St. Martin, Laval Co	Cap St. Martin and St. François de Sales
Joseph Parent	Beauportville	
Pénitencier St. Vincent de Paul	St. Vincent de Paul	St. Vincent de Paul
Les Pères Trappistes de Mistassini	Mistassini, Lake St. John	Pelletier
Cité de Salaberry de Valleyfield	c-o Raphael Bélanger, City Engineer, Valleyfield	Valleyfield
St. Laurent Quarry, Limited	Cap St. Martin	Cap St. Martin
Carrière St. Michel, Ltée	Côte St. Michel de Laval	St. Michel de Laval
O. F. St. Onge	St. Dominique, Bagot Co	
W. Schetagne	Pointe Claire	Pointe Claire
Shawinigan Chemicals, Limited	Room 611, Power Building, 107 Craig St. West, Montreal	St. Damien de Stanbridge
Standard Clay Products, Limited	P. O. Box 819, St. John's	St. John's
Standard Lime Company, Limited	Joliette	St. Paul de Joliette and St. Marc des Carrières
Stinson-Reeb Builders Supply Co.	360 Dorchester Street West, Montreal	Côte St. Michel de Laval
Stone & Quarry, Limited	1340 Bellechasse Street, Montreal	Montreal and St. François de Sales
Magloire Théorêt	Bellerive	Nouveau-Salaberry-Valleyfield

LIMESTONE—Continued

Name of Operator	Address	Location of Quarry
Nap. Tremblay	Joffre Avenue, Hull	Hull
Trust Général du Canada	112 St. James Street, Montreal	St. Vincent de Paul
Union Quarry, Limited	1340 Bellechasse Street, Montreal	Côte St. Michel
Elzéar Verreault, Limitée	194 du Pont Street, Quebec	Giffard
François Villeneuve	Pointe au Pic, Charlevoix Co	
Paul Vincelette	St. Honoré, Chicoutimi Co	St. Honoré
Roads department, Quebec	Parliament Buildings, Quebec	

MARBLE

Name of Operator	Address	Location of Quarry
Canada Marble and Lime Company	630 Cathcart Street, Montreal	Marchand
Wallace Sandstone Quarries, Limited	Architects Building, 1135 Beaver Hall Hill, Montreal	Phillipsburg
White Grit Company	Hurdman Road, Ottawa, Ont	Portage du Fort

POTTERY

Name of Operator	Address	Location of Plant
Jos. Bégin	Petite Rivière, Quebec Co	Petite Rivière
La Brique de Chicoutimi	Montcalm Street, Chicoutimi	Chicoutimi
Citadel Brick, Limited	14 St. Joseph Street, Quebec	Boischatel and L'Islet
La Brique Frontenac, Ltée	140 St. John Street, Quebec	Beauport East
La Brique Lotbinière, Ltée	Deschaillons	Lotbinière
La Cie de Briques Panet, Ltée	L'Islet, L'Islet Co	L'Islet
La Brique de Scott, Inc	St. Maxime de Scott	St. Maxime de Scott
Canada Fire Brick Co., Limited	4741 St. Ambroise St., Montreal	Montreal
Canadian Potteries, Limited	140 Longueuil Street, St. Jean	St. Jean
Dominion Sanitary Pottery Co., Limited	189 St. James Street, St. Jean	St. Jean
Duquette & Lacroix	East Angus	Westbury
David T. Hodgins	Shawville	Clarendon
The Laprairie Company, Inc	Canada Cement Building, Montreal	Delson and Laprairie
Montreal Terra Cotta Co., Ltd	Room 923, 1010 St. Catherine St. West, Montreal	Lakeside
Standard Clay Products, Limited	P. O. Box 819, St. Jean	St. Jean

SAND AND GRAVEL

Name of Operator	Address	Location of Pit
Alma and Jonquière Railway Co	Isle Maligne	
Baillargeon & Faubert	62 Union Boulevard, St. Lambert	Caughnawaga
Joseph Bélanger	Ascot Corner	Stoke
J. A. Benoît	Mont St. Grégoire	Mount Johnson
Ursin Bergeron	Jonquière	Jonquière
Honoré Bigras	St. Vincent de Paul, Laval Co	St. Vincent de Paul
Omer Bigras	Ste. Dorothée, Laval Co	Ste. Rose West
Jos. Blais Enrg	10 Mont-Marie Avenue, Lévis	St. Romuald
The Bonner Sand & Ballast, Limited	Room 201, 1434 St. Catherine St. W., Montreal	South Durham

SAND AND GRAVEL—Continued

Name of Operator	Address	Location of Pit
Noel Bouchard	Ste. Anne de Beaupré	
Brouillet Sand & Gravel Co., Ltd	Rawdon	Ste. Julienne
Basile Brassard	Côte de la Réserve, Chicoutimi	
Canadian Import Company	83 Dalhousie Street, Quebec	St. Lawrence River
Canadian National Railways	c-o E. G. Newson, Engineer, Maintenance of Way, Union Station, Toronto 2, Ont	
Canadian Pacific Railway Company	c-o Chief Engineer, Windsor Station, Montreal	
Canadian Good Roads Construction Co., Ltd.	2020 Union Avenue, Montreal	Waterloo
La Ville de Coaticook	P. O. Box 150, Coaticook	Coaticook
La Compagnie de Sable, Ltée	3rd Avenue, Limoilou	St. Charles River
Consolidated Oka Sand & Gravel Co., Ltd.	248 McCord Street, Montreal	Lake of Two Mountains
Joseph Demers	Kateville, Stanstead Co	Hatley
Mastai Deslandes	St. Dominique, Bagot Co	St. Dominique de Bagot
Dominion Sand & Stone Co., Ltd	c-o M. Lacombe, 1472 Laurier St. East, Montreal	South Durham
Albert Dubreuil	St. Dominique, Bagot Co	St. Dominique de Bagot
Noel Dutrizac	Plage Laval, Laval Co	Ste. Dorothée
Arthur Emond	Richmond	
Gauthier & Tremblay	c-o William Gauthier, Racine Street, Chicoutimi	Moulin River
Gosselin & Gosselin	Chicoutimi	Chicoutimi
Donat Grandmaitre	Eastview, Ont	Hull
Adjutor Hervey	St. Joseph d'Alma	St. Joseph d'Alma
Dr. J. B. Fred Houde	8 du Platon Street, Trois-Rivières	Trois-Rivières
The Independent Sand Company	c-o P. E. O'Brien, 3731 Notre-Dame St. East, Montreal	Lake St. Peter
Walter Kemp	Ste. Thérèse, Terrebonne Co	
Wm. Kenney	Gaspé South Bay	
Laflamme & Laflamme	363 Sherbrooke Street West, Montreal	Gaspé and Shawinigan Falls
J. A. Langevin	12,380 Dion Street, Cartierville	
Arthur Laporte	53 de Lanaudière Street, Joliette	Joliette
Jos. Laporte	Rang du Vieux Moulin, Joliette	Joliette
Philippe & Amédée Latulippe	240 de la Ronde Street, Quebec	St. Charles River
Adélard LeBeau	St. Dominique de Bagot	St. Dominique de Bagot
René Lemay	St. Jérôme, Terrebonne Co	St. Jérôme
Azarie Lussier	Mascouche, L'Assomption Co	Mascouche
Ville de Magog	c-o Sec'y-Treas., Magog	Hatley
J. G. Mallory	Lennoxville	Ascot
Euclide Marchand	Almaville, Champlain Co	Mont-Carmel
Esdras Métras	Mont St. Grégoire	Grand Bois Range
J. Harry Moody	St. Louis Avenue, Terrebonne, Co	Terrebonne Parish
Louis Nantel	Terrebonne	Mascouche
Wellington Newton	Buckingham	Buckingham
Damase Ouellette	Ste. Foy	Parish of Ste. Foy
Joseph Pépin	Warwick	Warwick
Euclide Perron	Chicoutimi	Rivière du Moulin Village
Arthur Plante	Stratford, Richelieu Co	Stratford
Point Calumet Sand & Gravel Co., Limited	St. Eustache, Two Mountains Co	Point Calumet
City of Quebec	c-o Chief Engineer, City Hall, Quebec	St. Michel de Beauport
St. Eustache Sand & Stone Company	445 St. François-Xavier Street, Montreal	Mascouche
The Shawinigan Engineering Co., Ltd	c-o H. Budden, Power Building, 107 Craig Street West, Montreal	St. Michel des Saints
City of Sherbrooke	c-o Thos. Tremblay, City Engineer, Sherbrooke	Broughton Road
Sorel Sand Company, Limited	82 Montcalm Street, St. Joseph de Sorel	St. Joseph de Sorel
Standard Lime Company, Limited	Joliette	Notre-Dame de Lourdes Range
Standard Sand & Gravel, Limited	St. Félix de Valois	St. Martin
La Municipalité de Stratford	Stratford, Wolfe Co	Stratford
Township of Stanstead	Stanstead	Beebe
Emile Têtreault	Rang Chartier, Mount St. Grégoire	
J. Thouin	Mascouche	Mascouche
Arthur Touchette	Ste. Thérèse, Terrebonne Co	
Oscar Venne	Lachenaie	Lachenaie
Roads Department, Quebec	Parliament Buildings, Quebec	

SAND-LIME BRICK

Name of Operator	Address	Location of Plant
Canadian Carborundum Company	Shawinigan Falls	St. Canut
Standard Lime Company, Limited	Joliette	1395 St. Grégoire St., Montreal

SANDSTONE

Name of Operator	Address	Location of Quarry
Jos. Blais Enrg	10 Mont-Marie Avenue, Lévis	St. Louis de Pintendre and St. Nicholas
Broughton Soapstone & Quarry Co., Ltd	Broughton Station	Ste. Hénédine, Dorchester Co.
Citadel Brick, Limited	14 St. Joseph Street, Quebec	Lauzon
Emile Cloutier	L'Islet	L'Islet
Jos. Corrigan	St. Louis Road, Sillery	Ste. Foy
Ls. Philippe Gagnon	St. David, Lévis Co	St. David Road
Carrière de la Ville de Montmagny	c-o J. René Côté, Sec'y-Treas., City Hall, Montmagny	
Paul Ouimet	P. O. Box 593, Kénogami	
Sherbrooke Quarry, Limited	395 Bowen Street S., Sherbrooke	
City of Sherbrooke	c-o Thos. Tremblay, Engineer, Sherbrooke	Ascot
Joseph Vézina, Enrg	Bergerville	Parish of Ste. Foy

SLATE AND SHALE

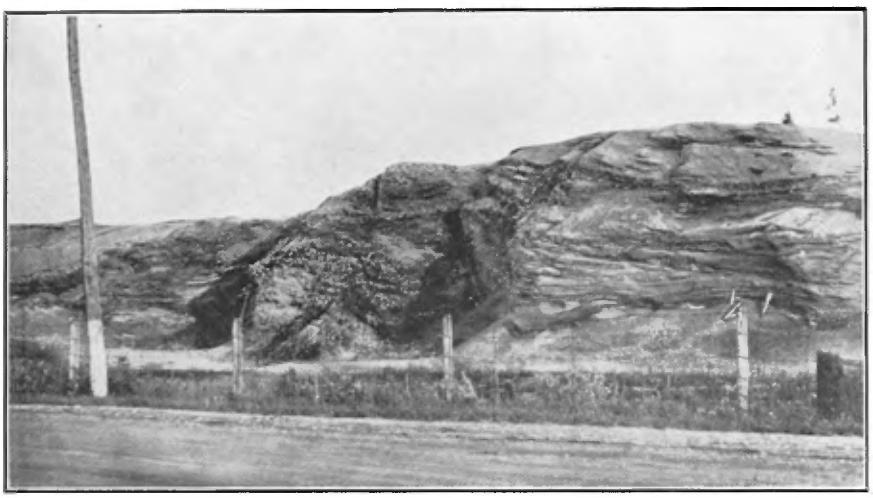
Name of Operator	Address	Location of Plant
La Brique Citadelle Ltée	14 St. Joseph Street, Quebec	Lauzon
Broughton Soapstone & Quarry Co., Ltd	Broughton Station	St. Hénédine
Davis Slate & Manufacturing Co. of Canada, Limited	131 Shaftesbury Avenue, Toronto, Ont.	
The Mystic Slate Company, Limited	c-o E. F. Currie, Bedford	Stanbridge
John Taylor	R.R. No. 4, Granby	

A.—Muscovite mica. McGie mine on lake Charlotte, Block *G*, Bergeronnes township, Saguenay county.

B.—Well of Canadian Seaboard Oil and Gas, Limited, lot 160, Petit Bois range, Ste. Angèle de Laval, Nicolet county.

A.—Ground moraine, with embedded fragments ranging from the size of coarse sand to boulders several feet in diameter, at St. Emile, Quebec county.

B.—A group of kames bordering main road leading to lake Beauport, Quebec county.



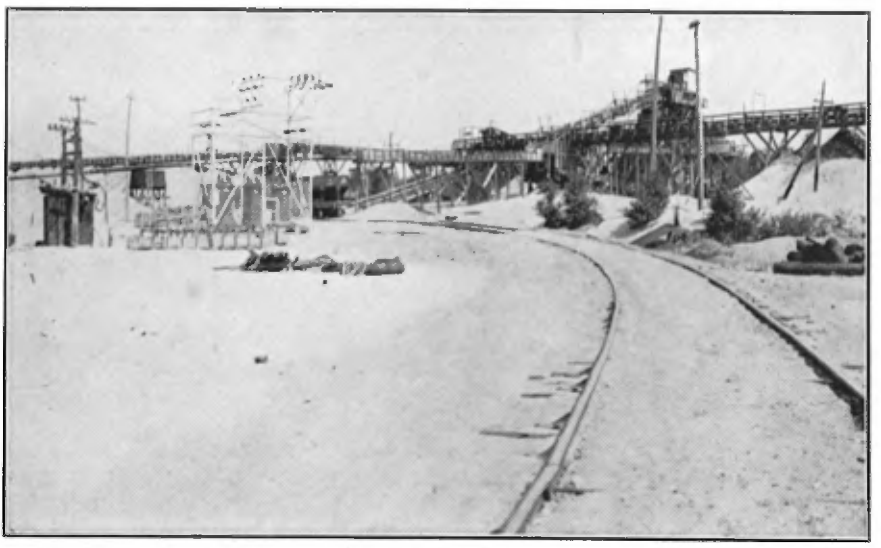
A.—Typical form of eskers near Coaticook, township of Barnston, Sherbrooke county, showing the variable and irregular stratification, with coarse, semi-stratified and unstratified lenticular masses.

B.—A marine terrace in the vicinity of Batiscan, Champlain county.

A.—Cross-bedding in a delta deposit, at Beauport-East, near Montmorency river, Quebec county.

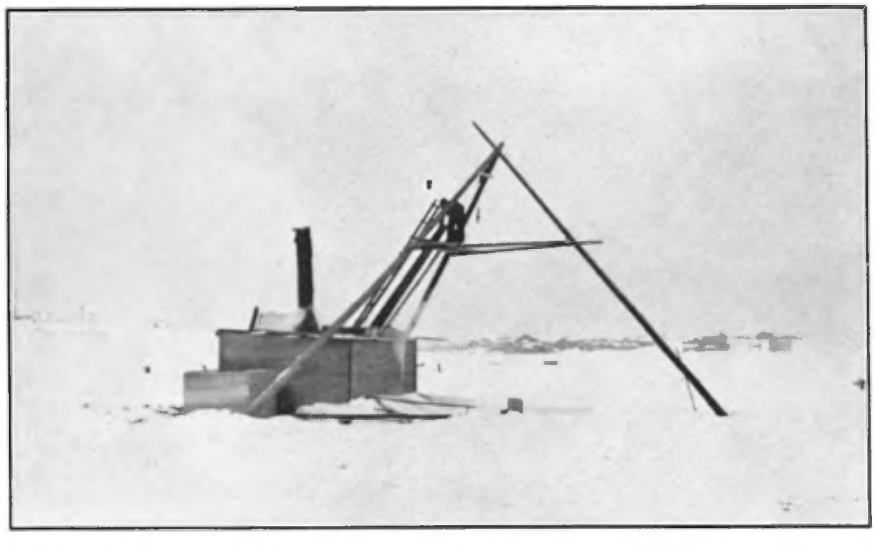
B.—Ballast gravel at St. Régis pit, two miles southeast of Ste. Philomène, Châteauguay county.

A.—Suction dredge in an artificial pond, at sand deposit of Standard Lime Company, Limited, St. Félix de Valois, Joliette county.



B.—Sand washing and screening plant of Standard Lime Company, Limited, St. Félix de Valois, Joliette county.

A.—Normont mine shaft, Beauchastel township.



B.—Diamond drilling from ice, on Osisko lake, Bagamac-Rouyn claim, Rouyn township.

A.—Northwestern Quebec Prospectors, Limited. Ten-ton Nutt mill on shore of lake Bousquet, Bousquet township, July 1933.

B.—Pandora Gold Mines, Limited, Cadillac township, October 1933.

A.—Greene-Stabell railway, from lake Montigny,
Dubuisson township, September 1933

B.—Greene-Stabell mine and mill, Dubuisson township,
January 1934

A.—Lamaque mine, No. 5 shaft, Bourlamaque township, February 1934.

B.—Camp of Sigma Mines, Limited, Bourlamaque township, July 1934.

ALPHABETICAL INDEX